NIGERIA

CONTENTS

LIST OF TABLES

PART ONE

TABLE II

PART TWO

Government Notice of 1991

FEDERAL ENVIRONMENTAL PROTECTION AGENCY
DECREE 1988

(1988 No. 58)

NATIONAL GUIDELINES AND STANDARDS FOR
INDUSTRIAL EFFLUENTS, GASEOUS EMISSIONS AND
HAZARDOUS WASTE MANAGEMENT IN NIGERIA

WHEREAS, the Federal Government of Nigeria established in 1988 the Federal Environmental Protection Agency to protect, restore and preserve the ecosystems of the Federal Republic of Nigeria:

NOW THEREFORE, the Agency, in consonance with its powers under the Decree establishing it, hereby give to managers and operators of manufacturing industries in order to improve the quality of the environment and to free it from pollutant and other environmental hazards, the national guidelines and standards for industrial effluents, gaseous emissions and hazardous wastes, specified in the Schedule hereto, until Regulations are made on related matters to replace them.

SCHEDULE

FEDERAL ENVIRONMENTAL PROTECTION AGENCY
(FEPA)

NATIONAL INTERIM GUIDELINES AND STANDARDS FOR INDUSTRIAL
EFFLUENTS, GASEOUS EMISSIONS AND HAZARDOUS
WASTES MANAGEMENT IN NIGERIA

1991

FOREWORD

The administration set the nation on the path of sustainable development with the establishment of the Federal Environmental Protection Agency (FEPA) by Decree 58 of 1988. Thereafter, the National Policy on the Environment was put together and launched in 1989 by the President and Commander-in-Chief of the Armed Forces, General Ibrahim Badamasi Babangida.

Decree 58 of 1988 requires FEPA to establish environmental guidelines and standards for the abatement and control of all forms of pollution. Industrial pollution has been identified as a priority environmental problem which must be halted without delay before disastrous health and irreversible environmental problems occur. In fulfillment of its mandate, FEPA has produced the first ever "National Guidelines and Standards for Environmental Pollution control in Nigeria". This is another landmark in the history of environmental protection efforts in our country and indeed in Africa.

These guidelines and standards are set to ensure that industrial activities and wastes management practices are compatible with our overall goal of bequeathing a clean and safe environmental to present generations of Nigerians and those yet unborn.

I will from time to time utilise materials from the present guidelines to prepare Regulations

which would put necessary sanctions on breaches that tend to derogate and damage the environment.

I urge industries to co-operate with FEPA to ensure the successful implementation of the Guidelines and Standards for the common good of present and future generations of Nigerians.

I commend this document to the use of manufacturing industries in particular and the members of the public in general.

MAJOR-GENERAL M. T. KONTAGORA
Hon. Minister of Works and Housing
With Responsibility for the Environment
November 1990.

GUIDELINES AND STANDARDS FOR ENVIRONMENTAL POLLUTION CONTROL IN NIGERIA

PREFACE

The Federal Government of Nigeria through the promulgation of Decree 58 of December 1988, established the Federal Environmental Protection Agency (FEPA). By Sections 16 and 17 of the Decree, the Agency is mandated to protect, restore and preserve the ecosystems of the Nigerian environment.

It is in fulfillment of this mandate that the contents of this publication known as "Interim Guidelines and Standards for Environmental Pollution control in Nigeria" is hereby presented. These are interim guidelines and standards which will be periodically reviewed and updated in the light of new knowledge.

It is now globally accepted that where there are threats of serious irreversible environmental damages, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. Environmental monitoring and assessment must anticipate, prevent and attack the root cause of degradation.

The survival of man, and of any nation for that matter depends on their ability to manage their wastes in an environmentally sound manner. This can only be achieved by the establishment and enforcement of appropriate guidelines and standards set to ensure that we do not destroy our environment and indeed the very basis of our existence.

DR. E. O. A. AINA
Director/Chief Executive
Federal Environmental Protection Agency (FEPA)

PART I

GENERAL INTRODUCTION, INTERIM GUIDELINES AND STANDARDS FOR INDUSTRIAL EFFLUENT, GASEOUS EMISSION AND NOISE LIMITATIONS

0.1 INTRODUCTION

Industrialisation is vital to a nation's soci-economic development as well as its political stature in the international committee of nations. It provides ready employment opportunities for a good percentage of the population in medium to highly developed economies. However, industries vary according to process technology, size, nature of products, characteristics and complexity of wastes discharged.

Ideally, siting of industries should strike a balance between socio-economic and environmental considerations. Availability and access to raw materials, Proximity of water sources (Appendix 1) market for products, cost of effective transportation route, major settlements and labour as well as infrastructural amenities often influence the siting of industries. In developing countries such as Nigeria, siting of industries is determined by various criteria, some of which are environmentally unacceptable thereby posing serious threat to public health. Significant in this respect is the establishment of industrial estates alongside residential areas in most State capitals and large urban centres in Nigeria.

Although industrialisation is inevitable, various devastating ecological and human disasters which have continuously occurred over the last three decades or so implicate industries as major contributors to environmental degradation and pollution problems of various magnitude. Industrial wastes and emissions, contain toxic and hazardous substances most of which can be detrimental to human health. These include heavy metals such as lead, Cadmium and mercury, and toxic organic chemicals such as pesticides, polychorinated biphenyls (PCBs), dioxins, polyaromatic hydrocardons (PAHs), petrochemicals and phenolic compounds. For instance, there was the case of the "Minamata disease" in Japan in the 60s caused by mercury poisoning of consumers of fish from Minamata Bay, Japan, which had received untreated effluents from a plastic factory. Then, there was the case of "Ita-Itai" poisoning from ingestion of rice irrigated with effluent containing the toxic metal cadmium. Appendix 2 is a panoramic view of global, human and ecological disasters caused by industrial pollution and industrial accidents.

Rapid industrial development in developed and developing countries have increased hazardous wastes generation several fold. High level of environmental awareness and existence of regulatory environmental protection measures in the developed countries have discouraged indiscriminate disposal of those wastes in conflict with environmental laid down principles. "Not in my backyard" syndrome made burying of wastes or dumping in surface waters or open land increasingly difficult. Ironically, the available technologies in developed countries are inadequate to cope with the volume and complex nature of wastes generated. Furthermore, the cost of waste disposal was becoming highly prohibitive and unaffordable by most industries.

Realising the low-level of environmental awareness in developing countries, coupled with the non-existence of environmental protection laws, and the abject poverty of these nations, the developed countries have, within the last decade, embarked upon "Toxic Wastes Trade" or "Illegal Dumping of Toxic Wastes" in poor, debt-strapped developing countries. Nigeria has been a victim of this illegal act, when in 1988 about 3,880 tons of toxic and hazardous wastes were dumped in Koko, Bendel State by an Italian Company.

In order to stem the tide of toxic wastes dumping in third would countries, the United Nations Environment Programme (UNEP), passed the resolutions on the Transboundary Movement of Toxic and Hazardous Wastes at the 1989 Basel Convention, Appendix 3, a document to which Nigeria is a signatory.

Surface and ground water contamination, air pollution, solid wastes heaps, general environmental degradation including loss of land and aquatic resources are major environmental problems caused by industrialisation in Nigeria. Improper disposal of untreated industrial wastes has resulted in coloured, murky, odorous and unwholesome surface waters, fish kills and loss of recreational amenities. A significant amount of the population still rely on surface waters for drinking, washing, fishing and swimming. Industry also needs water of acceptable quality for its processes.

Economic development can be compatible with environmental conservation. Hence, the present problems of environmental resources degradation need not arise within the framework of sustainable development. Failure to halt further deterioration of environmental quality might jeopardise the health of large segment of the population with serious political and socio-economic implications.

The Federal Military Government places high premium on the environment. It established the Federal Environmental Protection Agency (FEPA) by Decree 58 of 30th December, 1988 with the statutory responsibility for overall protection of the environment. The National Environmental Policy was put together and launched by the President in Abuja on 27th November, 1989. Logically, implementation of the policy should follow. Introducing these guidelines and standards is part of the implementation of the policy and environmental pollution abatement strategy contained therein.

These guidelines and standards relate to six (6) areas of environmental pollution control:

(i) Effluent limitations
(ii) Water quality for industrial water uses at point of in-take
(iii) Industrial emission limitations
(iv) Noise exposure limitations
(v) Management of solid and hazardous wastes
(vi) Pollution abatement in industries.

Environmental protection measures are only meaningful if the environment to be protected is adequately understood. Neither over-protection nor under-protection of the environment is desirable. Ideally, standards are set based on nationally generated environmental baseline data which are scanty in the present circumstance. An alternative approach is to adapt standards adopted by World Health Organization (WHO), and the developed nations of Europe and America. However, in transposing data between countries, socio-economic and climatic differences will be taken into account.

Nonetheless, industrial pollution cannot be abated and halted if appropriate legal framework does not exist. Existing guidelines and standards in operating in West Germany, India, Japan, United Kingdom, USA, Brazil, Sweden, Canada, Singapore, Turkey, Poland and Russia have been consulted in drawing up these guidelines and standards. Where the guidelines were deemed relevant and appropriate for Nigerian conditions, they have been adopted, and where they were deemed inappropriate they were modified on the basis of published available data locally and elsewhere.

The "Interim Guidelines and Standards" are presented in four parts as follows:

PART I: General Introduction, Interim guidelines and Standards for Industrial Effluent, Gaseous Emissions and Noise Limitations.

PART II: Management of Solid and Hazardous Wastes.

PART III: Exclusive list of Hazardous/Dangerous Chemicals.

PART IV: Glossary of Environmental Terms.

In summary, steps can be taken for the prevention of industrial pollution and protection of the environment. to this end, the following guidelines shall become operational in Nigeria.

0.2 General Guidelines for Pollution Abatement in Industries

1. No industry shall release toxic substances into the air, water and land of the Nigerian environment, beyond permissible limits.

2. It is mandatory for all industries to have industrial pollution monitoring capabilities within their own set up. Preferably they should have on site pollution control unit or assign it to a Consultant/Contractor approved by the Federal Environmental Protection Agency (FEPA).

3. Records of all discharges (solid, air and liquid), treatment and disposal must be remitted to the nearest FEPA office on a monthly basis.

4. In the event of unusual disposal and treatment of the waste, such report should be filed with the nearest FEPA office within twenty-four (24) hours.

5. Any accidental discharge must be reported to the nearest FEPA office and nearest community within twenty-four (24) hours of the release.

6. All manufacturers must submit the chemicals in use to the nearest FEPA office. Details about stored chemicals and storage conditions should also be submitted. When such chemicals are sold, names of secondary buyer, should be made known to FEPA office.

7. FEPA offices shall serve as Pollution Response Centres for co-ordinating response activities.

8. Each manufacturer should draw up a contingency plan against accidental release of pollutants.

9. Each manufacturing industry should set up a machinery for combating pollution hazard and maintain equipment in the event of emergency. Towards this end, stock of pollution response equipment should be available or readily accessible.

10. In case of pollution emergency, the nearest FEPA office shall be the "On the Scene Co-ordinator" which should co-ordinate response activities.

11. No individual or corporate body shall engage in storage and transport of harmful toxic waste within Nigeria without a permit by FEPA as stipulated by Decree 42 of November, 1988.

12. The collection, transport and final disposal of waste should be the responsibility/liability of the company generating the waste (i.e., from cradle to grave) which shall be liable for clean up, remediation, restoration and where necessary, compensation to all affected parties.

13. Each State shall designate industrial layout which shall be separate from residential areas. A buffer zone shall be provided and rigidly enforced and monitored to deter illegal development.

14. All new pollution sources that will come on stream after the enactment of these guidelines shall be encouraged to adopt in-plant waste reduction and pollution prevention strategies.

15. No new point sources of industrial pollution shall come on stream without compliance with the provisions of these guidelines.

16. All discharges of effluent with constituents beyond permissible limits into public drains, streams, rivers, lakes, sea or underground injection are unacceptable and are prohibited unless a permit is

obtained in writing from FEPA or any organisation so designated by FEPA. All permits (notices, order, consent or demand) shall be in writing. The format of the permit is as prescribed in the appendices 4-8.

17. Solid wastes generated by industry including, sludges and all bye-products resulting from the operation of pollution abatement equipment shall be disposed of in an environmentally safe manner as prescribed in these guidelines. Under no circumstance should any of these substances be co-disposed in any municipal landfill.

18. For the present point and non-point sources of industrial pollution, it is hereby stated that all industries with potential for the release of gaseous, particulate, liquid or solid untreated discharges are mandated to install into their system, appropriate abatement equipment in accordance with the prescribed guidelines.

19. The general aesthetic sanitary conditions of factories and surroundings shall be adequately maintained.

20. Within the limits of the provisions by the National Policy on Environment, the safety of workers from exposures to hazardous conditions in the workplace, should be guaranteed.

21. Environmental auditing of existing industries and Environmental Impact Assessment (EIA) of new industries and major developmental projects shall be mandatory.

0.3. Summary of the Consultation Between FEPA and Interested Parties on the Interim Guidelines and Standards.

These guidelines have been widely circulated among industries, government ministries and agencies at the State and Federal levels for discussion and the summary of the consultation is prevented hereunder.

0.3.1 The Procedure

FEPA presented the proposed "Interim Guidelines and Standards" to the Industrial Sector for consideration at the First National Environmental Seminar on "Industry and the Nigerian Environment" held between 21st to 23rd May, 1990. The seminar accepted the document as a working paper for study and comments from various industries, government and non-governmental organizations as well as all other interested bodies. FEPA solicited public comments in writing on the proposed document within six weeks which expired on 6th July, 1990.

0.3.2 FEPA received Comments, Submittals from Federal Ministries, State Governments, Industries, Universities and individuals. On July 12, 1990, the Director/ Chief Executive of FEPA inaugurated a 22 member National Technical Committee comprising representatives of Federal and State Ministries, professional bodies, non-governmental organisations, universities and individuals to harmonise all the comment submittals received so far on the proposed draft document with a view to making recommendations to FEPA for further consideration by Government. The Committee was given about three weeks to complete its task. The committee reconvened on July 30, 1990 to consider the draft of the revised Guidelines and Standards.

0.3.3. A summary of the major comments received and FEPA response are presented below:

Comment 1: The value in the Interim Guidelines and Standards were imported, inappropriate and irrelevant to the Nigerian situation.

Response 1: FEPA does not share this view because Appendix 9 of the proposed Interim guidelines

and Standards already circulated showed that data obtained from wide spread previous studies on the physicoeconomical characteristics of effluents from selected industries in the country were reviewed and used in arriving at the values in the Interim Guidelines and Standards. Furthermore, experiences of other developing countries with similar climatic conditions and level of development as Nigeria such as India and Singapore as well as those of developed countries of Europe and North America were also considered. Guidelines and Standards from other countries that were deemed inappropriate to Nigerian conditions were modified with published available local data, and then adopted.

Comment 2: Small industries that are not major polluters cannot afford to wholly maintain on-site pollution units. Hence groups of contiguous industries could borrow or jointly sustain such services.

Response: FEPA does not disagree with this suggestion as long as compliance with the provisions of FEPA Guidelines are met by all industries.

Comment 3: Further clarification is required on the types of records of discharges that must be remitted by industries to nearest FEPA office monthly.

Response: FEPA has designed formats for presenting records of Pollutant discharges similar to the forms illustrated in Appendices 4 to 8 of the proposed document. These forms have comprehensive list of requirements on quality and quantity of discharges (gases, particulates, liquid and solid).

Comment 4: Is it the list of chemicals or samples of chemicals in use that should be submitted to FEPA?

Response: The first line, section 0.2.4 of the Proposed Interim Guidelines document should read "All manufacturers shall submit the list of chemicals in use" to the nearest FEPA office.

Comment 5: The collection and transportation of industrial wastes should be the responsibility/liability of the company generating the waste but the final disposal of such waste should be the responsibility or liability of the local authority (local government or state government) or the owner of the industrial estate in which the industry is sited - private or government. Any liability for wrong disposal should fairly be on the Agency and not on the waste generating industry.

Response: FEPA believes strongly in environmental responsibility. Every generator of waste shall take responsibility for its disposal. Section 0.2.12 of the interim document states clearly our position that-

"The collection, transport and final disposal of waste should be the responsibility/liability of the company generating the waste (that is, from cradle to grave) which shall be liable for clean up remediation, restoration and where necessary compensation to all affected parties".

FEPA intends to license waste collection organisations who shall collect and transport the wastes according to guidelines approved by FEPA. Disposal of wastes shall be at approved sites using methods approved by the FEPA. Where an industry has contractual agreement with another organisation for the safe disposal of its waste, any liability for wrong disposal shall be on the waste management company.

Comment 6: State governments and private estate developers should be encouraged to have properly

designated and fully developed industrial estates with adequate provision for waste treatment.

Response: FEPA shares this view and has noted the requirement for the provision of adequate treatment facilities in every industrial estate. Accordingly, section 0.2.13 of the draft document has been amended to incorporate this suggestion.

Comment 7: Additional costs of establishing in-plant waste treatment and pollution control plants pre-operationally will further discourage new industrial establishments

Response: FEPA is of the view that industry stands to profit from pollution prevention. It is in fact cheaper for industry to incorporate in-plant waste treatment and pollution control plant pre-operationally than to retrofit.

Comment 8: The proposed effluent limitation for the Tannery Industry is too low. If the guideline is adopted in its present form, it is impossible for any tannery in the country to meet its requirement. Comparison with the effluent limitations of some member countries of the International Council of Tanner Syndicate that what is obtained in those countries is much higher than those proposed for Nigeria.

Response: A careful study of the effluent limitation for various industries in different countries usually contain two sets of values. The pre-treatment Standards for Existing Sources (PSEs) for effluents to be discharged into Publicly Owned Treatment Works (POTW) or Sewers are usually less stringent. The effluent limitation for effluents to be discharged into surface waters are often more stringent in order to ensure the sustenance of the quality of receiving water bodies. The higher values referred to by the Tanners Council are applicable to effluents being discharged into POTW or Sewers and not for discharges into surface waters. The effluent limitations contained in the draft document are quite attacinable for discharges into surface waters in the country, if the effluents undergo minimum conventional treatment such as primary or secondary treatment process. Presently, most industries in the country do not carry out the treatment of their waste waters before discharge into the nearest water body. Nonetheless, the additional information provided by the Tanners Council was evaluated along with other data available. Accordingly, the effluent limitation for the following parameters have been reviewed as follows:

Parameter	Chrome Tanning mg/1	Vegetable Tanning mg/1
BOD_5	Old Value 15 New Value 50 (15)	30 100
COD	Old Value 32 New Value 160 (30)	25 80
Suspended Solids	Old Value 9 New Value 30 (10)	19 40
Total Chromium	New Value 2.0 Old Value 0.1	
Chromium 6	0.1	
Chromium 3	2.0	

Note: Indicate values for discharge into streams.

Comment 9 : The word "additional" should be altered to "specific" and the phrase "can be set" to read "should be set" in Group II on page 30 Table 1 of the draft document.

Response : FEPA reserves the right to maintain the validity of the word "additional" and the phrase "can be set" being the true reflection of the intention of

Comment 10: Clarification is required of Group III on page 30 of draft document.

Response: The Agency's view is that item 3 on page 30 should be deleted as it is not applicable.

Comment 11: The issue of spent oil discharges from garages, mechanic workshop and petrol stations should be addressed in the Guidelines.

Response: The issues of crankcase oil has been addressed under the section of "service industries" which include garages, mechanic workshops and petrol stations on page 38 of the draft document. Furthermore, under the stipulated values for discharges from service industries oil and grease are now mandatory at a limit of 10 mg/l as indicated on Effluent limitation guidelines for industries in page 31 of the document. FEPA, moreover, does not consider the limiting value of 10 mg/l for oil and grease as too stringent especially as majority of people use the receiving water bodies for drinking, washing and bathing.

Comment 12: FEPA should define clearly the following terms: drains, sewers, surface water, water courses, sewage works and ocean outfall.

Response: The glossary of terms under the section on introduction of the Interim guidelines will now form a separate section in the revised document to incorporate most terminologies and definitions.

Comment 13: The guideline only dealt with industrial water uses as distinct from potable water use. There is need for FEPA to look into details on the control and management of all

water uses.

Response: The issue of potable water quality in our country is being addressed in the First National Symposium on Water Quality Monitoring and Status in Nigeria scheduled for December 1990. Water Quality Data to be collated at the Symposium along with baseline data already gathered by FEPA shall be used to evolve Interim Potable Water Quality Standards. Meanwhile, the World Health Organisation (WHO), International Quality for Drinking Water can be used as a guide.

Comment 14: The Interim Guidelines did not consider emissions from mobile sources, aviation and generating sets.

Response: FEPA accepts this comment. The matter will be addressed later in the revised Guidelines.

Comment 15: The Interim Guidelines did not consider noise from religious houses, machines, etc.

Response: Noise from occupational exposure in factories is considered presently to be of top priority. Action in respect of noise from domestic sources, though important in the urban areas, shall be taken in future.

Comment 16: The issuance of operating permit for the handling, including transportation of wastes should not be an exclusive preserve of FEPA. rather the issuance or permit for intra-state movement should rest with State Governments while FEPA will issue permit for wastes across one or more States.

Response: FEPA reserves to itself the responsibility for the issuance of permits. For effective implementation of this scheme, FEPA is in agreement with the delegation of issuance of permit for intra-state movement of wastes to State governments while it handles the issuance of permit for interstate movement of wastes. Furthermore, the responsibilities of FEPA according to the provisions of Decree 58 of December 1988 and Decree 42 of November 1988 are explicit on this issue.

Comment 17: FEPA should recommend acceptable buffer zone between industrial estates and residential estates.

Response: FEPA will issue guidelines to the States on modalities for delimiting buffer zones according to ecological locations.

Comment 18: The Pharmacy Board of the Food and Drug Administration (FDA) of the Federal Ministry of Health issues a list of approved chemicals which are renewable yearly, as such should individual companies send a list of their chemicals for clearance?

Response: All drugs are chemicals but not all chemicals are drug. The Pharmacy Board of FDA will continue to issue permits for the importation of chemical for drugs and pharmaceutical production. The list of such chemicals shall be forwarded by FDA to FEPA as part of FEPA Tracking System of Chemicals Imported into the country. FEPA shall in addition issue permit for the importation of all other chemicals. FEPA shall publish annually a list of all approved chemicals in the country.

Comment 19: FEPA should be specific on the roles and level of responsibility by the three-tiers of government: federal, state and local governments and FEPA should be seen to play the monitoring role.

Response: FEPA and the States. The National Policy on Environment provides for the establishment of "State Committee on the Environment" with chairmen of local governments as members and the State commissioner with responsibility for environment as chairman. The National council on Environment comprises state commissioners with responsibilities for environment as members with Honourable Minister of Works and Housing with responsibility for Environment as chairman. Environmental Guidelines and Standards set by FEPA shall be mandatory in all the States. Each State should adopt FEPA's standards as the minimum standards. State governments with the appropriate infrastructure and capability approved by FEPA will implement FEPA policies, guidelines and standards in the States. Otherwise, FEPA will implement its own programmes and enforce regulations in States without the necessary infrastructure and capability.

Comment 20: Item I of page 50 of the draft document should be amended to include state government agencies rather than FEPA only.

This is now amended to read:

`It is mandatory for all industries to have industrial pollution monitoring unit capabilities within their own set up. Preferably, they should have on-site pollution control unit or assign to a consultant/contractor registered with State government agencies and/or FEPA.'

Response: The view of FEPA on the provision of item I of page 50 stands unchanged based on the provisions of Decree 58 of December 1988. Accreditation of all consultants and contractors shall be with the agency. (See Section 0.2.2).

Comment 21: A State government remarked that some brewery industries located in the rural areas discharge their waste waters into local streams which in many cases are the only source of water supply for the rural population. Some of the receiving streams even dry up completely during the dry season. It has been observed that this practice leads to heavy pollution of these local streams and during periods of low stream flow or when the streams dry up, a stream or ponds of stinking waste water is left for the rural community, heavily polluting the environment and providing a ready source for the spread of disease. It is therefore recommended for the case where brewery effluent is discharged into small receiving water resulting in small dilution factor, that maximum effluent concentrations allowable be made more stringent than so far provided in the draft guidelines as follows:

Suspended solids .. .. 10 mg/l
BOD_5 .. .. 15 mg/l

Response: The view of FEPA is that State Governments can establish more stringent guidelines taking into consideration peculiar ecological problems in their localities provided FEPA Guidelines and standards are accepted as the minimum.

Comment 22: Experience in some States shows that hospitals do generate large volumes of toxic and hazardous waste effluents. Very often these waste waters are discharged into the streams resulting in endemic diseases and occasional inexplicable epidemics among the local communities which use the stream for their domestic and other requirements. The inhabitants of these communities are thus made to become regular customers of the hospital thus completing the vicious cycle. In order to minimise this environmental health problem, which is common in most urban centres that have not achieved 100 per cent piped water supply systems, the on-going national/baseline studies should include the study of waste water effluents from large

hospitals. This will enable FEPA to enforce provision of waste treatment facilities in hospitals and to determine safe standards for waste water discharges into the environment by hospitals.

Response: FEPA shares the views expressed and has now included guidelines for wastes management in hospitals and medical laboratories.

Comment 23: Sulphur dioxide, SO_2, should be included under gaseous pollutant for Integrated Steel Mills and hydrocarbons as vapour pollutant under Petroleum Refining.

Response: FEPA notes with appreciation the discovery of the omissions made on page 33 Table 6 of the draft document. These parameters and values for the emission limitations have now been included in the respective sections. (Table 3.1).

Comment 24: The proposed guidelines are good, but there is the need to establish baseline data for control purposes.

Response: FEPA has already initiated national environmental baseline studies.

Comment 25: The proposed guidelines do not include radioactive waste vis-a-vis occupational control and safety to personnel and environment.

Response: FEPA has initiated consultations with appropriate bodies and will come out in due course with guidelines on the management of radioactive waste. In respect of the specific view on occupational safety and health, FEPA is in full consultation and collaboration with the Federal Ministry of Health, Labour and Productivity and the Federal Radiation Protection Service, University of Ibadan respectively.

Comment 26: The proposed guidelines seem to be silent on the methods of analysis to be adopted in the establishment of baseline date.

Response: Page 21 of the draft document states explicitly that any of the recognised standard methods for environmental analysis by the United States Environmental Protection Agency (USEPA), Department of Environment (DOE) U.K., American Public Health Association (APHA), American Petroleum Institute (API) or the American Society for Testing and Materials (ASTM) is acceptable for monitoring purpose until FEPA produces its recommended methods.

Comment 27: There is the need to classify pollutants accordingly to their level of toxicity.

Response: Classification of environmental pollutants is based on several factors for example, toxicity, persistence, physico-chemical characteristics, etc. The environmental objectives and goals determined the mode of classification. However, in order to ensure that various categories of pollutants are considered, the 129 priority pollutants identified by the USEPA have been adopted by the Agency pending the availability of new scientific data locally. Furthermore, toxicity values for restricted chemicals have now been included in the revised document.

Comment 28: In deciding on moratorium to enable industries comply with the guidelines and standards we suggest that a difference be made between existing industries and new coming industries. While:

existing industries should strive to obtain facilities to achieve the de-pollution limits

new coming industries should be mandated to include the de-pollution programme in the factory planning from onset.

Response: This view is in total agreement with FEPA's position.

Comment 29: Equipment purchase, operation and maintenance will be imported (not the same in developed countries) for a considerable period of time. Therefore FEPA should consider the cost of these as final responsibility of the consumer of goods.

Response: The cost of pollution control equipment constitutes about 1-10 per cent of the plant for a new industrial establishment. It costs much more to retrofit anti-pollution equipment into an old plant. Nonetheless, since waste is a resource in the wrong place, a lot of recyclable valuable products are discarded by industries as wastes. Consequently, the additional cost of installing anti-pollution equipment will be recovered in form of higher production output, less waste generation and greater market turnover. In the long term, the additional cost burden to the Accordingly, FEPA will encourage wastes recycling as well as local research into cheap, and efficient methods of industrial wastes treatment. Also the Agency will assist industries in the judicious choice of low wastes technologies for new industrial processes or the modernisation of old industrial plants.

Chapter ONE

INTERIM EFFLUENT LIMITATION GUIDELINES IN NIGERIA

1.1 The latest issue of the Directory of Industries in Nigeria published by the Federal Ministry of Industry indicates that over three thousand industrial establishments exist in the country. The industries operating in the country vary in process technology, size, nature of products, characteristics of the wastes discharged and the receiving environment. Presently, there are ten major Industrial Categories readily discernible in Nigeria (listed in Appendix 10) namely:

(i) Metal and Mining
(ii) Food, Beverages and Tobacco
(iii) Breweries, Distilleries and Blending or Spirits
(iv) Textiles
(v) Tannery
(vi) Leather products
(vii) Woods, Wood products including furniture and fixtures
(viii) Pulp, Paper and paper products
(ix) Chemical and Allied
(x) Others

Significant waste water parameters that must be continuously monitored for selected industries are indicated in Table 1.1.

1.2. Ideally, each pollution source should be detoxified with the installation of anti-pollution equipment based on the Best Practical Technology (BPT) and/or Best Available Technology (BAT). In cognisance of the high cost of imported BPT and BAT, and the non-availability of local environmental pollution technology, Uniform Effluent Standards (UES) is normally based on the pollution potential of effluent and/or the effectiveness of current treatment technology. This approach, is easy to administer, but it can result in over-protection in some areas and under-protection in others. To overcome this problem, uniform effluent limitations based on the assimilative capacity of the receiving water have been drawn up for all categories of industrial effluents in Nigeria (Table 1.2),

while additional sectoral effluent limitations have been provided for individual industries with certain peculiarities, (Table 1.3).

TABLE 1.1

SIGNIFICANT WASTEWATER PARAMETERS FOR SELECTED INDUSTRIAL CLASSIFICATIONS

Industry	Group I*	Group II*
A. Aluminium Industry	Suspended Solids Free Chlorine Fluoride Phosphorus Oil and Grease pH	Total dissolved solids Phenol Aluminium
B. Automobile Industry	Suspended solids Oil and grease BOD_5 Chromium Phosphorus Cyanide Copper Nickel Iron Zinc Phenols	COD Chlorides Nitrate Ammonia Sulphate Tin Lead Cadmium Total dissolved solids
C. Cane Sugar Processing Industry	BOD_5 pH Suspended solids Settleable solids Total coliforms Oil and Grease Toxic materials	Alkalinity Nitrogen, total Temperature Total dissolved solids Colour Turbidity Foam
D. Beverage Industry	BOD_5 pH Suspended solids Settleable solids Total coliforms Oil and Grease Toxic materials	Nitrogen Phosphorus Temperature Total dissolved solids Colour Turbidity Foam
E. Canned and preserved fruits and vegetables Industry	BOD_5 COD pH	Colour Faecal coliforms Phosphorus, total Suspended solids Temperature Total Organic Carbon (TOC)
F. Confined Livestock Feeding Industry	BOD_5 COD	Faecal coliforms Nitrogen Total solids Phosphate pH TOC

Industry	Group I*	Group II*
G. Dairy Industry	BOD_5	Chlorides
	COD	Colour
	pH	Nitrogen
	Suspended solids	Phosphorus
		Temperature
		Total Organic Carbon
		Toxicity
		Turbidity
H. Fertilizer Industry	Ammonia	Calcium
Nitrogen Fertilizer	Chloride	COD
Industry	Chromium, total	Gas purification
	Dissolved Solids	chemicals
	Nitrate	Iron, total
	Sulphate	Oil and grease
	Suspended solids	pH
	Urea and other	Phosphate
	Organic Nitrogen	Sodium
	Compounds	Temperature
Phosphate Fertilizer	Zinc	
Industry	Calcium	Acidity
	Dissolved solids	Aluminium
	Fluoride	Arsenic
	pH	Iron
	Phosphorus	Mercury
	Suspended solids	Nitrogen
	Temperature	Sulphate
		Uranium
I. Flatglass, Cement	COD	BOD_5
Lime, Gypsum and	pH	Chromates
Asbestos Industries	Phosphorus	Zinc
Flatglass	Sulphate	Copper
	Suspended solids	Chromium
	Temperature	Iron
		Tin
		Silver
		Nitrates
		Organic and Inorganic
		Waterbreaking
		chemicals
		Synthetic resins
		Total dissolved solids
Cement, Concrete	COD	Alkalinity
Line and Gypsum	pH	Chromates
	Suspended solids	Phosphates
	Temperature	Zinc
		Sulphite
		Total dissolved solids
Asbestos	BOD_5	Chromates
	COD	Phosphates
	pH	Zinc
	Suspended Solids	Sulphite

Industry	Group I*	Group II*
		Total dissolved solids
J. Grain Milling Industry	BOD_5 Suspended Solids Temperature	COD pH TOC Total dissolved solids
K. Inorganic Chemicals Alkalines and Chlorine Industry	Acidity/Alkalinity Total Solids Total Suspended Solids Chlorides Sulphates	BOD_5 COD TOC Chlorinated Benzenoids Polynuclear Aromatics Phenol Fluoride Silicates Total Phosphorus Cyanide Mercury Chromium Lead Titanium Iron Aluminium Boron Arsenic Temperature
L. Leather Tanning and Finishing Industry	BOD_5 COD Chromium, total Grease pH Suspended Solids Total Solids	Alkalinity Colour Hardness Nitrogen Sodium Chloride Temperature Toxicity
M. Meat Products Industry	BOD_5 pH Suspended Solids Settleable Solids Oil and Grease Total coliforms Toxic materials	Ammonia Turbidity Total dissolved solids Phosphate Colour
N. Metal Finishing	COD Oil and Grease Heavy Metals Suspended Solids Cyanide	None specified
O. Organic Chemicals Industry	BOD_5 COD pH Total Suspended	TOC Organic Chloride Total Phosphorous

Industry	Group I*	Group II*
	Solids Free-Floating Oil	Heavy Metals Phenol Cyanides Total Nitrogen Other Pollutants
P. Petroleum Refining Industry	Ammonia BOD_5 Chromium COD Oil, Total pH Phenol Sulphide Suspended Solids Temperature Total Dissolved Solids	Chloride Colour Copper Cyanide Iron Lead Mercaptans Nitrogen Odour Total Phosphorus Sulphate TOC Toxicity Turbidity Volatile Suspended Solids Zinc
Q. Plastic Materials and Synthetics Industry	BOD_5 COD pH Total Suspended Solids Oil and Grease Phenols	Total Dissolved Solids Sulphates Phosphorus Nitrate Organic Nitrogen Ammonia Cyanides Toxic Additives and Materials Chlorinate Benzenoids and Polynuclear Aromatics Zinc Mercaptans
R. Pulp and Paper Industry	BOD_5 COD TOC pH Total Suspended Solids Coliforms, Total and Faecal Colour Heavy Metals Toxic Materials Turbidity Ammonia Oil and grease Phenols Sulphite	Nutrients (Nitrogen and Phosphorus) Total Dissolved Solids

Industry	Group I*	Group II*
S. Steam Generation and Steam Electric Power Generation	BOD_5 Chlorine Chromate Oil pH Phosphate Suspended Solids Temperature	Boron Copper Iron Non-degradable Organics Total Dissolved Solids Zinc
T. Steel Industry	Oil and grease pH Chloride Sulphate Ammonia Cyanide Phenol Suspended solids Iron Tin Temperature Chromium Zinc	None specified
U. Textile Mill Products Industry	BOD_5 COD pH Suspended solids Chromium Phenolics Sulphide Alkalinity	Heavy metals Colour Oil and grease Total dissolved solid Sulphides Temperatures Toxic materials

Note:

1. Group I: Consists of the most significant parameters for which effluent limits will most often be seen.
2. Group II: consists of some additional parameters for which effluent limits can be set on an individual basis.

TABLE 1.2

INTERIM EFFLUENT LIMITATION GUIDELINES IN NIGERIA
FOR ALL CATEGORIES OR INDUSTRIES

Parameters	Units in milligram per little (mg/l) Unless otherwise stated. Limit for discharge into surface water	Limit for Land application
Temperature	Less than 40 ^{0}C withi of outfall	Less than 40 ^{0}C
Colour (Lovibond Units)	7	-
pH	6-9	6-9
BOD_5 at 20^{0}C	50	500
Total suspended solids	30	-
Total dissolved solids	2,000	2,000
Chloride (as CL)	600	600
Sulphate (as $SO_4$2)	500	1,000
Sulphide (as S^2)	0.2	-
Cyanide (as CN-)	0.1	-
Detergents (linear alkylate sulphonate as methylene blue active substance)	15	15
Oil and grease	10	30
Nitrate (as $NO_{3)}$ NO3	20	-
Phosphate (as PO_4^{3-})	5	10
Arsenic (as AS)	0.1	-
Barium (as Ba)		5
Tin (as Sn)		10
Iron (as Fe)	20	-
Manganese (as Mn)	5	-
Phenolic compounds (as phenol)	0.2	-
Chlorine (free)	1.0	-
Cadmium, Cd	Less than 1	-
Chromium (trivalent and hexavalent)	Less than 1	-
Copper	Less than 1	-

Parameters	Units in milligram per little (mg/l) Unless otherwise stated. Limit for discharge into surface water	Limit for Land application
Temperature	Less than 40 ^{0}C withi of outfall	Less than 40 ^{0}C
Lead	Less than 1	-
Mercury	0.05	-
Nickel	Less than 1	-
Selenium	Less than 1	-
Silver	0.1	-
Zinc	Less than 1	-
Total Metals	3	-
Calcium (as Ca^{2+})	200	-
Magnesium (as Mg^{2+})	200	-
Boron (as B)	5	5

:s	Units in milligram per little (mg/l) Unless otherwise stated Limit for discharge into surface water	Limit for Land application
:cury compounds	Not detectable	Not detectable
nated Biphenyls (PCBs)	0.003	0.003
(Total)	Less than 0.01	Less than 0.01
tters, uc/ml	10^{-7}	-
:ers, uc/ml	10^{-6}	-
(daily average)	400 MPN/100ml	500 MPN/100ml
l fibre	-	-

TABLE 1.3
NATIONAL EFFLUENT LIMITATIONS AND GASEOUS EMISSIONS GUIDELINES IN NIGERIA FOR SPECIFIC INDUSTRIES

Industry	Problems	Guidelines for Maximum concentration allowed for discharge into inland waters	
AGRICULTURAL CHEMICALS	PHOSPHATE FERTILIZER	EFFLUENT (mg/l)	
(Waste Water)	Gypsum sludge	Suspended solids	15
	Acid waste water	Phosphate ($PO4^3$)	3
	High fluoride	Fluorides (F)	1
	High phosphate	pH	8-9
	NITROGENOUS FERTILIZER		
	Similar problem	Free Ammonia (as NH_{4+})	0.1
		Arsenic (as AS)	0.1
		pH	6-9
		NO_3	20
	UREA FERTILIZER		
	Similar problem	Ammonia (as N)	0.6
		pH	6-9
	PESTICIDES		
		Total Pesticides Less than	0.1
		EMISSION (ug/m^3)	
(Gaseous Emissions)	Particulate matter from blending and mixing	Particulate	100
		Fluoride	9.0
	Fluorides	Ammonia	3,600
	Ammonia vapours	Total Pesticides	100
	Pesticide vapours		
(Solid Wastes)	High volume gypsum from fertilizer manufacturer		
AUTOMOTIVE BATTERY		EFFLUENT (mg/l)	
		Total suspended solids (TSS)	28
(Waste Water)	Acid Waste Water	Oil and grease	10

Industry	Problems	Guidelines for Maximum concentration allowed for discharge into inland waters	
AGRICULTURAL CHEMICALS	PHOSPHATE FERTILIZER	EFFLUENT (mg/l)	
		pH	6-9
		Iron	0.20
		Cadmium	0.01
		Nickel	0.05
		Copper	0.06
		Lead	0.01
		Cobalt	0.5
		Arsenic	0.1
(Gaseous Emission)	Lead particulate		
(Solid Wastes)	Defective battery casing Defective lead plates		
BREWERY		EFFLUENT (mg/l)	
	Alkaline effluent	Suspended solids	15
	High suspended solids	BOD_5	30
(Waste Water)	High BOD	pH	6-9
	High COD	COD	80
(Solid Waste)	Spent grain		
	Defective packaging		
	materials and labels		
	Broken bottles		
DYESTUFFS AND DYE INTERMEDIATES	Coloured effluent	EFFLUENT (mg/l)	
	High suspended solids	Suspended solids	5.0
(Waste Water)	High BOD	Zinc (as Zn)	3.0
	High COD	BOD_5	15
		Oil and grease	15
(Gaseous Emission) (Solid Wastes)	Organic vapour Sludge		
FOOD PROCESSING		EFFLUENT (mg/l)	

Industry	Problems	Guidelines for Maximum concentration allowed for discharge into inland waters	
AGRICULTURAL CHEMICALS	PHOSPHATE FERTILIZER	EFFLUENT (mg/l)	
	High BOD_5	BOD_5	15
	Oil and grease	Suspended solids	15
(Waste Water)	High suspended solids	oil and grease	15
	Particulate matter from grain elevators, starch manufacturing, feed and flour mills	EMISSION (ug/m^3) Particulate	100
(Gaseous Emission)	Odours from meat packaging, fish processing, coffee roasting, starch manufacturing and rendering some solid wastes		
(Solid Wastes)			
INORGANIC CHEMICALS		EFFLUENT (mg/l)	
	Acid waste waters from acid plants	Suspended solids	15
	Gypsum sludge from soda ash plants	Chlorides	100
	Chlorides from soda ash	Sulphates	100
	plant and electrolytic	pH	6-9
	Chlorine plant mer- cury from electrolytic chlorine plants		
		EMISSION (ug/m^3)	
	Particulate matter from cement, soda ash and brick plants	Particulates	100
	Fluorides	Acetic acid	2,500

Industry	Problems	Guidelines for Maximum concentration allowed for discharge into inland waters	
(Gaseious Emission)	Acid mist	Fluorides	100
	SO_2	Hydrochloric acid	100
	Chlorine (as Cl_2)	Nitric acid	100
	NO_x from acid plants	Hydrogen sulphide	30
		SO_2	830
		NO_x	500
(Solid Wastes) Sludges			
IRON AND STEEL			EFFLUENT (mg/l)
	High suspended solids	pH	5.5-9.0
(Waste water)	High phenols	Suspended solids	15
	High ammonia	Ether solubles	10
	High cyanides	Phenol	0.020
	Spent pickle liquors	NH_3as N	10
	Rolling mill oils	Cyanide (CN)	0.1
		Oil and grease	15
		Fe less than	1.0
		EMISSIONS ug/m^3	
	Suspended particulate Sulphur dioxide profrom boilers, sinister plant coke ovens and blast	Particulate SO_x	100 830
(Gaseous Emission)	Furnace	NO_x	500
(Solid wastes)	Flue dust		
	Slag		
	Sludges		
METAL WORKING, PLATING AND FINISHING			EFFLUENT mg/l
	Acids	Hg	0.01
(Waste Water)	Cyanides	Cu	1.0
	Toxic metals	Ni	1.0
	Cutting and machine oils	Cr	1.0

Industry	Problems	Guidelines for Maximum concentration allowed for discharge into inland waters	
		Zn	1.0
		Pb	0.01
		cd	0.01
		Sn	1.0
		TSS	15.0
		pH	5.5-9.5
		EMISSION (ug/m^3)	
	Acid mist	Chromic acid	30
	Alkaline mist	Cyanide	1,150
	cyanides	Hydrogen chloride	100
(Gaseous Emission)	fumes from anodizing, rust-proofing cleaning, stripping, etc. operations	Fluorides Nitric acid Phosphoric acid	806 100 100
(Solid Wastes)	Sludges containing metals		
MINING AND METALLURGY			EFFLUENT (mg/l)
(Waste Water)	High volume of suspended	Suspended solids	15
	Solids from milling of ores (tailings)	pH	5.5-9.0
	Acidic wastes	Cu less than 1	
	Dissolved metals from high	Zn less than 1	
	Sulphide ores processing	Ni less than 1	
	Radionu clite	Nd less than 1	
	Radioactive effluent from Uranium mining tailings disposal	Pb less than 1 Ra^{226}	 3pCi/l
			EMISSION (ug/m^3)
	Airborne dust crushing, grinding etc.	Particulate Silica	100 15
	generation of arsine, acid fumes, ammonia vapour, radon gas, and radioactivity during uranium	SO_2 Ni Fe Cu	830 5 10 100
(Gaseous Emission)	Milling operations	Arsine	10

Industry	Problems	Guidelines for Maximum concentration allowed for discharge into inland waters	
	and dust during yellow cake handling	H_2SO_4 HNO_3	100 100
	SO_2 generation from smelting operation	NH_3	^{3},600
(Solid Wastes)	Generation of waste rock and mine/mill waste.		

Industries	Problems	Guidelines for Maximum Concentration allowed for discharge into inland waters	
PETROLEUM REFINERY		EFFLUENT (mg/l)	
	High waste volumes	Temperature (^{O}C)	30
	containing:	pH	6.5-8.5
	phenolics	Oil and grease	10
(Wastes Water)	sulphides	Phenol (Total)	0.5
	Oil and oil products	Ammonia (as NH_4)	0.210
	(waste water)	Sulphide (as H_2S)	0.2
		Spent caustics	
		Total suspended solids	30
		BOD_5	10
		COD	40
		Total chromium	0.3
		Chromium (vi) less	0.1
		than	0.05
		Lead as pb^{2+}	0.05
		Cadmium less than	0.01
		Cyanide less than	0.01
		EMISSION (ug/m^3)	
	Particulates	Particulate	500
	Sulphur dioxide (SO^2)	SO_2	830
(Gaseous Emission)	NO_x	NO_x	500
	H_2S vapours	CO	5,000
	NH_3	H_2S	30
	Hydrocarbon vapours	Hydrocarbon	5,000
		Volatile Organic Carbon (VOC)	6,000
(Solid Wastes)	Oily chemical sludges, spent catalyst, discarded packaging materials		

PETROCHEMICALS		EFFLUENT (mg/l)	
	High volume waste matter	Temperature (^{0}C)	30
(Waste water)	Storm water	pH	6.5-8.5
	Cooling water	oil and grease	10
		Phenol	0.5
		Ammonia (MH_{4+})	0.2
		Sulphide as H_2S	0.2
		Total suspended solids	30
		BOD_5	10
		COD	40
		Lead as Pb^2+	0.05

Industries	Problems	Guidelines for Maximum Concentration allowed for discharge into inland waters	
		Chromium (VI)	<0.1
		Cadmium as Cd^{2+}	<0.1
		EMISSION (ug/m)	
(Gaseous Emission)	Particulates	Particulates	500
	Carbon black dusts	Hydrocarbon	5,000
	SOx	Volatile organic carbon	
	NOx	(VOC)	6,000
	CO	Benzene	1,500
	Hydrocarbons (HC)	Xylene	2,300
	Benzene	Toluene	2,000
	Xylene		
(Solid Wastes)	Oily chemical sludges		
	Off speck products : (carbon black : polypropy-lene chunks)		
	Spent catalyst		
	Discarded packaging Material		
PETROLEUM EXPLORATION AND PRODUCTION INDUSTRY		EFFLUENT (mg/l)	
(Waste Water)	Produced formation water	Temperature (^{0}C)	35
		pH	6.5-8.5
	Oily waste waters	Oil and grease	10
	Drilling fluids	Total suspended solids	30
	Accidental spill of oil	BOD_5	10
		COD	40

Industries	Problems	Guidelines for Maximum Concentration allowed for discharge into inland waters	
		Lead as Pb^{2+}	0.05
		Cr (VI) less than	0.1
		Zinc as Zn^{2+}	1.0
		Copper as Cu^{2+}	1.5
		Cadmium as Cd^{2+}	<0.1
		EMISSION (ug/m_3)	
(Gaseous Emission) (Solid Wastes)	Hydrocarbon vapours drilling mud, drilling cuttings produced sand domestic wastes oily sludges	Hydrocarbon	5,000
PHARMACEUTICALS		EFFLUENTS (mg/l)	
(Waste Water)	None specified	BOD_5	30
		Total suspended solids	25
		pH	6-9
PLASTIC AND SYNTHETICS		EFFLUENTS (mg/l)	
(Waste Water)	High BOD High COD containing mercury, plasticisers and PCBs	BOD_5	10
		Total suspended solids (TSS)	30
		COD	40
		Phenolics less than	0.50
		Zinc less than	1.0
		Chromium less than	0.01
		Oil and grease	10.0
		Fluoride (F) less than	1.0
		Copper (Cu^{2+}) less than	0.05
(Gaseous Emission)	Volatile organics Hydrocarbons		
(Solid Wastes)	Waste plastic products		

Industries	Problems	Guidelines for Maximum Concentration allowed for discharge into inland waters	
PULP AND PAPER		EFFLUENTS (mg/l)	
	High waste volumes containing: suspended bark and fibre from debarking and paper operations; fibres; spend liquors; wash waters from bleaching process; taste and odour producing wastes	BOD_5	15
		COD	100
		Suspended solids	30
		Bleaching agent should not be detectable Settleable matter	3.0
(Gaseous Emission)		EMISSION (ug/m^3)	
	Particulates, Sulphur dioxide, NOx from power boilers, Calcium oxide, Calcium sulphate particulate from lime kilns, Foul gases from digester blow tanks, Particulates and sulphur compounds from recovery boilers.	Particulate	100
		Hydrogen sulphide (H_2S)	100
		Sulphur dioxide (SO_2)	830
		Nitrogen oxides (NOx)	500
(Solid Wastes)	High volumes of bark, saw-dust and clarifier sludge.		
RUBBER MANUFACTURING			EFFLUENT (mg/l)
	BOD	BOD_5	15
	Suspended solids	Total suspended solid	10
(Waste Water)	Toxic metals	pH	6-9
		Lead (Pb) less than	1

Industries	Problems	Guidelines for Maximum Concentration allowed for discharge into inland waters	
		Chromium less than	1
		Zinc (Zn) less than	0.1
			EMISSION (ug/m^3)
(Gaseous Emission)	Foul gases	Volatile Organic Carbon (VOC)	2,000
SERVICE INDUSTRIES			EFFLUENT (mg/l)
	Oily waste waters from maintenance shops fueling depots and washing platforms	BOD_5	15
		Oil and Grease	10
		COD	40
		Lead less than	1
(Waste Water)	High BOD wastes from tank car washings	Total Chromium less than	0.3
		Zinc (Zn) less than	0.1
			EMISSION (ug/m^3)
	Exhaust fumes from idling containing SO_2, NO_2 and particulates.	Particulate	100
		Sulphur-dioxide	830
(Gaseous Emission)	Exhaust air from maintenance shop containing particulate, welding fumes, solvents, and paint spray booths, etc.	(SO_2)	
		Nitrogen oxides (NOx)	500
		Toulene	2,000
		Xylene	2,300
		VOC	6,000
		Benzene	1,500
		CO	5,000
		(hydrocarbons)	500

Industries	Problems	Guidelines for Maximum Concentration allowed for discharge into inland waters	
(Solid Wastes)	Rags, wood, soil impregnated with oil or oily wastes due to spills or accidents		
SOAP AND DETERGENT		EFFLUENT (mg/l)	
(Waste Water)	High pH	COD	40
	Oil and grease	BOD_5	15
		Total suspended solids	<10
		Oil and grease	<10
		pH	6-9
			EMISSION ($mg/m^{3)}$
(Gaseous Emission)	Particulate matter	Particulate	100
	Sulphur Oxide	Sulphur dioxide	830
(Solid Wastes)	packaging material		
SUGAR PROCESSING		EFFLUENT (mg/l)	
(Waste water)	High BOD	BOD_5	30
		Suspended solids	5
		pH	6-9
			EMISSION (ug/m^3)
(Gaseous Emission)	Bagasse dust	particulate	500
(Solid Wastes)	Press Cake		
	Bagasse		
	Bagasse ash		
TANNERY			EFFLUENT (mg/l)
(Waste Water)	High BOD	Parameter Chrome Vegetable	

Industries	Problems	Guidelines for Maximum Concentration allowed for discharge into inland waters	
	Suspended solid waster from hide washings High pH High Sulphide Solid wastes from lime Sulphide treatment of hides	BOD_5 COD Suspended solids Total Chromium (iii)	50(15)* 100 (30) 160(40)* 80 (25) 30(10)* 40 (19)* 2.0
	Spent vegetable and chrome tanning liquors Grease from rendering operations	Chromium (vi) Floating matter Oil and grease Chlorides (as Cl-) pH Sulphide Colour Odour	0.1 Not to be visible to naked eye 10 10 50 50 6-9 6-9 1 None None None None
		EMISSION (ug/m^3)	
(Gaseous Emission)	Particulate Odour in boiler emissions Odour from plant processes	Particulate 100 Hydrogen sulphide	500 30
(Solid Wastes)	Solids from screening, sludge		
TEXTILE MILLS			EFFLUENT (mg/l)
(Waste Water)	High pH High suspended solids Colour	Ph BOD_5 COD Suspended solids Chromium (vi) Phenols Sulphide Coliform 400 MPN/	6-9 20 80 30 <0.10 0.01 0.20 100ml

Industries	Problems		Guidelines for Maximum Concentration allowed for discharge into inland waters
		Colour	NS None
		Odour	NS None
			EMISSION (ug/m^3)
(Gaseous Emission)	Particulate matter	Particulate	100
(Solid Wastes)	Sludge		
	Textile Wastes		

*( ) For discharges into small streams.

CHAPTER TWO

WATER QUALITY STANDARDS

2.1 Water quality requirements differ for various industries and processes even within the same plant. Water treatment technology is often employed to bring raw process water to the desired quality for each industry. The cost of water treatment will be considerably minimized if less polluting effluents are discharged into water sources for industrial uses. Based on available data, Water Quality Guidelines are presented for selected industries in Tables 2.1 to 2.7 World Health Organizations (WHO) limits for domestic water use are being adopted as FEPA guidelines (Table 2.8).

2.2 Water and Waste Water Quality Monitoring

It is important that industries monitor their effluents in-house while FEPA will also cross-check the effluent characteristics to ascertain the degree of compliance with the proposed guidelines. Analytical methods are conventionally prescribed for all parties to be involved in the monitoring exercises. An overview of the general analytical methods commonly used for the determination of significant parameters in Waters and Waste Waters is given in Table 2.9.

Any of the well tested standard methods for water and waste waters analysis by United States Environmental Protection Agency (USEPA), Department of Environment (DOE) U.K., American Public Health Association (APHA) or American Society for Testing and Materials (ASTM) are hereby adopted for monitoring purposes pending the development of standard methods by FPA. For reporting purposes, the analytical method(s) used shall be specified.

TABLE 2.1

WATER QUALITY GUIDELINES FOR
POWER GENERATION STATION

CONCENTRATION (mg/l) COOLING ONCE-THROUGH

Parameter	Boiler			Misc.
	Fresh	Brackish*	Feedwater	Use
Silica	<50	<25	<0.21	-
Aluminum	NS	NS	<0.01	-
Iron	NS	NS	<0.01	<1.0
Manganese	NS	NS	<0.01	-
Calcium	<200	<420	<0.01	-
Magnesium	NS	NS	<0.01	-
Ammonia	NS	NS	<0.07	-
Bicarbonate	<600	<140	<0.5	-
Sulphate	<680	<2700	NS	-
Chloride	<600	<19000	NS	-
Dissolved solids	<1000	<35000	<0.5	1000
Copper	NS	NS	<0.01	-
Hardness	<850	<6260	<0.07	-
Zinc	NS	NS	<0.01	-
Alkalinity (as $CaCo_3$)	500	<115	<1	-
pH unit	5.0-8.3	6.0-8.3	8.8-9.4	5.0-9.0
Organic Material Methylene blue active substances	NS	NS	<0.1	<10
Carbon tetrachloride extract	<NS	NS	NS	<10
Chemical Oxygen Demand (COD)	<75	<75	<1.0	-
Dissolved oxygen	-	-	<0.007	-
Total suspended solids	<500	<2500	<0.05	<5

Note:

• = Brackish water-dissolved solids more than 1000 mg/l
NS = No Specification

TABLE 2.2

WHAT WATER QUALITY GUIDELINES AT
INTAKE FOR THE
IRON AND STEEL INDUSTRY CONCENTRATION (mg/l)
RINSE WATER

	Hot-rolling quenching gas cleaning	Cold-rolling	Softened	Demineralised
pH	5.0-9.0	5.0-9.0	6.0-9.0	
Total suspended solids	<25	<10	NS	N
Total dissolved solids	<1000	<1000	NS	N
Settleable solids	<100	<5.0	NS	N
Dissolved oxygen	.....	.....	(minimum for aerobic conditions)....	
Temperature (^{0}C)	<38	<38	38	<
Hardness	NS[b]	NS[b]	100	<0
Alkalinity	NS	NS	NS	<8
Sulphate	<200	<200	200	
Chloride	<150	<150	150	
Oil	NS	NS	NS	N
Floating material	NS	NS	NS	N

Note:
NS = No Specification

TABLE 2.3

WATER QUALITY GUIDELINES AT IN-TAKE
FOR THE PETROLEUM INDUSTRY

Parameter	Concentration (mg/l)
pH	6.0-9.0 (No Unit)
Colour	NS
Calcium	<75
Magnesium	<25
Iron	<1
Bicarbonate	NS
Sulphate	NS
Chloride	<200
Nitrate	NS
Fluoride	NS
Silica	NS
Hardness (as $CaCo_3$)	<350
Total dissolved solids	<750
Total suspended solids	<10

Note:

NS = No Specification

TABLE 2.4

WATER QUALITY GUIDELINES FOR THE PULP AND PAPER INDUSTRY
CONCENTRATION (mg/l)

			Kraft		Chem. Pulp and Paper	
Parameter	Fine Paper	Groundwater	Bleached	Unbleached	Bleached	Unbleached
pH	-	-6-8	-	-	6-	6-8
Colour (HU)	<40	<100	<25	<100	<50	<100
Turbidity (NTU)	<10	<20	<40	<100	<10	<20
Calcium	<20	<20	-	-	<20	<20
Magnesium	<12	<12	-	-	<12	<12
Iron	<0.1	<0.1	<0.2	<1.0	<0.1	<1.0
Manganese	<0.3	<0.1	<0.1	<1.0	<0.1	<1.0
Chloride	-	25-75	<200	<200	<200	<200
Silica	<20	<100	<50	<100	<50	<50
Hardness	<100	<100	<100	<100	<100	<100
Alkalinity	40-75	<150	<75	<150	-	-
Total dissolved solids	<200	<250	<300	<500	<200	<200
Total suspended solids	<10	-	-	-	<10	<10
Temperature (^{0}C)	-	-	-	-	<36	-
CO_2	<10	<10	<10	<10	-	-
Corrosion tendency	Nil	Nil	Nil	Nil	Nil	Nil
Residual Chlorine	<2.0	-	-	-	-	-

TABLE 2.5

WATER QUALITY GUIDELINES FOR THE FOOD BEVERAGE INDUSTRY
CONCENTRATION (mg/1)

Parameter	Baking	Brewing	Carbo-nate beve-rage	Confec-tionary	Dairy	Food canning, greezing dried frozen fruits vegetable	Food Processing (general	Sugar Manufactur-ing
pH	-	<7.0	6.9	7.0	-	<8.5	-	-
Colour (HU)	10	5	10	-	NS	5	5.10	-
Turbidity (NTU)	10	10	<2	-	-	5	1.10	-
	low	low	NS	low	NS	NS	low	-
..	-	-	NS	low	500	10	-	NS
Taste, odour (units)	-	800	850	<100	500	500	850	-
Total suspended solids	NS	100	-	-	-	100	-	20
Total dissolved solids	-	30	-	-	-	-	-	10
Calcium	0.2	-	01	0.2	<0.3	0.2	0.2	1
	0.2	0.1	0.05	0.2	<1.0	0.2	0.2	0.1
..	-	-	-	-	NS	-	-	-
Magnesium	-	-	-	-	trace	0.5	-	100
Iron	-	NS	-	-	-	-	-	-
Manganese	-	50	5	-	-	-	-	-
Copper	-	100	200	-	60	250	-	20
Ammonium	-	20.00	250	250	30	250	-	-
Bicarbonate	-	10	-	-	20	10	-	-
Carbonate	-	1	<1.0	-	-	1	1	-
Sulphate	-	50	NS	NS	-	50	-	-
	NS	70	<250	-	80	250	<250	100
..	-	85	<128	-	-	<250	<250	-
Chloride	0.2	0.2	0.2	0.2	-	-	-	-
	-	-	15	-	-	-	-	-
..	-	-	slight	-	10	0.2	-	-

Nitrate	-	-	0.2	0.2	-	NS	-	-
Fluoride	-	-	-	-	-	NS	-	-
	-	-	-	-	NS	-	-	NS
..	-	NS	NS	-	NS	-	-	-
Silica	-	-	-	-	-	-	-	trace
Hardness		trace	trace					
Alkalinity								
Hydrogen Sulphide								
Oxygen consumed								
..								
Carbon tetrachloride extract ..								
Chloroform extract Acidity....								
Acidity								
Phenol								
Nitrate								
Organic matter								

Note: NS = No specification

TABLE 2.6
WATER QUALITY GUIDELINES FOR CHEMICAL AND ALLIED INDUSTRIES
CONCENTRATION (mg.l)

Parameter	Alkalines and Chlorine	Organic Chemicals	Inorganic Chemicals	Clear Plastics	Synthetic Rubber	Drugs and Pharma-ceuticals	Soap and Deter-gents	Paints	Ferti-lizers
pH	NS	6.5-8.7	NS	6.2-8.3	NS	NS	NS	NS	NS
Colour units	NS	NS	NS	NS	<20	<5	NS	NS	NS
Turbidity units	-	-	-	<2	-	<1	-	-	-
Taste and odour (threshold)	NS	NS	NS	<2	NS	-	NS	NS	NS
	<2	<68	NS	NS	<80	NS	NS	NS	NS
..	<2	<19	NS	NS	<35	-	NS	NS	NS
Calcium	<0.1	<0.1	NS	<0.2	<0.1	-	NS	NS	NS
	<0.1	<0.1	NS	<0.02	<0.1	-	NS	NS	NS
..	NS	<128	NS	NS	-	-	NS	NS	NS
Magnesium	NS	NS	NS	NS	NS	NS	NS	NS	NS
Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Manganese	NS	NS	NS	NS	NS	-	NS	NS	NS
Bicarbonate	NS	NS	NS	NS	NS	-	NS	NS	NS
Sulphate	low	<250	NS	NS	<350	-	NS	NS	NS
	NS	<125	NS	NS	<150	-	NS	NS	NS
..	NS	NS	NS	<200	NS	-	NS	NS	NS
Chloride	NS	NS	NS	NS	<5	<10	NS	NS	NS
	NS	NS	NS	NS	NS	-	NS	NS	NS
..	NS	NS	NS	NS	NS	c	NS	NS	NS
Nitrate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Silica							NS	NS	NS
Hardness (as $CaCo_3$)									
Alkalinity (as $CaCo_3$)									
Total dissolved solids									
Total suspended solids									
Dissolved									
Chemical Oxygen Demand									

..

Biochemical Oxygen Demand .. ..

TABLE 2.7

WATER QUALITY GUIDELINES FOR THE TEXTILE INDUSTRY
CONCENTRATION (mg/l)

Parameter	Sizing Suspension	Scouring	Bleaching	Dyeing	Pulp Manufacture	Manufacture
Iron	0.3	0.1	0.1	0.1	0.05(Fe+Mn)	ND
Manganese	0.05	0.01	0.01	0.01	0.03	ND
Copper	0.05	0.01	0.01	0.01	5	-
Total dissolved solids	1.00	1.00	1.00	1.00	1.00	-
Total suspended solids	5	5	5	5	-	-
Hardness (as CaCo)	25	25	25	25	8	25
pH: Cotton	6.5-10.0	9.0-10.5	2.5-10.5	7.5-10.0	-	-
Synthetics	6.5-10.0	3.0-10.0	NA	6.5-7.5	-	-
Wool	6.5-10.0	3.0-5.0	2.5-5.0	3.5-6.0	-	-
Viscose Rayon	-	-	-	-	-	7.8-8.3
Colour (Relative Units)	5	5	5	5	5	-
Turbidity (NTU)	-	-	-	15	5	0.3
Aluminum	-	-	-	-	8	-
Silica	-	-	-	-	25	-
Alkalinity (as $CaCo_3$)	-	-	-	-	50-75	50-75

Note:
ND = Not Detected
NA = Not Applicable

TABLE 2.8

COMPARATIVE FIGURES OF LIMITS FOR SUBSTANCES AFFECTING THE ACCEPTABILITY OF WATER FROM DOMESTIC PURPOSES (CONCENTRATION (mg/l)

Substances	W. H. O. International Limits*			European	USSR Limits	USA Limits	Proposed EEC Limits
		Highest Desirable	Maximum Permis-sible			Guide Level	Maximum Admissible Concentra-tion
Phenolic compound (as phenol)	0.001	0.001	0.001	0.001		-	0.001
Fluoride (as F)	1.0-1.7[a]	-	0.2-1.7[a]	0.7-1.5[b]	1.4-2.4[a]	-	0.7-1.5[a]
Nitrate (as No_3)	50.100	-	-	10 (as N)	10 (as N)	-	0.7-1.5[a]
pH	-	7.0-8.5	6.5-9.2	6.5-8.2	-	6.5-8.5	9.5
Copper (as (Cu^{2+})	0.5[c]	0.05	1.5	1.0	-	-	0.05[c]
Iron (as Fe^{2+})	0.1[c]	0.1	1.0	0.5	-	0.1	0.05
Manganese (as Mn^{2+})	0.05	0.05	0.5	0.1	-	0.02	0.5
Zinc (as Zn^{2+})	5.0	5.0	15.	5.0	-	-	0.1[c]
Magnesium (as Mg^{2+})	50.125[d]	50-150[d]	150	-	-	50	50
Sulphate (as SO_4^{2-})	150	200	400	500	-	5	250
Hydrogen Sulphate (as H_2S)	0.05	-	-	Sulphides:	-	-	nil
Chloride (as Cl^-)	200-600	200	600	350	-	5	200
Chlorine (fee)	-	-	-	nil	-	-	-
Anionic detergent	0.2	0.2	1.0	individual limits	-	-	0.1
Ammonia (as NH_4)	0.5	-	-	2.0 (as N)	-	0.05	0.5
Carbon dioxide (free)	nil	-	-	-	-	-	-
Calcium (as Ca^{2+})	-	75	200	-	-	100	-
Mineral Oil	-	0.01	0.5	0.5	0.1	-	0.01

Mineral Oil with high Sulphur content	-	-	0.1	0.1	-	-	-
Turbidity (units)	-	5	25	1.5	1[c]	5	10
Organics	0.2-0.5	-	-	-	0.7	0.1	-

Note:

(a) Depending on temperature
(b) Varies according to climatic conditions
(c) Under certain circumstances higher levels
(d) Depending on sulphate concentration
(e) Carbon Chloroform Extract

WHO Limits is being adopted as FEPA Guidelines.

TABLE 2.9

SOME IMPORTANT WATER QUALITY TESTS, THEIR MAJOR SIGNIFICANCE AND GENERAL MEANS OF MEASUREMENT

Quality Parameter	Significance	General Method of Analysis; Expression of Results
Colour (apparent)	Suspended and dissolved solids	Colorimetry method: comparison with platinum cobalt standard: unit of colour being produced by 1 mg/l platinum in the form of chroplatinate iron.
Odour	Most organic and some inorganic chemicals	Subjective perceived odour: threshold number
Turbidity	Estimate of suspended matter	Jackson candle turbidimetry (Jackson units) or Nephelometry method (Formazin units)
Dissolved oxygen	Potential for oxidation of organic matter; life support	Titrimetry or electrochemical method percent saturation or mg/l 0_2
Carbon dioxide	Aerobic/anaerobic decomposition of organic matter; carbonate equilibrium	Nomographic, titrimetry mg/l of CO_2
Total suspended solids	Turbidity: treatment efficiency	Gravimetry; mg/l
Settleable solids	Turbidity; treatment	Gravimetry; mg/l
Total dissolved solids	Salinity: may affect ecosystems and domestic and agricultural usefulness	Gravimetry; mg/l
Total solids	General polluting potential	Gravimetry; mg/l
Calcium	Hardness: Scale formation	Tritimetry and gravimetry mg/l of $CaCo_3$
Total Organic Carbon (TOC)	Extent of organic matter	Tritimetry and colorimetry; mg/l of carbon
Organic nitrogen	Extent of nitrogenous organic matter	Colorimetry of titrimetry mg/l of organic nitrogen
Ammonia nitrogen	Extent of nitrogenous organic matter (proteins) toxicity	Titrimetry: mg/l of ammonia nitrogen
Nitrate nitrogen	Extent of oxidation of NH_3 plant nutrient may serve as source of 0_2, toxic in excessive amounts (Methaeomglobinemia)	Colorimetry: mg/l of ammonia nitrogen

Quality Parameter	Significance	General Method of Analysis; Expression of Results
Nitrite nitrogen Phosphate	Extent of oxidation of NH_3 plant nutrient may serve as source of 0_2, toxic in excessive amounts (Methaeomglobinemia) Plant nutrient	Colorimetry: mg/l of nitrite nitrogen Colorimetry: mg/l of phosphate as PM_4^{3-}
Sulphate	Possible reduction to H_2S: corrosion of concrete, possible gastrointestinal irritation	Gravimetry or colorimetry: mg/l of sulphate as SO_4^{2-}
Cyanides	Toxic potential	Colorimetry; mg/l or titrimetry: mg/l or cyanide
Phenols	Toxic potential odour; taste	Titrimetry, chromatography or dolorimetry: mg/l of phenol
Synthetic detergents	Foam: toxic potential: taste	Colorimetry or titrimetry: mg/l of specific detergent
Pesticides	Toxic potential	Gas chromatography method: mg/l of pesticide
Iron	Taste: discolouration: turbidity; growth of (iron) bacteria	Colorimetry or atomic absorption spectroscopy: mg/l of iron
Magnesium	Hardness: taste, possible gastrointestinal irritation, scale formation	Colorimetry or atomic absorption spectroscopy: mg/l or magnesium
Hardness	Soap consummation; scale formation	Titrimetry: mg/l of CaCo3
pH value	Intensity of acid or alkali present, strength of effluents affects many chemical and biological properties	
Chloride ion	Degree of pollution, sewage; degree of salt water intrusion; taste, corrosion in her water systems	Titrimetry or colorimetry: mg/l of Cl
Stability/saturation with respect calcium carbonate	Ability to maintain oxidised condition: tendency to revert to anaerobic conditions with foul odours	Stability/saturation index
Biochemical Oxygen Demand (BOD)	Extent of biodegradable organic matter	Measurement of dissolved oxygen before and after incubation for 5 days at 20^0C: mg of oxygen consumed per litre
Chemical Oxygen Demand	Organic matter susceptible to	Titrimetry: mg/l of oxygen

Quality Parameter	Significance	General Method of Analysis; Expression of Results
(COD)	oxidation by a strong chemical oxidant	consumed from standard dichromate solution
Permanganate values	Oxidizable inorganic matter, also oxidised organic matter	Titrimetry: mg/l or oxygen consumed from a standard permanganate solution

CHAPTER THREE

INTERIM GASEOUS EMISSION AND AMBIENT AIR QUALITY LIMITATIONS

3.1 Gaseous Emission Limitations

Guidelines for emission limits from stationary sources represent maximum allowable levels of pollutants from a site, process, stack, vent, etc. with the objective of achieving a desired air quality. The prescribed emission limits depend on socio-economic and political considerations. Sources and types of pollutants are given in Table 3.1

Based on available data in literature, the proposed guidelines for emission limits for particulates in stationary sources as well as for specific pollutants are given in Tables 3.2 and 3.3, respectively.

TABLE 3.1

SOURCES AND TYPES OF AIR POLLUTANTS

Type	Aerosol	Gases	Vapour
Combustion process	Dust fume	SO_2	Organics, acids
Automotive engines	Fume, smoke	NO_2, SO_2,	CO, acids
Chemical process	Dust, mist fume, spray	Process dependent CO_2, SO_2, NH_3, H_2S	Odour, acids, sol-vents organics
Fluoro and electro-metallurgical process	Dust, fume	SO_2, CO fluorides	Organics
Petroleum Operations	Dust, fume	SO_2, H_2S NH_3, CO	Hydrocar bons, mercap tans

Quality Parameter	Significance	General Method of Analysis; Expression of Result	
Mineral processing	Dust, fume	Process dependent SO_2, CO AsH_3 fluorides	Organics
Food and feed operations	Dust	-	Odours
Biological decay sewage and refuse	Fume, mist	CH_4 H_2S	Odours -
Wind storms	Dust	-	-
Explosives (TNT)	Dust	$NO^{2'}$ - HN^2O (Mist)[3] H_2SO (Mist)[4]	
Cement	Dust	SO_2 NO_2	-
Primary aluminium (bauxite)	Dust, fluoride particu-lates	fluoride -	

Quality Parameter	Significance	General Method of Analysis; Expression of Result
Kraft pulp	Dust	SO_2 CO H_2S Methyl sulphide methyl mercap-tans
Chlor-alkali	-	CI_2 Mercury
Integrated steel mills	Dust, particu-lates, fluoride	CO, gaseous fluorides NH_3, SO_2
Metallurgical coke	Dust	SO_2 CO, NO_2 Hydrocar-bons
Petroleum refining	Hydrocar-bons	SO_2 CO, NO_2, NH_3 Alde-hydes, hydrocar-bons

TABLE 3.2

EMISSION LIMITS FOR PARTICULATES FROM STATIONARY SOURCES

Substance	Limits (mg/m^3)
COMBUSTION OF FUELS	
Dark burning (pulp mills)	250
Blast furnace gas burning	50
Central Stations	200-500
Coal burning	100-500
Oil burning	50-250
Heavy oil burning	50-300
Solid oil burning	100-500
Incineration of refuse	150-1,000
Asphalt plants	70-5,000
Carbon black manufacture	40-60
Cement production	150-500
Coal processing	150
Coke Manufacture (metallurgical)	40-60
Electrode manufacture (metallurgical)	150
Furnaces	75-600
Kilns (cement)	75-600
Kilns (ceramics)	150-600
Kilns (lime)	300-600

TABLE 3.3

EMISSION LIMITS FOR SPECIFIC POLLUTANTS FROM STATIONARY SOURCES

Source	Limits (mg/m^3)
Acid gases	200-9,000
Aldehydes	20
Ammonia	3 kg/hour
Antimony	20-100
Arsenic	20-100
Asbestos fibre	NS
Benzene	24.0 kg/hour
Beryllium	0.1
Cadmium	1.0-40
Carbon	50-250
Carbon dioxide	10% by volume
Carbon disulphide	100-500
Chlorine	3.0-200
Copper	20
Formaldehyde	0.5 kg/hour
Fluorine	1.0-100
Fluorine compounds	20-50
Heavy metals (Total)	10.0
Hydrocarbon	50
Hydrochloric acid	100
Hydrofluoric acid	100
Hydrogen fluoride	1.0230
Hydrogen sulphide	5-1,500
Lead	10-100
Manganese	0.1 kg/hour
Mercury	1.0-230
Nickel	20
Nickel carbonyl	0.5
Nitric acid	500-4,000
Nitrogen oxides	350-100
Organic compounds	50
Sulphur dioxide	30-3,000
Sulphur acid	5.0-1,000
Sulphur trioxide	100-200
Sulphur trioxide and sulphuric acid mist	0.8 kg/ton acid
Vinyl chloride	10-200 PPm

3.2 Ambient Air Standards

Since emissions from industries and other sources have impact on ambient air it is of utmost importance to prescribe guidelines for safe levels of air pollutants tolerable to humans, aquatic organisms and vegetation.

Table 3.4 indicates Guidelines for Nigerian Ambient Air limits for conventional pollutants while Table 3.5 gives levels for specific substances in the air.

3.3 Monitoring of Gaseous Emission and Ambient Air Limits

A summary of analytical methods for determination of air pollutants is given in Table 3.6 Standard method(s) of analysis from USEPA, DOE, EEC and SCOPE for the purpose of surveillance and monitoring studies are adopted pending the development of standard methods by FEPA.

Note:

*NS-None Specified emission standard for asbestos fibres is at present exceedingly difficult to define

TABLE 3.4

NIGERIAN AMBIENT AIR QUALITY STANDARD

Pollutants	Time of Average	Limit
Particulates	Daily average of daily values 1 hour.	250 ug/m^3 *600 ug/m^3
Sulphur oxides (Sulphur dioxide)	Daily average of hourly values 1 hour	0.01 ppm (26 ug/m^3) 0.1 ppm (26 ug/m^3
Non-methane Hydrocarbon	Daily average of 3-hourly values	160 ug/m^3
Carbon monoxide	Daily average of hourly values 8-hourly average	10 ppm (11.4 ug/m^3) 20 ppm (22.8 ug/m^3)
Nitrogen oxides (Nitrogen dioxide)	Daily average of hourly values (range)	0.04 ppm-0.06 ppm (75.0 ug/m^3-113 ug/m^3)
Photochemical oxidant	Hourly values	0.06 ppm

TABLE 3.5

TOLERANCE LIMITS FOR AMBIENT AIR POLLUTANTS

Pollutants	Long-Term	Limits	Short-term	Limits
	mg/m^3	+(hours)	mg/m^3	+(min.)
Acetic acid	0.06	24	0.2	30
Acetone	0.35	24	0.35	30
Ammonia	0.20	24	0.2	30
Aniline	0.03	24	0.05	30
Benzene	0.8	24	1.5	30
Cadmium	0.003	24	0.01	30
Chromium	0.001	24	0.0015	30
Dichloromethane	1.0	24	3.0	30
Diethylamine	0.05	24	0.08	30
Diethylether	65.00	12	155.0	30
Dimethylamine	0.005	24	0.005	30
Dimethyl disulphide	0.2	24	0.7	30
Carbon monoxide	1.0	24	5.0	30
Carbon tetrachloride	2.0	24	4.0	30

Note:
*Concentration not to be exceeded for more than once a year.

Pollutants	Long-Term	Limits	Short-term	Limits
	mg/m^3	+(hours)	mg/m^3	+(min.)
Chlorine	0.03	24	0.1	30
Chloroform	10.0	12	50.0	30
Dimethyl sulphide	0.05	24	0.08	30
Ethanol	5.0	24	5.0	30
Ethylene	5.0	24	5.0	30
Ethylene oxide	0.5	24	0.8	30
Fluorides (as F^-	0.005	24	0.02	30
Fluorides	0.01	24	0.08	30
Formaldehyde	0.012	24	0.055	30

Pollutants	Long-Term	Limits	Short-term	Limits
	mg/m^3	+(hours)	mg/m^3	+(min.)
Furfural	0.05	24	0.08	30
Hexachoronhexane	0.01	24	0.08	30
Hydrochloric acid	0.006	24	0.006	30
Hydrocarbons (total)	2.0	24	5.0	30
Hydrogen cyanide	0.01	24	-	-
Hydrogen sulphide	0.008	24	0.008	30
Lead	0.005	24	0.002	30
Lead sulphide	0.001	24	-	-
Malathion	-	0.015 ppm		30
Intrathion	0.001	24	0.001	30
Manganese	0.01	24	0.03	30
Mercury	0.0003	24	-	-
Methanol	0.5	24	1.0	30
Methyl acetate	0.07	24	0.07	30
Methyl acrylate	0.01	24	0.08	30
Methyl methacrylate	0.1	24	0.1	30
Methyl parathion	-	-	0.008	30
Methylene chloride	20.0	12	55.0	30
Mono methylamine	0.01	24	0.01	30
Naphthalene	0.008	24	0.008	30
Nitric acid	0.006	24	0.006	30
Nitrobenzene	0.008	24	0.008	30
Nitrogen dioxide	0.085	24	0.085	30
Nitrogen monoxide	0.4	12	0.8	30
Nitrogen oxides	0.004	24	0.1	30
Oxidants	0.08	24	0.1	30
Ozone	0.1	24	0.2	30
Pentane	25.1	24	100.0	30
Phenol	0.1	24	0.8	30
Phosphoric acid	0.1	24	0.8	30
Phosphorus Pentoxide	0.5	24	0.15	30
Propanol	0.5	24	1.00	30

Pollutants	Long-Term	Limits	Short-term	Limits
	mg/m^3	+(hours)	mg/m^3	+(min.)
Propylene	5.0	24	5.0	30
Pyridine	0.08	24	0.08	30
Silica	0.02	24	5.0	30
Soot	0.05	24	0.1	30
Styrene	0.08	24	0.008	30
Sulphur Dioxide	0.05	24	0.5	30
Sulphuric Acid	0.1	24	0.5	30
Suspended Particulates	0.15	24	0.5	30
Tetrahydrofuran	0.2	24	0.2	30
Tetrachloromethane	-	-	4.0	30
Thiophene	-	-	0.6	30
Toluene	0.6	24	0.6	30
Toluene Dissocyanate	0.02	24	0.05	30
Trichloroethylene	1.0	24	0.14	30
Triethylamine	0.14	24	0.14	30
Turpentine	25.0	12	75	30
Vanadium Pentoxide	0.002	24	-	-
Vinyl Acetate	0.15	24	0.15	30
Xylene	0.2	24	0.2	30

TABLE 3.6

COMMONLY MEASURED AIR POLLUTANTS AND METHODS USED

Pollutant	Methods
Grit and dust fall	bucket, jar, British standard deposit gauge (monthly)
Suspended particulates - Total - Smoke	USA high volume filter (gravimetric; 8 hourly) British Standard Smoke Filter (Soil Index; Daily) Tape-Filter (Soiling Index: hourly)

Pollutants	Long-Term	Limits	Short-term	Limits
	mg/m^3	+(hours)	mg/m^3	+(min.)
Sulphur Dioxide	West-Gaeke (specific for SO_2; daily) H_2O_2 followed by analysis for sulphate (specific			

	for SO_2; daily) H_2O_2 followed by titration or determination of conductivity (not gaseous acidity; daily or continuous) Coulometric (specific for SO_2; continuous) Statmann silical gel (8-hourly)
Sulphuric Acid Mist	Double Filtration (Daily)
Carbon Monoxide	Non-Dispersive infra-red (continuous)
Ozone	Chemiluminescence
Oxidants	Neutral KI (daily)
Methane	Flame Ionization (continuous)
Higher Hydrocarbons	Flame Ionization (continuous)
Nitric Oxide	Chemiluminescence - reaction with 0_3 (continuous)
Nitrogen Dioxide	Chemiluminescence - reduction to NO then reaction with 0_3 (continuous)

Continuous methods are those operating automatically

CHAPTER FOUR

NOISE EXPOSURE LIMITS FOR NIGERIA

4. Industrial or workplace noise arises from occupational exposure of workers to noise from industrial machines or exposure of neighbourhood population to noise from factories nearby. This is quite important in the country as most industrial estates exist alongside or close to residential areas. Other sources of noise include, aircrafts, loud music and public address systems. Exposure to industrial and other forms of noise can induce hearing loss and other pathological changes in the affected population.

Hence, it is recommended that daily noise exposure for workers should not exceed 90 decibels, dB(A) daily for a 8-hour working period. Equivalent 8-hour exposure calculations are shown in Table 4.1 Noise exposure limits for Nigeria are shown in Table 4.2.

TABLE 4.1

EQUIVALENT 8-HOUR EXPOSURE (L_8) CALCULATIONS

Proposed summation formula for estimating equivalent 8-hour noise exposure at the workplace is shown below.

$$D = \frac{t_1}{\overline{T}_1} + \frac{t_2}{\overline{T}_2} + \frac{t_3}{\overline{T}_3} + \frac{t_n}{T_n}$$

where:

D = Daily noise dose (must not exceed unity)
t = Actual exposure time at a given noise level

T = Permissible exposure time at that level in accordance with the table 4.2.
n = Number of discrete periods of exposure above 90 dB (A)

NOTE: 1. Maximum Exposure corresponds to D = 1.0
control required for D > 1.0
2. Noise levels below 90 dB (A) are not included in the summation.

TABLE 4.2

NOISE EXPOSURE LIMITS FOR NIGERIA

Duration Day, Hour	Permissible Exposure Limit dB (A)
8	90
6	92
4	95
3	97
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Note:
Exposure to impulsive or impact noise should not exceed 140 dB (A) peak sound pressure level.

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APPENDIX

WATER USE IN SELECTED MAJOR MANUFACTURING INDUSTRIAL GROUPS IN NIGERIA

		Total Number of Companies Visited			
Code	Industrial	Com-panies	Employees	Industrial Water used M^3/Yr	Industrial Waste Water M^3/Yr
31.	Feed and Allied Products	1	2,200	936,000	102,289.5
32.	Textile Mill Products	6	3,400	780×10^6	729×10^6
34.	Paper and Allied Products	4	2,491	$76,440 \times 10^6$	$72,060 \times 10^6$
35.	Chemical and Allied Products	7	5,979	$429,524 \times 10^6$	604×10^6
35.	Pharmaceutical Products	4	1,097	6.8×10^6	3.5×10^6
36-58.	Metal Products	7	4,122	686.4×10^6	565.2×10^6
	Miscellaneous Manufacturing Industries	3	1,370	1.07×10^6	870,000

APPENDIX 2

EXAMPLES OF GLOBAL HUMAN DISASTER EPISODES CAUSED BY INDUSTRIAL POLLUTION AND ACCIDENTS

Country and Year	Nature of Disaster
1. Oppau, Germany, Sept. 21, 1921	The biggest chemical explosion in Germany history occurred in a warehouse about fifty (50) miles south of Frankfurt when workers used dynamite to pry loose 4,000 tons of caked ammonium nitrate fertilizer. The blast killed 561 people and levelled houses four miles away.
2. Cleveland, Ohio, U.S.A. Oct. 20, 1944	A liquified-natural-gas tank belonging to the East Ohio Gas Company developed a structural weak-ness that led to a huge explosion. The blast and fire killed 131.
3. Texas City, U.S.A	The freighter `High flyer' loaded with ammonium nitrate fertilisers exploded in the harbour. The toll: 578 dead; 2,000 seriously injured
4. Ludwigshafau, Germany, July 28, 1948	A railway car transporting dimethyl-tether, used in making acetic acid and dimethyl-sulphate, to the 1.6 Farben Chemical Plant, exploded inside the factory gates. The blast and resulting fire killed 207 people and injured 4,000.

Country and Year		Nature of Disaster
5.	Nigeria, 1960s	Many reported cases of human poisoning by Gamalin 20 at University College Hospital, Ibadan from the cocoa producing areas of the old Western Nigeria.
6.	Minamata, Japan, 1953-60	Methylmercury poisoning of people eating fish polluted by mercury. Toll: 120 deaths, many victims hospitalised.
7.	Niigata, Japan, 1964-65	Similar incident to No. 6 Toll: 48 deaths.
8.	Vietnam, 1960s	High birth defects recorded in areas where U.S.A. forces applied 2,4,5-T herbicide for de-foliation of forests during the Vietnam war.
9.	Ghana, 1967	Methylmercury poisoning from fish. Toll: 144 deaths.
10.	Tijuana, Mexico, 1968	Severe intoxication of people after eating bakering products contaminated with parathion pesticide.
11.	Pakistan, 1969	Methylmercury poisoning from fish. Toll: 100 deaths.
12.	Iraq, 1971	Methylmercury poisoning from eating rice treated chemically for planting. Toll: 1,000 deaths.
13.	Almagordo, New Mexico	Pigs poisoned and deaths recorded from ingestion of grains treated with organomercurial fungicides. Farmers poisoned from eating contaminated pork.
14.	Flixborough on Plumberside, England Jumel, June 1, 1976	Britain's biggest peace time explosion occurred at the Nypro (U.K.) Ltd Chemical Plant when a pipe ruptured. The plant produced caprolactum, which is woven into Nylon. Toll: 28 workers killed. Every building on the 60 acre site levelled.
15.	Pakistan, 1976	Malathion poisoning of 7,500 public health field workers. 5 deaths reported.
16.	U.S.A., 1976	Kepone poisoning of Industrial workers.
17.	Seveso Italy, July 10, 1976	Accidental release of poisonous Dioxin due to an explosion at the Heffmann-la Roche plant.
18.	Love Canal, Niagara Falls, 1977	Human poisoning, high birth defects rate, from pesticides and industrial chemicals buried under ground 25 years earlier. Over 60 million dollars were spent in clean-up
19.	Akure, Ondo State, Nigeria, 1982	20 public health field workers poisoned by malathion in Ondo State.
20.	Mexico City, Nov. 19, 1984	Liquified gas tanks exploded at the San Juan Ixhuatepec Storage Facility operated by State-owned Petroleos Mexicanos. The resulting fire took 452 lives and injured 4,248 in Mexico's largest industrial disaster; 1,000 people are still missing
21.	Bhopal, India Dec. 4, 1984	2,500 people killed in the Industrial city of Bhopal due to accidental release of poisonous methyl Isocyanate gas from Union Carbide's Pesticide plant due to a faulty pump. Over 50,000 people were affected and treated for various ailments. Claims running into several billion

Country and Year	Nature of Disaster
	dollars were instituted against Du Pont Company by the victims
22. Onne, Nigeria, 1988	Accidental discharge of water containing high ammonia level into Okrika River from NAFCON, a fertiliser company, near Port Harcourt, caused massive fish kill and socio-economic problems for the artisanal fishery industry in the surrounding village. The villagers are claiming about N3 million compensation from the Company
23. Idimangoro, Agege, Lagos; Nigeria, 1979	Combined industrial effluent from Ikeja Industrial Estate through WEMABOD Treatment Plant which had broken down, spilled into Idimangoro area due to the blockage of one of the manholes on the effluent channel. Drinking well waters in the area were grossly polluted. The foundation of one of the houses affected by the spillage caved in. The occupants were evacuated.
24. Kaduna, Nigeria, 1987	Petroleum product spillage from the Kaduna Refinery into Rome and Rido Rivers had occurred unabated. Well waters in Rido Village as well as the Rido and Romi Rivers were grossly polluted. Compensation of more than N3 million have been paid to the villagers affected by the pollution problems caused.
25. Chernobyl, USSR, 26th April, 1986	Nuclear plant explosion. Radiation fall out contaminated total environment over a radius of 30-60 kilometres. Agricultural products, meat and fish were declared unfit. Evacuation of people from vicinity of plant.
26. Basel, Switzerland, 1st Nov., 1986	Fire accident occurred in Sandoz Company, a chemical company. Large quantities of toxic chemicals, insecticides and herbicides were washed into Rhine River by water used in quenching the fire. Massive fish kill involving several thousand tons of fish occurred over several kilometres along the River and across many countries. River Thine water was therefore declared unsafe for human use.
27. Koko, Bendel State, Nigeria June, 1988	3,888 tons of assorted toxic wastes from Italy were found to have been illegally dumped at the fishing Port of Koko. The Government ensured that the wastes were returned to Italy and promulgated Decree 42 of 1988 to forestall future re-occurrence. The environmental implications of this dumping episode are yet to be fully realised.

APPENDIX 3

CATEGORIES OF WASTES TO BE CONTROLLED ACCORDING TO UNEP BASEL CONVENTION FINAL ACT, 1989

3:0. Waste Streams

Y1	Clinical wastes from medical care in hospitals, medical centers and clinics
Y2	Wastes from the production and preparation of pharmaceutical products
Y3	Waste pharmaceuticals, drugs and medicines
Y4	Wastes from the production, formulation and use of biocides and phytopharmaceuticals
Y5	Wastes from the manufacture, formulation and use of organic solvents
Y6	Wastes from the production, formulation and use of organic solvents
Y7	Wastes from heat treatment and tempering operations containing cyanides
Y8	Waste mineral oils unfit for their originally intended use
Y9	Waste oils/water, hydrocarbons/water mixtures, emulsions
Y10	Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenys (PCTs) and/or polybrominated biphenyls (PBBs)
Y11	Waste tarry residues arising from refining, distillation and any pyrolytic treatment
Y12	Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
Y13	Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives
Y14	Waste chemical substances arising from research and development or teaching activities which are not identified and/or the environment are not known
Y15	Wastes of an explosive nature not subject to other legislation
Y16	Wastes from production, formulation and use of photographic chemicals and processing materials
Y17	Wastes resulting from surface treatment of metals and plastics
Y18	Residues arising from industrial waste disposal operations

3.1 Wastes having as Constituents

Y19	Metal carbonyls
Y20	Beryllium: beryllium compounds
Y21	Hexavalent chromium compounds
Y22	Copper compounds
Y23	Zinc compounds
Y24	Arsenic: arsenic compounds
Y25	Selenium: selenium compounds
Y26	Cadmium: cadmium compounds
Y27	Antimony: antimony compounds
Y28	Tellurium: tellurium compounds
Y29	Mercury: mercury compounds
Y30	Thallium: thallium compounds
Y31	Lead: lead compounds
Y32	Inorganic fluorine compounds excluding calcium fluoride
Y33	Inorganic cyanides
Y34	Acidic solutions or acids in solid form
Y35	Basic solutions or bases in solid form
Y36	Asbestos (dust and fibres)
Y37	Organic phosphorous compounds
Y38	Organic cyanides
Y39	Phenols: phenol compounds including chlorophenols
Y40	Ethers
Y41	Halogenated organic solvents
Y42	Organic solvents excluding halogenated solvents
Y43	Any congenor of polychlorinated dibenzo-furan
Y44	Any congenor of polychlorinated dibenzo-dioxin

Y45	Organohalogen compounds other than substances referred to in this Section (e.g. Y39, Y41, Y42, Y43, Y44).

APPENDIX IV

FEDERAL ENVIRONMENTAL PROTECTION AGENCY
FEPA DECREE NO. 58 OF 1988
HARMFUL WASTES (SPECIAL PROVISION)
DECREE NO. 42 OF 1988

APPLICATION FOR AN INDUSTRIAL WASTE
DISCHARGES/DISPOSAL PERMIT

FULL NAME AND ADDRESS OF REGISTERED PLANT .....

LOCATION OF SITE .....

AUTHORITY TO OPERATE ..... PLANT IN NIGERIA

(LICENCE NUMBER) .....

LOCATION OF POINT SOURCES: .....

WASTE CHARACTERISTICS-TYPE Mode/State (Liquid, gaseous, solid etc; constituents and their concentrations; volume/quantity, etc:
.....
.....
.....

DETAILED DESCRIPTION OF THE TREATMENT(S) AND DISPOSAL METHOD(S):
.....
.....
.....

(The description shall be in a form of an Environmental Evaluation Report for already operating plants and an Environmental Impact Assessment for new plants).

I declared that all the foregoing information is correct to the best of my knowledge.

....
Name/Signature of Applicant or
His Attorney Date

Note: Guidelines on the contents of Environmental Impact Assessment and Environmental Evaluation Report are as made available by Federal Environmental Protection Agency (FEPA)

APPENDIX V

FEDERAL ENVIRONMENTAL PROTECTION AGENCY
FEPA DECREE NO. 58 OF 1988
HARMFUL WASTES (SPECIAL PROVISION)
DECREE NO. 42 OF 1988

P/No.....

INDUSTRIAL WASTE DISCHARGE/DISPOSAL PERMIT

The Director/Chief Executive of the Federal Environmental Protection Agency (FEPA), hereby grant an Industrial Waste Disposal Permit, in Pursuant to an application for Registration dated .....day of .....19.....
in respect of the following:

FULL NAME AND ADDRESS OF PERMIT HOLDER .....

LOCATION OF SITE TO WHICH PERMIT RELATES .....

MODE OF DISCHARGE OF DISPOSAL TO WHICH THIS PERMIT RELATES .....

TYPE/VOLUME/QUALITY OF WASTES/WASTES/WASTESTREAM OF WHICH DISCHARGE OR DISPOSAL IS AUTHORISED .....
.....

This permit is granted subject to the following conditions:

....
Name and Signature Date

Note:

1. The following conditions shall apply to:

1a. Industrial Solid Waste

appropriate site preparation
pre-determination of

(i) Depth to groundwater

(ii) Direction of Groundwater flow

iii Groundwater of Characteristics
Available provisions for leachate containment

iv Available provision for leachate sampling and analysis

APPENDIX VI

FEDERAL ENVIRONMENTAL PROTECTION AGENCY
FEPA DECREE NO. 58 OF 1988
HARMFUL WASTES (SPECIAL PROVISION)
DECREE NO. 42 OF 1988

ABATEMENT NOTIFICATION FOR NON COMPLIANCE
WITH PERMIT CONDITIONS

To: .....
.....
.....

Whereas the Federal Environmental Protection Agency on ..... 19....., granted you a waste disposal/discharge Permit relating to .....
.....
and Whereas it appears to the Agency that the following condition(s) specified in the Permit is/are not being complied with, namely:
.....
.....
.....
Now the Federal Environmental Protection Agency hereby require you to comply with the said condition(s) before .....
.....
Failure to do so shall result in the revocation of the Permit

....
Signed Date

....
Designation Name

APPENDIX VII

FEDERAL ENVIRONMENTAL PROTECTION AGENCY
FEPA DECREE No. 58 OF 1988

HARMFUL WASTES (SPECIAL PROVISION)
DECREE No. 42 OF 1988

NOTICE OF REVOCATION OF PERMIT TO DISCHARGE/DISPOSE OF INDUSTRIAL WASTES

To: .....
.....
.....

Whereas the Federal Environmental Protection Agency on ..... 19....., granted you a Waste Disposal Permit No ....., relating to .....
.....

AND WHEREAS it appears to the Agency that the continuation of activities to which the permit relates would cause pollution or danger to public health or would be so seriously detrimental to the amenities of the locality affected by the activities that the continuation of them ought not to be permitted and that the pollution, danger or detriment cannot be avoided by modifying the conditions specified in the permit;

AND WASTES a notice by the Agency dated ....., 19..... requiring you to comply with the following condition(s), namely;
.....
.....
before ....., 19 ..... was served upon you on ....., 19 ..... and you have not complied with the said conditions within the said period: Now the Agency HEREBY GIVES NOTICE that the said permit to REVOKED with

....
Signature Designation

APPENDIX 8

FEDERAL ENVIRONMENTAL PROTECTION AGENCY
FEPA DECREE No. 58 OF 1988

HARMFUL WASTES (SPECIAL PROVISION)
DECREE No. 42 OF 1988

CERTIFICATE OF SAMPLING

This is to certify that .....
Name of Registered Plant

discharging treated waste/storm water/solid waste into:
.....
identify point of discharge

from a treatment plant .....
identify unit/code

has collected water sample(s)/solid wastes samples from/at .....
.....
identify point of source

on ..... at .....
(dated) (Time)

Sample(s) has/have been taken to .....
(identify laboratory)

for the analyses of the following parameters

(i)	.....	(vi)	.....
(ii)	.....	(vii)	.....
(iii)	.....	(viii)	.....
(iv)	.....	(ix)	.....
(v)	.....	(x)	.....

Sample Preservation Method: .....

Name and Signature of Sample Collector .....

Name and Signature of FEPA Official .....

Name and Signature of Company/Officer-in-Charge .....

APPENDIX 9

This consists of tables showing data on the physico-chemical characteristics of effluents from selected industries in Nigeria. (Source; FMWH, 1981)

LIST OF TABLES

TABLE 9.1

INDUSTRIAL SOURCES OF SOLID ORGANIC WASTES

Compound	Remarks
1. Tree Barks	Pulp and Paper industry - waste from debarking of trees before pulping
2. Baggasse	Sugar industry - waste straw left after the extraction of juice from sugar cane
3. Spent Grain	Brewery - waste grain after extraction of wort from mash
Parameter mg. per Litre	1st Visit 2nd Visit
4. Pulp	Tapioca Starch industry - waste after extraction of starch from peeled cassava
5. Plant Residue	Fruit canning - fruit peels, skin core, base, crown, seeds, etc. from the dressing of fruits for canning

TABLE 9.2

SOME SYNTHETIC ORGANIC CHEMICALS THAT COULD CAUSE SERIOUS ENVIRONMENTAL POLLUTION

Compound	Remarks
1. Synthetic detergents	Slightly toxic to fishes, used as active washing component of commercial detergents.
2. Chlorinated Pesticide	Moderately toxic. Stable to biodegradation and easily bioaccumulated, used for pest control
3. Cyclic insecticides and rodenticides	High toxic, used for the control of insects and rodents
4. Polychlorinated dioxins and dibenzofurans	Highly toxic, by-product in the production of chlorinated phenols and PCBs.
5. Polychlorinated biphenyls	Toxic, very stable to biodegradation, easily bioaccumulated, varied industrial applications, e.g. in heat exchange systems, in transformers and capacitors.

TABLE 9.3

WASTE WATER FROM NIYAMCO (Distillery, Nigeria)

Parameter mg. per Litre	1st Visit	2nd Visit
Temp. [c]	52 C	58 C
pH	4.7	4.1
Total Solids	23,390	23,415
Suspended Solids	1,102	722
Settleable Solids	397	400
Total Dissolved Solids (TDS)	22,290	22,630
Conductivity (umho/Cm)	4,200	5,300
BOD	20,944	21,450
COD^5	44,350	45,220
Chloride	-	12
Phosphate	3.1	1.2
Sodium	500	240
Potassium	87.5	51.2
Calcium	2.5	1.8
Magnesium	1.3	1.2
Heavy Metals		
Copper	0.02	0.05
Zinc	0.03	0.04
Lead	0.02	0.01
Manganese	0.13	0.23
Iron	1.8	3.2

Note: NIYAMCO being a Distillery discharges very concentrated and heavily polluting exhausted molasses or residuary liquors which are bio-degradable, and are responsible for the high BOD and total solids.

TABLE 9.4

EFFECT OF COMBINED (NIYAMCO AND NISUCO) WASTE WATER ON IRRIGATION WATER

Parameter mg. per Litre	Fresh Irrigation Water	Combined NISUCO NIYAMCO Effluent	A Main Drain Contaminated by Combined Effluent
pH	7.2	4.1	4.0
Total Solids	80.0	4,410	1,390
Suspended Solids	1.0	994	667
Settleable Solids	1.4	678	888
Total Dissolved Solids (TDS)	79.0	3,416	723
Conductivity (umho Cm^1)	60.0	1,030	320
BOD	0.6	4,246	600*
COD^5	6.6	11,100	974
Chloride	-	-	-
Phosphate	0.06	3.5	2.2

WASTE WATER FROM NIYAMCO (Distillery, Nigeria)-continued

Parameter mg. per litre			1st 2nd Visit
Sodium	20.0	500	80
Potassium	1.2	85	31.5
Calcium	0.2	2.7	1.6
Magnesium	1.3	1.4	0.8
Heavy Metals			
Copper	0.01	0.10	0.07
Zinc	0.05	0.25	0.13
Lead	0.02	0.02	0.02
Manganese	0.01	0.15	0.11
Iron	1.5	1.5	1.5

Note:

*The major pollutant in the waste water is bio-degradable sugars. This should not normally affect yield in the irrigated field.

TABLE 9.5

EFFLUENT FROM DIFFERENT POINTS AT THE PAPER MILL (NIGERIA)

Parameters (mg. per litre)	Line Washing effluent	Suction flat Boxes waste Water	Overflow from white Water Tank	Combined factory effluent (1st visit)	Black Water tank sample
pH	5.9	5.7	5.3	5.7	6.3
Total Solids	976	90	1,270	675	245
Total Dissolved Solids	153	84	259	204	220
(TDS)	779	0.0	912	407	15
Settleable Solids	823	6	1,011	471	25
Suspended Solids	-	7.5	5.5	7.5	12.5
Alkalinity	265	86	78	45	-
Hardness	5.7	3.4	2.8	1.6	7.5
Calcium	26.5	1.5	0.5	1.4	2.5
Magnesium	15	4.8	25	8.8	5.0
Sodium	7.5	2.2	50	68.0	15.0
Potassium	0.06	0.02	0.12	0.26	0.06
Zinc	0.01	0.02	0.06	0.07	0.02
Lead	0.02	0.02	0.15	0.05	0.03
Copper	0.70	0.08	1.2	0.30	1.7
Iron	0.03	0.02	0.11	0.11	0.3

Manganese	..	..

Parameter mg. per Litre			Fresh Irrigation Water	Combined NISUCO NIYAMCO Effluent	A Main Drain Contaminated by Combined Effluent
Chromium	0.02	0.02	-	-	-
BOD	4.7	3.2	5.3	3.9	2.5
COD^5	390	60	430	260	140

Note:

The major pollutant in most of the cases is settleable solids (pulp fibre). Settleable solids are low in the Black water and waste water from suction pump. Waste water from the white water tank is high in settleable solids. It is overflow of this nature which is responsible for high settleable solids in final effluent.

TABLE 9.6
EFFECT OF PAPER MILL EFFLUENT ON RIVER NIGER

Parameter	Combined Factory Effluent	River Niger Downstream of Discharge Point	River Niger About 50m From Discharge Point	River Niger but 100m from Discharge Point
pH	4.4	7.3	6.5	6.8
Total Solids	905	45	135	65
Total Dissolved Solids	135	20	40	31
(TDS)	764	15	82	17
Settleable Solids	220	25	54	35
Conductivity (umho/Cm)..	6.5	69	91	65
Hardness	2.5	10.5	10.1	9.7
Calcium	45.7	25.3	46.2	31.9
Magnesium	17	15	15	17
Potassium	16.3	33	60	48
Sodium	0.02	0.01	0.05	0.03
Manganese	0.65	0.21	0.29	0.25
Iron	1.87	0.01	0.01	0.01
Copper	0.07	0.07	0.02	0.08
Zinc	0.02	0.01	0.01	0.01
Chromium	730	20	70	30
COD	10.2	3.2	8.5	3.6
BOD_5				

Note:

The effect of the effluent on the River Niger and is localised to a short stretch near the River Band is reflected visually in colouration of the water and chemically in increased settleable solids and dissolved solids. The character of the River Bed in the affected area must have been completely altered over the years.

TABLE 9.7
CHARACTERISTICS OF WASTE WATER FROM NBL (BREWERY)

Parameter mg per litre	1	2	3	4	5	6
pH	10.7	11.2	11.0	8.8	9.0	4.6
Total solids	550	315	440	3,500	3,170	2,530
Suspended solids	154	18	38	616	406	804
Settleable solids	76	1.6	23	256	122	311
Dissolved solids	396	297	402	2,884	2,764	2,219
Alkalinity	-	-	112.5	125	230	-
Hardness	-	-	-	-	-	-
Conductivity	960	1,520	1,020	810	700	1,340
Sodium	21.5	25.0	135	160	160	40
Potassium	8.0	15.2	16	120	120	28
Calcium	1.1	0.4	0.5	42.0	37.0	9.0
Magnesium	1.3	0.4	0.5	1.5	1.7	7.6
Chloride	-	-	2	1.0	1.0	-
Phosphate	-	-	0.4	1.7	1.9	-
BOD_5	250.4	108.7	35	2,400	2,110	1,250
COD	-	-	63	3,100	3,000	-
Zinc	0.09	0.28	0.12	0.12	0.71	1.7
Copper	0.02	0.17	0.13	0.06	0.18	0.2
Manganese	0.09	0.03	0.02	0.16	0.19	0.5

1. Brew House Effluent
2. Bottling Hall Effluent (1st Visit)
3. Bottling Hall Effluent (2nd Visit)
4. Hourly composite sample over 10 hours (1st Visit)
5. Hourly composite sample over 10 hours (2nd Visit)
6. Grab sample of combined Effluent.

Note:

Apart from the need for neutralization, the Bottling Hall effluent (2 and 3) can be discharged without treatment. The final factory effluent (6) has contributions from all the possible sources and its composition is very variable. The suspended solids, for example, can go up suddenly when there is contribution from filter Press Sludge or Residual Sludge from whirlpool. Contributions from these sources are included in the composite.

TABLE 9.8
CHARACTERISTICS OF WASTE WATER FROM GUINNESS (GUINNESS)

Parameter mg. per litre	1	2	3	4	5	6
pH	6.1.	4.6	5.0	4.8	4.5	8.6
Total solids	3,496	2,100	2,820	1,800	1,950	914
Suspended solids	1,226	1,071	1,150	714	612	354
Settleable solids	30	482	272	84	207	76
Dissolved solids	2,250	1,029	1,670	1,166	1,344	560

Hardness	165	89	102	95	110	78
Alkalinity	17.8	acid	20.2	acid	acid	28.5
Conductivity	540	500	510	480	450	960
BOD	3,240	1,554	3,012	1,624	1,629	1,250
COD[5]	6,320	3,750	5,300	2,900	3,100	780
	(1st visit)	(2nd visit)	(2nd visit)	(2nd visit)	(2nd visit)	(2nd visit)

1. A grap sample of Final Effluent
2. 1st sudden change in appearance of Final Effluent
3. 2nd sudden change in the appearance of Final Effluent
4. 1st Composite sample over 5-hour period
5. 2nd Composite sample over 5-hour period
6. Combined Effluent

Note:

1 and 6 shows the variability of the combined factory effluent. Now and then, a change in the visual characteristics of the effluent is noticed (2 and 3) and the composite effluent (500 cm^3 hourly for 5 hours), 4 and 5, give an idea of what the average character of the effluent is. Notice the high BOD and COD and total solids. The effluent is now discharged untreated along with others through WEMABOD pipeline into Shasha stream.

TABLE 9.9

QUALITY OF PROCESS WATER AT THE SOFT DRINKS BOTTLING FACTORIES VISITED, COMPARED TO QUALITY OF PUBLIC WATER SUPPLIES IN OYO AND LAGOS STATES

	Pepsi-Cola* Factory	Coca-Cola* Factory	Range of Values reported for 16 different sup-plies in Oyo and Lagos States
pH	6.5	10.8	5.8-7.3
Appearance	Clear	Clear	Clear
Odour and taste	None	None	None
Total Solids	190	210	29-189
Dissolved Solids	190	210	29-189
Suspended Solids	None	None	None
Alkanility	27.5	37.5	16.9-34.5
Hardness	43	125	18-64.5
Calcium	15.5	50.6	-
Magnesium	1.0	7.1	-
Sodium	63	9.0	-
Potassium	20	4.0	-
Chloride	5	33	8.0-27.1
Phosphate	0.05	0.02	-
Zinc	0.04	0.05	0.06-3.7
Copper	0.01	0.03	0.05
Manganese	<0.05	0.05	0.05

Cadmium	……. ..	<0.05	0.05	0.05

*Note:

1. There is nothing unusual about the process water except the high pH of the water at Nigerian Bottling Company which may be due to over-dosing with lime. Level of Calcium is high for same reason.

TABLE 9.10

CHEMICAL CHARACTERISTICS OF EFFLUENTS FROM THE SOFT-DRINKS BOTTLING FACTORIES VISITED COMPARED WITH INDUSTRIAL EFFLUENT STANDARDS OF 1ST INDIA EFFLUENT STANDARD AND QUALITY PARAMETERS FOR SOME NIGERIAN RIVERS

Parameters (mg per litre)	Pepsi-Cola Factory	Coca-Cola Factory	1st India Effluent Standard	Quality Parameter for Nigeria Rivers
pH	9.0	11.1	5.5-9.0	5.5-7.5
Total Solids	770	3,000	-	50-500
Dissolved solids	760	2,980	-	50-450
Settleable solids	6	14	-	20
Suspended solids	10	20	100	20
Conductivity	990	1,850	-	-
Alkalinity	322.5	350	-	-
Hardness	105	308	-	-
Calcium	39	94.8	-	1.6-4.4
Magnesium	1.3	7.6	-	-
Potassium	22	9	-	-
Sodium	124	170	-	-
Chloride	11	47	-	-
Phosphate	1.0	10.5	-	-
Zinc	0.4	0.11	1.0	0.03-11
Copper	0.01	0.05	1.0	0.1
Lead	0.05	0.05	1.0	0.1

Note:

1. Extracted from India standards for effluents discharged into surface water.

2. The main pollutant here is pH-especially since the receiving streams are small. Neutrialisation to pH 7 is recommended before discharge.

3. Range for 21 rivers in South-Western Area of Nigeria discharging into River Niger and the Lagos Lagoon network.

TABLE 9.11

EFFLUENT QUALITY OF SOME TEXTILE MILLS IN NIGERIA
(SINGLE GRAB SAMPLES)

Parameter	Units	1st Factory	2nd Factory	1st Factory	2nd Factory	A Factory in
pH ..		8.5	9.2	9.3	6.3	11.7
Conductivity ..	Mmho/cm	1750	2100	375	190	5800
Alkalinity ..	mg$CaCo^3$/	-	-	167	56	846
Total Solids ..	1	1815	2050	430	360	3510
Turbidity ..	mg/1	-	-	32	22	30
COD ..	NTU	725	150	660	227	583
Colour ..	mg°2/1	Yellow	Yellow	Green	Yellow	Deep Purple
Chloride	-	-	-	285	312	222
BOD ..	mg/1	41	47	-	-	-
Nitrite ..	mg°2/1	1.58	-	-	-	-
Ammonia ..	mgN/1	48	-	-	-	-
Sodium ..	mgN/1	245	-	100	33	1000
Manganese ..	mg/1	0.23	-	-	-	0.2
Calcium	mg/1	69	-	4	4	12
Chromium ..	mg/1	0.25	-	-	-	-
Magnesium ..	mg/1	8.0	-	1.3	1.7	0.3
	mg/1					

TABLE 9.12

WATER QUALITY OF STREAMS POLLUTED BY TEXTILE WASTE WATER

Parameter	1st Polluted stream	2nd Polluted stream	3rd Polluted stream	Polluted stream in Kaduna
pH	6.1	11.0	6.5	11.5
Conductivity (umhos/cm)	155	1510	550	3300
	-	-	-	987
..	1191	1550	800	2685
Alkalinity	50	73	165	145
Total Solids (mg/1)	-	-	-	-
Total Suspended Solids	Green	-	-	Purple
Turbidity				Green
Colour	150	330	750	425
	10.4	80	230	-
COD (mg°2/1)	-	-	-	-
BOD (mg°2/1)	80	-	-	-
Nitrite	122	3,800	1,100	800
Ammonia	30	2.5	5.1	1.3
Sodium (mg/1)	18	1.1	3.6	7.2
Magnesium (mg/1)	0.2	-	-	-
Calcium (mg/1)	0.25	0.04	0.16	-
Chromium	1.5	4.9	4.8	-
Manganese (mg/1)	-	-	-	235
Iron (mg/1)	-	-	-	0.7
Chloride (mg/1)	-	200	300	20
Zinc				
Potassium (mg/1)				
..				

Note:
1st Stream: A Stream in Iganmu Industrial Estate
2nd Stream: A Stream in Ikeja Industrial Estate (Iya-Alaro Stream)
3rd Stream: Another Stream in Ikeja Industrial Estate (Shasha Stream)

TABLE 9.13

SOME QUALITY PARAMETERS FOR WATER FROM THE WELL IN IDIMAN-GORO, IKEJA 1976 COMPARED TO WHO (1971) RECOMMENDED HIGHEST DESIRABLE LEVELS (FOR DRINKING WATER)

Parameters	Well Water	WHO recommended Levels
pH	6.0	7.0-8.5
Colour	Dirty Green	Unobjectionable
Odour	Septic	Unobjectionable
Total Solids	470 mg/1	500 mg/1
Potassium	30 mg/1	-
Calcium	0.04 mg/1	75 mg/1
Sodium	500 mg/1	-

Copper	0.15 mg/	0.05 mg/1
Lead	0.07 mg/1	0.010 mg/1 (Upper Limit)
Iron	2.9 mg/1	0.1 mg/1
Manganese	0.02 mg/1	0.05 mg/1
BOD_5	60 mg°2/1	-
COD	240 mg°2/1	-

Note:

The major chemical pollutants in the well are biodegradable organic matters. The septic condition of the water was possible as a result of anaerobic decomposition of the dissolved organic matter. The dirty green colour suggested contribution from a textile factory.

TABLE 9.14

EFFECT OF "WEMABO EFFLUENT" ON SHASHA STREAM

Parameter	Effluent	Shasha Stream
Temperature	36°C	36°C
pH	7.2	6.5
Total Solids (mg/1)	1,110	800
Settleable Solids (mg/1)	37.5	43.6
Total Suspended solids (mg/1)..	252	165
Conductivity (umhos)/cm	515	550
	250	230
	.. 800	750
BOD_5 (mg°2/1)	Nil	Nil
COD (mg°2/1)	1,000	1,100
DO (mg°2/-)	300	300
Sodium (mg/1)	2.0	3.6
Potassium (mg/1)	4.0	5.1
	0.33	0.24
	.. 0.04	0.20
Calcium (mg/1)	0.01	0.16
Magnesium (mg/1)	2.7	4.8
Copper (mg/1)		
Lead (mg/1)		
Manganese (mg/1)		
Iron (mg/1)		

Note:

There was no convenient point upstream of the point of discharge to sample Shasha Stream before receiving the effluent. The effluent was sampled just before discharging into the stream and the stream was sampled about 200m after receiving the discharge.

The effluent obviously contributed greatly to the poor quality of the stream water. Notice especially the high Biochemical Oxygen Demand (BOD) and the low dissolved Oxygen (DO). A stream of normally acceptable quality should have a BOD_5 not greater than 6.0mg°2/1 and a DO not less than 4.0mg°2/1.

TABLE 9.15

SOME QUALITY PARAMETERS FOR EFFLUENTS DISCHARGING THROUGH PUBLIC SEWERS INTO SHASHA AND IYA ALARO STREAM JUST AFTER LEAVING THE IKEJA ESTATE

Parameter	Sewer 1	Sewer 2	Iya-Alaro Stream	Tolerance Limits for Effluent
Temperature	30°C	38°C	36°C	46°C
pH	6.2	11.7	11.0	6.0-9.0
Total Solids (mg/1)	445	2,725	1,150	2,500
Settleable Solids (mg/1)	57	336	38	-
Total Suspended Solids (mg/1)..	196	414	73	50
Conductivity (umhos/cm)	320	5800	1510	-
	75	250	80	50
..	290	880	330	100
BOD_5 (mg°2/1)	Nil	Nil	Nil	-
COD (mg°2/1)	367	13,500	3,800	-
DO (mg°2/1)	133	400	200	-
Sodium (mg/1)	3.6	1.0	1.1	200
Potassium (mg/1)	3.2	8.1	2.5	200
	0.04	0.44	0.12	0.1
..	0.05	0.07	0.06	0.1
Calcium (mg/1)	0.14	0.05	0.04	5.0
Magnesium (mg/1)	4.6	4.3	4.9	20
Copper (mg/1)				
Lead				
Manganese (mg/1)				
Iron (mg/1)				

Note:

The values quoted in this column are the tolerance limit for industrial effluents discharged into inland surface waters recommended by the Ministry of the Environment, Singapore. Notice that the pH, BOD, COD and suspended solids in the effluent in Sewer 2 which discharges into Iya-Alaro are very much higher than these tolerance limits.

APPENDIX 10

MAJOR CATEGORIES OF INDUSTRIES IN NIGERIA

10.1 Mining and Quarrying Activities

10.1.1 Metal and mining

10.1.2 Dredging, sand filling and land reclamation

10.1.3 Coal

10.1.4 Non-metallic mineral products including clays, sand, etc.

10.2 Food, Beverages and Tobacco

10.2.1 Abattoir, meat processing

10.2.2 Canned and preserved fruits and vegetables

10.2.3 Canned and preserved foods

10.2.4 Canning, preserving and processing of fish and sea foods

10.2.5 Dairy products

10.2.6 Vegetable and animal oils and feeds

10.2.7 Grain/Cereal Mill products

10.2.8 Bakery products

10.2.9 Sugar Factories and Refineries

10.2.10 Sugar Confectionery

10.2.11 Animal feeds

10.2.12 Soft drinks including carbonated water and mineral water

10.2.13 Tobacco products

10.3 Breweries, Distilleries and Blending of Spirits

10.3.1 Breweries

10.3.2 Distilleries

10.3.3 Blending of Spirits

10.4. Textiles

10.4.1 Woven fabrics finishing

10.4.2 Natural and synthetic fabric

10.4.3 Non-fabric finishing

10.4.4 Stock and yarn dyeing

10.4.5 Carpet mills

10.5 Tannery Industry

10.5.1 Vegetable Tanning

10.5.2 Chrome Tanning

10.6 Leather Products

10.6.1 Footwear

10.6.2 Luggage

10.6.3 Leather finishing

10.7. Wood, Wood Products including Furniture and Fixtures

10.7.1 Sawmills

10.7.2 Wood preserving

10.7.3 Particle board

10.8 Pulp, Paper and Paper Products

10.8.1 Pulp and Paper Mill

10.8.2 Paper Conversion and packaging

10.8.3 Printing and Publishing.

10.9 Miscellaneous

PART II

GUIDELINES FOR THE MANAGEMENT OF SOLID AND HAZARDOUS WASTES

INTRODUCTION

0.1. Following the promulgation of Decree 42 of November 1988, it is imperative and worthwhile that locally generated toxic and hazardous waste fall within the limits set by the National Policy on Environment which stipulates that the appropriate governmental agencies shall:

(a) maintain an up-to-date register of toxic, hazardous and radioactive substances;

(b) control the generation of toxic, hazardous and radioactive wastes and ensure that those banned shall be stringently controlled;

(c) monitor the effects and control all phases of the life-cycle of all substances likely to have an adverse impact on human health and environment;

(d) determine and use environmentally safe and technologically sound techniques for disposal of toxic, hazardous and radioactive wastes;

(e) set up regional framework and standards for the proposed "DUMP WATCH" against trans-boundary movement of toxic, hazardous and radioactive wastes and for the achievement of the environmentally sound management of hazardous substances.

0.2. Hazardous waste is potentially damaging to the environment and must be regulated. Most of it, however, comes from industries that are among the most important to the growth and maintenance of a modern industrial society.

The need for a hazardous waste management system begins when waste is generated and continues through subsequent stages to final treatment and disposal.

0.3. Objectives

For effective management, there shall be co-operation between the generator of the waste and the enforcement agency, and there shall be co-ordination among various persons and corporate bodies involved in the control activities.

The objectives of solid and hazardous waste management shall be to:

(a) designate those solid wastes which are dangerous or extremely hazardous to the public health and environment;

(b) provide for surveillance and monitoring of dangerous and extremely hazardous wastes and substances, until they are detoxified, reclaimed, neutralised, or disposed of safely;

(c) provide the form and rules necessary to establish a system for manifesting, tracking, reporting, monitoring, record keeping, sampling, and labelling dangerous and extremely hazardous wastes;

(d) establish the siting, design, operation, closure, post-closure, and monitoring requirements for managing hazardous waste disposal facilities;

(e) encourage recycling, reuse, reclamation and recovery to the maximum extent possible.

0.4. Designation of Dangerous (Hazardous) Waste

In the context of this document, dangerous waste is synonymous to hazardous waste. The two expressions are used interchangeably. Code numbers have been assigned to the various categories of dangerous wastes for easy identification. Each code number has a prefix FAC (FEPA Action Committee)

(i) The procedure for determining whether or not a solid waste is dangerous waste (D.W.) or extremely hazardous waste (EHW) is described below, and are applicable to any person who must determine whether or not his solid waste is so designated. Any person who determines by these procedures that his waste (or substances) is (are) designated DW or EHW shall be subject to all applicable requirement in these guidelines.

(ii) Once a material has been determined to be a dangerous waste, any solid waste generated from the recycling, treatment, storage, or disposal of that dangerous waste is dangerous waste unless and until;

(a) It does not exhibit any of the characteristics of dangerous waste.

(b) Such solid waste shall include but not be limited to any sludge, spill residue, ash emissions, control dust, leachate, or precipitation run-off. Precipitation run-off will not be considered a dangerous waste if it can be shown that the run off has not been contaminated with the dangerous waste or that the run off is adequately addressed under any other FEPA guidelines.

0.5. Designation Procedures

(a) To determine whether or not a waste is designated, a person shall check his wastes against the following sections below and in the following order:

(i) Discarded chemical products

(ii) Dangerous waste sources

(iii) Infectious dangerous waste

(iv) Dangerous waste mixtures

(v) Toxic dangerous waste

(vi) Persistent dangerous waste

(vii) Carcinogenic dangerous waste.

(b) When a person is reporting or keeping records on a dangerous waste, he shall use all the

Dangerous Waste Numbers which he knows are assignable to his waste from the dangerous waste list, characteristics, or criteria.

CHAPTER ONE

DANGEROUS WASTE LIST, CHARACTERISTICS AND CRITERIA

This chapter describes the characteristics and criteria of various types of dangerous wastes listed in Section 0.5 in the Introduction.

1.1. Discarded Chemical Products

1.1.1. A waste shall be designated as discarded chemical product if it is handled in any of the manners described in (a) to (d) of this subsection, and if it is a residue from the management of:

(a) a commercial chemical product or manufacturing intermediate which has the generic name listed in the discarded chemical product list FAC-000-000-9903;

(b) an off-specification commercial chemical product or manufacturing chemical intermediate which if it had met specification would have the generic name listed in the discarded chemical product list FAC-000-000-9903;

(c) any containers or inner liners that have been used to hold any commercial chemical product or manufacturing chemical intermediate that has, or any off-specification commercial chemical product or manufacturing chemical intermediate which if it had met specification, would have the generic name listed on the acutely dangerous chemical product list of FAC-000-000-9903 unless the container or inner liners are empty and have been triple rinsed;

(d) Any residue or contaminated soil, water, or other debris resulting from the clean up of a spill of a commercial chemical product or manufacturing chemical intermediate which has, or an off specification commercial chemical product or manufacturing chemical intermediate which if it has met specification would have, the generic name listed in the discarded chemical product list FAC-000-000-9903.

1.1.2. The materials or items described in (a) (b) (c) and (d) of this subsection shall be designated as dangerous waste when they are:

(a) discarded or intended to be discarded or described as abandoned i.e. disposal of, or burned or incinerated, accumulated, stored, or treated (but not recycled) before or in lieu of being abandoned by being disposed through burning or incineration;

(b) burned for purposes of energy in lieu of their original intended use;

(c) used to produce fuel in lieu of their original intended use;

(d) applied to the land in lieu of their original intended use; or

(e) contained in product that are applied to land in lieu of their intended use.

1.2. Dangerous Waste Sources

The dangerous waste sources list appears in FAC-000-000-9904. Any waste which is listed or which is a residue from the management of a waste listed on the dangerous waste sources list shall be designated a dangerous waste and shall be identified as DW, except the FAC-000-000-9904 includes several footnotes describing circumstances under which it is designated EHW rather than DW.

1.3. Infectious Dangerous Wastes

Infectious dangerous waste shall include, but need not be limited to, each of the following types of solid waste:

(i) culture and stock of infectious agents;

(ii) pathological wastes;

(iii) waste human blood and products of blood;

(iv) sharp instruments that have been used in patient care or in medical, research, or industrial laboratories;

(v) contaminated animal carcasses, body parts, etc;

(vi) wastes from surgery or autopsy that were in contact with infectious agents etc;

(vii) laboratory wastes from medical, pathological, pharmaceutical or other research, commercial or industrial laboratories.

1.4. Dangerous Waste Mixtures

1.4.1. A dangerous waste mixture shall be any waste about which some or all of its constituents and concentration are known and which have not been designated as:

(a) a discarded chemical product;

(b) an infectious dangerous waste;

(c) a dangerous waste source.

1.4.2. A person who has a waste mixture shall use data which is available to him,and when such data is inadequate for the purpose of this section, shall refer to FEPA Exclusive List of Registered Dangerous Substances in order to determine:

(a) toxicity data or category for each known constituent in his waste;

(b) whether or not each known constituent in his waste is a halogenated hydrocarbon or a polycyclic aromatic hydrocarbon with greater than three rings and less than seven rings; and

(c) whether or not each known constituent of his waste is an International Agency for Research on Cancer (IARC) human or animal positive or suspected carcinogen.

1.4.3. (a) If a person has toxic constituent in his waste, he shall determine the toxicity category for each known toxic constituent. The toxic category for each constituent may be determined directly

from FEPA Registry and checking this data against the Toxicity Category (Table 1.1.). If data is available for more than one of the four toxicity criteria (aquatic, oral, inhalation, or dermal), then Most Acutely Toxic Category shall be assigned to the constituent.

TABLE 1.1

TOXICITY CATEGORY TABLE

Category	TLm96 (Fish) Aquatic (Fish) or LC_{50} mg/l	Oral (Rat) LD_{50}	Inhalation (Rat) LC_{50} (mg/kg)	Dermal (Rabbit) LD_{50} (mg/kg)
X	<0.01	<0.5	<0.02	<2
A	0.01-1	0.5-5	0.02-0.2	2-20
B	1-10	5-50	0.2-20	20-200
C	10-100	50-500	2-20	200-2,000
D	100-1000	500-5,000	20-200	2,000-20,000

Note: Degree of toxicity decreases from X to D with X being the Most Acutely Toxic Category.

(b) A person whose waste mixture contains one or more toxic constituent shall determine the equivalent concentration for his waste from the following formula:

Equivalent concentration (%)

$$= X\% + \frac{A\%}{10} + \frac{B\%}{100} + \frac{C\%}{100} + \frac{D\%}{10,000}$$

Where (X,A,B,C, or D)% is the sum of all the concentration percentages for a particular toxic category.

1.5. Toxic Dangerous Wastes

(1) This section indicates how to determine the toxicity of a waste and the criteria by which a toxic waste shall be designated DW or EHW. The degree of toxicity shall be categorised according to the Toxic Table 1.1. If a person has established the toxicity of his waste by means of the bioassay test methods, and has determined his waste's toxicity range, then he shall designate his waste according to the Toxic Dangerous Waste Designation (Table 1.2).

TABLE 1.2.

TOXIC HAZARDOUS/DANGEROUS WASTE DESIGNATION TABLE

If your Waste's toxic range falls in the..	And your monthly or batch waste quantity as....	Then your waste's designa-tion is..
D Category	Greater than 100kg	DW
X, A, B, or C Category	182-100kg	DW
	Greater than 100kg	EHW

1.6. Persistent Hazardous/Dangerous wastes

1.6.1. This section describes the procedures for designating wastes which contain halogenated hydrocarbons (HH) and/or polycyclic aromatic hydrocarbons with more than three rings and less than seven rings (PAH).

1.6.2. A person shall determine the concentration of HH and/or PAH in his waste by either testing his waste as specified in (a) of this subsection, or by the calculation procedures described in (b) of this subsection.

(a) Concentration tests.-A person shall test his waste to determine its concentration level as stated in sampling and testing methods below.

(b) Concentration calculations.-If a person knows the concentrations in his waste, and if he can demonstrate to the Agency beyond a reasonable doubt that any remaining persistent constituents for which he does not know the concentrations would not contribute significantly to the total persistent concentration, then he may calculate the concentration of persistent constituents in his waste as follows:

(i) A person whose waste contains one or more halogenated hydrocarbons for which the concentrations are known shall determine his total halogenated hydrocarbon concentration by summing the concentration percentages for all of his waste's significant halogenated hydrocarbons.

Example 1:

A person's waste contains: Carbon tetrachloride of 0.009%; DDT of 0.012%, 1,1,1-trichloroethylene of 0.02%. His total halogenated hydrocarbon concentration would be:

Total HH Concentration (%)= 0.009% + 0.012% + 0.02% = 0.041%.

(ii) A person whose waste contains one or more polycyclic aromatic hydrocarbons with more than three rings and less than seven rings for which the concentrations are known shall determine his total polycyclic aromatic hydrocarbon concentration by summing the concentration percentages for all of his waste's significant polycyclic aromatic hydrocarbons with more than three rings and less than seven rings.

Example 2:

A person's waste contains: Chrysene of 0.08%; 3,4-benzopyrene of 1.22%. His total polycyclic aromatic hydrocarbon concentration would be:

Total PAH Concentration (%)=0.08%+1.22%=1.3%.

1.6.3. Designated criteria and quantity.-A person whose waste contains persistent (HH or PAH) constituents shall designate his waste according to the Persistent Dangerous Waste Table, (Table 1.3), if his monthly or batch waste quantity exceeds 100kg.

TABLE 1.3

PERSISTENT HAZARDOUS/DANGEROUS WASTE TABLE

If your waste Contains ...	At a Concentration level of...	Then your waste's designation is...
Halogenated Hydrocarbons (HH)	0.01 to 1.0%	DW
Polycyclic	Greater than 1.0%	EHW
Aromatic Hydrocarbons (PAH)	Greater than 1.0%	EHW*

* There is no DW concentration level for PAH.

1.7. Carcinogenic Dangerous Wastes

1.7.1. A substance which is listed as an IARC (International Agency for Research on Cancer) human or animal positive or suspected carcinogen, shall be a carcinogenic substance which is an inorganic, respiratory carcinogen shall be a carcinogenic substance only if it occurs in a friable format (i.e. if it is in a waste which easily crumbles and forms dust which can be inhaled).

1.7.2. Any person whose waste contains one or more IARC carcinogen(s) shall designate his waste if:

(a) The monthly or batch waste quantity exceeds 100kg; and

(b) (i) The concentration of any one IARC positive (human or animal) carcinogen exceeds 1.0 per cent of the waste quantity. Such waste shall be designated EHW, and such designation determined by (b) (ii) or (iii) of this subsection; or

(ii) The concentration of any one IARC positive (human or animal) carcinogen exceeds 0.01 per cent of the waste quantity. Such waste shall be designated DW; or

(iii) The total concentration summed for all IARC positive and suspected (human or animal) carcinogens exceeds (1.0 per cent of the waste quantity). Such waste shall be designated DW.

(c) For designation purposes, any IARC human or animal, positive or suspected carcinogen that is so rated because of studies involving implantation of the substance into test animals as site cause for the IARC rating, shall not be carcinogenic.

1.8. Dangerous Waste Characteristics

The following characteristics shall determine the designation or otherwise of a solid Waste as a Dangerous Waste:

(i) Ignitability

(ii) Corrosivity

(iii) Reactivity

(iv) Extraction Procedure Toxicity (EPTOX)

(v) Halogenated hydrocarbons concentration

(vi) Polycyclic aromatic, hydrocarbon concentration (PAH)

(vii) Static acute fish toxicity test

(viii) Acute oral rat toxicity test

(ix) Polychlorinated Dibenzo P-dioxins and dibenzofurans concentrations

(x) Polychlorinated Biphenyls (PCB's).

1.8.1. Sampling and Test Methods

The methods and equivalent used for obtaining representative samples of a waste will vary with the type and form of the waste. FEPA will consider samples collected using the sampling method below, for wastes with properties similar to the indicated materials, to be representative samples of the wastes:

(i) crushed or powdered material-ASTM Standard Method (D346-75);

(ii) extremely viscous liquid-ASTM Standard Method (D140-70);

(iii) flash-like material-ASTM Standard Method (D22234-76);

(iv) soil-like material-ASTM Standard Method (D1452-65);

(v) soil or rock-like materials-ASTM Method Standard (D420-69);

(vi) containerised liquid waste-(COLIWASA) described in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods", SW-846. USEPA (1985);

(vii) liquid wastes in pits, ponds, lagoons and similar reservoirs-"Pond sampler" described in "Test Methods for the evaluation of solid waste, physical/chemical methods:, SW-846, USEPA (1985).

1.8.1.1. Tests for Ignitability

(a) A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

(i) It is a liquid, other than an aqueous solution containing less than 24 per cent alcohol by volume and has a flash point less than 60°C as defined by Pensky-Mertens C Closed Cup Tester, using the test method specified in ASTM Standard D93-79 or D93-80, or a Setaflash closed cup tester using test method specified in ASTM Standard D3278:

(ii) It is not a liquid and is capable under standard temperature and pressure of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard;

(iii) It is an ignitable compressed gas.

(iv) It is an oxidizer.

(b) A solid waste that exhibits the characteristic of ignitability but is not designated as dangerous waste under any of the FEPA Dangerous Waste List or FEPA Dangerous Waste Criteria shall be assigned the dangerous waste number FD 001.

1.8.1.2. Tests for Corrosivity

(a) A solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has any or more of the following properties:

(i) It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5 as determined by a pH meter using method 5.2. in "Test Method for the Evaluation of solid waste, physical/chemical methods";

(ii) It is a liquid and corrodes steel (5AE 1020) at a rate greater than 6.35 mm per year at a test temperature of 55°C as determined by standard test method 01-69 as Standardised in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods".

(iii) It is a solid or semi-solid, and when mixed with an equal weight of water results in a solution, the liquid portion of which has the property specified in (a) (i) of this subsection.

(b) A solid waste that exhibits the characteristic of corrosivity, but is not designated as a dangerous waste under any of FEPA Exclusive List of Dangerous Substances listed in Sections 1.1 to 1.4, Dangerous Waste Criteria listed in Sections 1.5 to 1.7 shall be designated DW, and shall be assigned the dangerous waste number FD 002.

1.8.1.3. Tests for Reactivity

(a) A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

(i) It is normally unstable and readily undergoes violent change without detonating;

(ii) it reacts violently with water;

(iii) it forms potentially explosive mixtures with water;

(iv) when mixed with water, it generates toxic gases, vapours or fumes in a quantity sufficient to pose a danger to human health or the environment;

(v) it is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5 can generate toxic gases, vapours or fumes in a quantity sufficient to present a danger to human health or the environment;

(vi) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement;

(vii) it is readily capable of detoration or explosive decomposition or reaction at standard temperature and pressure; or

(viii) it is a forbidden explosive (FEPA's Reserve List);

(b) A solid waste that exhibits the characteristic of reactivity, but is not designated as a dangerous waste under any of the dangerous waste lists, or dangerous waste criteria, shall be designated dangerous waste (DW), and shall be assigned the dangerous waste number of FD 003.

1.8.1.4. Tests for Extraction Procedure (EP) Toxicity

(a) A solid waste exhibits the characteristic of Extraction Procedure (EP) toxicity if, using Extraction Procedure Tests methods, the extract from a representative sample of the waste contains any of the contaminants listed in the EP toxicity list in (c) of this subsection, at concentration equal to or greater than the respective value given in the list. When the waste contains less than 0.5 per cent filterable solids, the waste itself, after filtering, is considered to be the extract for the purpose of this subsection.

(b) A solid waste that exhibits the characteristic of EP toxicity, but is not designated as a dangerous waste under any of the dangerous waste lists, or dangerous criteria, has the FEPA dangerous waste number specified in the list which corresponds to the toxic contaminant causing it to be dangerous.

(c) Two levels of concentration are established for the contaminants listed (Table 1.4). Any waste containing one or more contaminants with concentrations in EHW (Extremely Hazardous Waste) ranges shall cause that waste to be designated EHW. Any waste containing contaminants which occur at concentrations in the Dangerous Waste (DW) range only (i.e. no EHW contaminants) shall be designated DW.

TABLE 1.4

EXTRACTION PROCEDURE (EP) TOXICITY LIST

Dangerous Waste Number	Contaminant	EHW Maximum Concentration In Extract (mg/1)	DW Maximum Concentration In Extract (mg/1)
FD 004	Arsenic	>500	5-500
FD 005	Barium	>10,000	100-10,000
FD 006	Cadmium	>100	1-100
FD 007	Chromium	>500	5-500
FD 008	Lead	>500	5-500
FD 009	Mercury	>20	02-20
FD 010	Selenium	>100	1-100
FD 011	Silver	>500	5-500
FD 012	Endrium	>2	0.02-2
FD 013	Lindane	>40	0.4-40
FD 014	Methoxychlor	>1,000	10-1,000
FD 015	Toxaphene	>50	0.5-50
FD 016	2, 4-D	>1,000	10-1,000
FD 017	2, 4, 5-T	>100	1-100

1.9. Generic Dangerous Waste Numbers

A waste which exhibits any of the dangerous waste characteristics listed above shall be assigned the dangerous waste number corresponding to the characteristics (s) exhibited by the waste as shown in Table 1.5.

TABLE 1.5

GENERIC HAZARDOUS/DANGEROUS WASTE NUMBERS TABLE

Dangerous Waste Number	Dangerous Waste Criteria and Designation
	Toxic Dangerous Wastes
FWT01	EHW
FWT02	DW
	Persistent Dangerous Wastes
	Halogenated Hydrocarbons
FWP01	EHW
FWP02	DW
	Polycyclic Aromatic Hydrocarbons
FWP03	EHW
	Carcinogenic Dangerous Wastes
FWC01	EHW
FWC02	DW

CHAPTER TWO

SPILLS AND DISCHARGES INTO THE ENVIRONMENT

2.1. Purpose and Applicability

This section sets out the requirement for any person responsible for a spill or discharge into the environment except when such release is otherwise permitted under the provision of "FEPA Guideline". For the purposes of complying with this section, a transporter who spills or discharges dangerous waste or hazardous substance during transportation will be considered the responsible person. This section shall apply when any dangerous waste or hazardous substance is intentionally or accidentally spilled or discharged into the environment (unless otherwise permitted) such that public health or environment are threatened, regardless of the quantity of dangerous waste or hazardous substance.

2.2. Notification

Any person who is responsible for a non-permitted spill or discharge shall immediately notify the local authorities and the nearest FEPA Office/State Environmental Protection Body or other agencies described for the following situation:

(a) for spills or discharges onto the ground or into groundwater or surface water, notify all local authorities in accordance with local contingency plan;

(b) for spills or discharges which result in emissions to the air, notify the Local Government Chairman, who is On the Scene Co-ordinator (OSC) in accordance with local contingency plan, who in turn will notify the nearest FEPA/State Environmental Protection Body and the Fire Department.

2.3. Mitigation and Control

The person responsible for a non-permitted spill or discharge shall take appropriate immediate

action to protect human health and the environment.

(a) In addition, the Agency may require the person responsible for a spill or discharge to:

(i) clean up all released dangerous, harmful waste or hazardous substances or take such actions as may be required or approved by the Agency, State/Local Government officials acting within the scope of their official responsibilities. This may include complete or partial removal of released dangerous waste or hazardous substances as may be justified by the nature of the released dangerous wastes or hazardous substances, the human and environmental circumstances of their incident and protection required by FEPA Guidelines;

(ii) designate and treat, store or dispose of all soils, water, or other materials contaminated by the spill or discharge in accordance with FEPA guidelines;

(iii) if the property on which the spill or discharge occurred is not owned or controlled by the person responsible for the incident, restore the area impacted by the spill or discharge, and replenish resources (e.g. fish, plants) in a manner acceptable to FEPA;

(b) Where immediate removal or temporary storage of spilled or discharge dangerous wastes or hazardous substances is necessary to protect human health or the environment, the Agency may direct that removal be accomplished without a manifest, by transporters who do not have FEPA identification numbers.

2.4. Containers

2.4.1. Waste Quantity.-Containers and inner liners shall not be considered as a part of the Waste when measuring or calculating the quantity of a dangerous waste. Only the weight of the residues in non-empty or non-rinsed containers or inner liners will be considered when determining waste quantities.

2.4.2. A container or inner liner is "empty" when:

(a) all wastes in it have been taken out, that can be removed using practices commonly employed to remove materials from that type of container or inner liner (e.g. pouring, pumping, aspirating, etc.) and whichever quantity is least, either less than two cm of waste remains at the bottom of the container or inner liner or the volume of waste remaining in the container or inner liner is equal to one per cent or less of the container's total capacity, or if the container's total capacity is greater than four hundred and sixteen litres the volume of waste remaining in the container or inner liner is no more than 0.3 per cent of the container's total capacity. A container which held compressed gas is empty when the pressure inside the container equals or nearly equals atmospheric pressure; and

(b) If the container or inner liner held extremely hazardous waste, or pesticides bearing the danger or warning label, the container or inner liner has been rinsed at least three times with an appropriate cleaner or solvent. The volume of cleaner or solvent used for each rinsing shall be ten per cent or more of the container's or inner liner's capacity. In lieu of rinsing for containers that might be damaged to make unusable by rinsing with liquids (e.g. fiber or card-board container without inner liners), an empty container may be vacuumcleaned, struck with the open end of the container up, three times (e.g., on the ground, with a hammer or hand) to remove or loosen particles from the inner walls and corners, and vacuum cleaned again. Equipment used for vacuum cleaning of residues from container or inner liners must be decontaminated before discharging, in accordance with procedures approved by FEPA;

(c) Any rinsate or vacuumed residue which results from the cleaning of containers to inner liners

shall whenever possible be reused in a manner consistent with the original intended purpose of the substance in the container or inner liner. In the case of a farmer if the rinsate is a pesticide residue then the rinsate shall be managed or reused in a manner consistent with the instructions on the pesticide label provided that when the label instructions specify disposal or burial, such disposal or burial must be on the farmer's own (including rented, leased or tenanted) property. Otherwise, the rinsate shall be checked against the designation requirements and, if designated, managed according to the requirements of this Section.

2.4.3. A person may petition the Agency to approve alternative container rinsing processes in accordance with FEPA Guidelines.

2.5. Overpacked Containers (Labpacks):

Small containers of dangerous waste may be placed in overpacked drums (or labpacks) provided that the following conditions are met:

2.5.1. Hazardous waste shall be packaged in non-leaking inside containers. The inside containers shall be of a design and constructed of a material that will not react dangerously with, decomposed by, or be ignited by the contained waste. Inside containers shall be tightly and securely sealed and, to the extent possible, should be full and have as little air as possible in them to minimize voids. The inside containers shall be of the size and type specified in FEPA hazardous materials guidelines, if those guidelines specify a particular inside container for the waste;

2.5.2. The inside containers must be overpacked in an open head metal shipping container at no more than 416-litre capacity and surrounded by, at a minimum, a sufficient quantity of absorbent material to completely absorb all of the liquid contents of the inside packing with inside containers and absorbent material;

2.5.3. The absorbent material used shall not be capable of reacting dangerously with, being decomposed by, or being ignited by the contents of the inside containers in accordance with FEPA guidelines.

2.6. Manifest System:

There shall be a manifest system which will include the following requirements;

(a) Packaging: The generator shall package all dangerous waste for transport in accordance with these FEPA Guidelines.

(b) The package shall have a Manifest Document Number.

(c) Labelling: The generator shall label each package as prescribed by FEPA.

(d) Marking: The generator shall mark each package of dangerous waste with the following, or equivalent words and information, very well displayed:

HAZARDOUS WASTE

State and Federal law prohibits improper disposal. If found, contact the nearest FEPA Zonal office, police, or public health authority.

General's Name and Address

Manifest Document Number

The generator shall placard, or provide bold warning signs to the transporter(s) as prescribed by FEPA.

2.6.2. Applicability

The requirements of this section apply to owners and operators who receive dangerous waste from off-site sources.

2.6.3. A facility shall only receive dangerous waste that is accompanied by a manifest.

2.6.4. If a facility receives dangerous waste accompanied by a manifest, the owner or operator, or his agent shall:

(a) sign and date each copy of the manifest to certify that the dangerous waste covered by the manifest was received;

(b) note any significant discrepancies in the manifest, as described in this section on each copy of the manifest.

(c) immediately give the transporter at least one copy of the signed manifest;

(d) within thirty days after the delivery, send a copy of the manifest to the generator; and

(e) retain at the facility a copy of each manifest for at least three years from the date of delivery.

2.6.5. If a facility receives, from a transporter, dangerous waste whose manifest or shipping paper contains discrepancies, it shall notify the generator as well as FEPA or its designee of such discrepancies within twenty-one days from the receipt of the dangerous waste.

2.6.6. Manifest Discrepancies

(a) Manifest discrepancies are significant discrepancies between the quantity or type of dangerous waste designated on the manifest or shipping paper and that actually received.

(i) Significant discrepancies in quantity are variations greater than ten per cent in weight for bulk quantities (e.g. tanker, trucks, railroad tank cars, etc.), or any variations in piece count for non-bulk quantities (i.e. any missing container or package).

(ii) Significant discrepancies in type are obvious physical or chemical difference which can be discovered by inspection or waste analysis (e.g. waste solvent substituted for waste acid).

(iii) A third type of significant discrepancy include omissions of the FEPA/State identification numbers, generator certification and signature, etc. from the manifest.

(b) Upon discovering a significant discrepancy, the owner or operator shall attempt to reconcile the discrepancies with the waste generator or transporter. If the discrepancy is not resolved within fifteen

days after receiving the waste, the owner or operator shall immediately notify FEPA by describing the discrepancy and attempts to reconcile it, sending a copy of the manifest or shipping paper at issue.

2.6.7. Non-acceptance of dangerous waste shipments

(a) The following shall be reasons for non-accepting a dangerous waste shipment:

(i) the facility is not capable of properly managing the type(s) of dangerous waste in the shipment;

(ii) there is a significant discrepancy (as described in subsection 2.6.6) between the shipment and the wastes listed on the manifest or shipping papers; or

(iii) the shipment has arrived in a condition which the owner or operator believes would present an unreasonable hazard to facility operations, or to facility personnel handling the dangerous waste(s).

(b) The owner or operator may send the shipment on the alternative facility designated on the manifest or shipping paper, or contact the generator to identify another facility capable of handling the waste and provide for its delivery to that other facility, unless, the containers are damaged to such an extent or the dangerous waste is in such a condition as to prevent a hazard to public health or the environment in the process of further transportation in such a situation the contingency plan (Section 2.8) shall be put in operation.

2.7. Preparedness and Prevention

Facilities shall be designed, constructed, maintained and operated to minimise the possibility of fire, explosion or any unplanned sudden or non-sudden of dangerous waste or dangerous waste constituents to air, soil, or surface or groundwater which could threaten public health or the environment. This section describes preparations and preventive measures which help avoid or mitigate such situations.

2.7.1. Required equipment:

All facilities shall be equipped with the following, unless it can be demonstrated to FEPA that none of the hazards posed by waste handled at the facility could require a particular kind of equipment specified below:

(a) an internal communication or alarm system capable of providing immediate emergency instructions to facility personnel;

(b) a device, such as telephone or hand-held two-way radio, capable of summoning emergency assistance from local police and fire service departments or state/local On-the-Scene Co-ordinator (OSC);

(c) portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment; and

(d) water as adequate volume and pressure to supply water hose streams, foam producing equipment, automatic sprinklers, or water spray systems.

2.7.2. All facility communications on alarm systems, fire protection equipment, spill control equipment and decontamination equipment, where required, shall be tested and maintained as necessary to assure their proper operation in time of emergency.

2.7.3. Access to communicatiions or alarms

Personnel shall have immediate access to the signalling devices in the following situations:

(a) whenever dangerous waste is being poured, mixed, spread, or otherwise handled, all personnel involved shall have immediate access to an internal alarm or emergency communication device, either directly or through visual or voice contact with other employees;

(b) even if there is only one employee on the premises while the facility is operating, he must have immediate access to a device, such as telephone or hand-held, two-way radio, capable of summoning external emergency assistance.

2.7.4. Aisle Space

The owner or operator must maintain aisle space to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any area of facility operation in an emergency, unless it can be demonstrated to the Agency that aisle space is not needed for any such purposes.

2.7.5. Arrangements with local Organisations and Agencies

2.7.5.1. The owner or operator shall inform FEPA that he has made the following arrangements, as appropriate for the type of waste or substances handled at his facility and the potential need for the services of the following organisations, unless the hazards posed by waste or substances handled at the facility would not require these arrangements:

(a) to familiarise police, fire services department, emergency response team and other such members of the Local Response Team (or Zonal Response Team where applicable with the layout of the facility, properties of dangerous waste or hazardous substances handled at the facility and associated hazards, places where facility personnel would normally be working, entrances to and roads inside facility, and possible evacuation routes;

(b) to familiarise local hospitals with the properties of dangerous waste or hazardous substances handled at the facility and the type of injuries or illness which could result from fires, explosions, or releases at the facility;

(c) where more than one party might respond to an emergency, to reach agreement with the others designate primary emergency authority to provide support to the primary emergency authority;

(d) to always notify the designated OSC in the event of any emergency, who will then co-ordinate response activities by the Zonal/Local response teams.

2.7.5.2. Where FEPA/State or local authority decline to enter into such arrangements, the owner or operator shall document the refusal in the operating record and the onus of proof of that refusal shall rest with the owner/operator.

2.8. Contingency Plan and Emergency Procedures

2.8.1. A contingency plan shall be developed to lessen the potential impact on public health and the environment in the event of an emergency, including a fire, explosion, or unplanned sudden or non-sudden release or dangerous waste, hazardous substances or dangerous waste constituent to air, soil, surface water, or ground water by a facility.

2.8.2. Contingency Plan

Each owner or operator shall have an On-Site and Off-Site Contingency Plans, at his facility for use in emergencies or sudden or non-sudden releases which threaten public health and the environment. The on site plan are as stipulated under section 2.7 on Preparedness and Prevention while the off site plan should be drawn up to integrate the right of community to know. The community next to a facility should be aware of the potential dangers of sudden or non-sudden discharges and activities to mitigate the emergencies.

2.8.2.1. The Contingency Plan shall contain the following:

(a) A description of the actions which facility personnel shall take to comply with this section;

(b) A description of the actions which shall be taken in the event that a dangerous waste shipment, which is damaged or otherwise presents a hazard to public health and the environment, arrives at the facility, and is not acceptable to the owner or operator, but cannot be transported;

(c) A description of the arrangements agreed to by local police and, fire service departments, hospitals, contractors, and zonal and state response teams to co-ordinate emergency services;

(d) A current of names, addresses, and phone numbers (office and home) of all persons qualified to act as the emergency co-ordinator in accordance with the provision of FEPA;

(e) A list of all emergency equipment and response equipment at the facility (such as fire extinguishing systems, spill control equipment communications and decontamination equipment), where these equipment are required. This list shall be kept up to date. In addition, the plan shall include the location and a physical description of each item on the list and a brief outline of its capabilities; and

(f) an evacuation plan for facility personnel where there is possibility that evacuation could be necessary. This plan shall describe the signal (s) to be used to begin evacuation, evacuation routes and alternative evacuation routes.

2.8.2.2. A copy of the contingency plan and all revisions to the plan shall be:

(a) maintained at the facility; and

(b) submitted to the designated OSC and all members of the State/Local response team.

2.8.2.3. The owner or operator shall review and immediately amend the contingency plan, if necessary, wherever:

(a) applicable regulations or the facility permit are revised;

(b) the plan fails in an emergency;

(c) the facility changes (in its design, construction, operation, maintenance or other circumstances) in a way that materially increases the potential for fires, explosions, or release of dangerous waste constituents, or hazardous substances, or in a way that changes the response necessary in an emergency;

(d) the list of emergency co-ordinator changes; or

(e) the list of emergency equipment changes.

2.8.3. Emergencies

2.8.3.1. Emergency Co-ordinator-At all times, there shall be at least one employee either on the facility premises or on call with the responsibility for co-ordinating all emergency response measures. This emergency co-ordinator shall be thoroughly familiar with all aspect of the facility's contingency plan required by FEPA guidelines, all operations and activities at the facility, the location and properties of all waste and hazardous substances handled, the location of all records within the facility and the facility layout. In addition, this person shall have the authority to commit the resources needed to carry out the contingency plan.

2.8.3.2. Emergency Procedures

The following procedures shall be implemented in the event of an emergency:

(a) whenever there is imminent or actual emergency situation, the emergency co-ordinator (or his designee in his absence) shall immediately:

(i) activate internal facility alarms or communication systems where applicable to notify all facility personnel; and

(ii) notify appropriate OSC who will co-ordinate all response activities.

(b) whenever there is a release, fire, or explosion, the emergency co-ordinator shall immediately identify the character, exact source, amount, and extent of any released materials;

(c) concurrently, the emergency co-ordinator shall assess possible hazard to human health and the environment (considering direct, indirect, immediate, and long term effect) that may result from the release fire, or explosion;

(d) if the emergency co-ordinator determines that the facility has had a release, fire, or explosion which could threaten human health or the environment outside the facility, he shall submit a report of his findings to FEPA;

(e) emergency co-ordinator's report shall include:

(i) name and telephone number of reporter;

(ii) name and address of facility;

(iii) time and type of incident (e.g. release, fire);

(iv) name and quantity of material(s) involved to the extent known;

(v) the extent of injuries, if any; and

(vi) the possible hazards to human health or the environment outside the facility.

(f) the emergency co-ordinator for a facility, shall take all reasonable measures to ensure that fires, explosions, and releases do not occur, or spread to other dangerous waste, and to stop processes and operations, collect and contain released waste or hazardous substances and remove or isolate containers;

(g) if the facility stops operations in response to fire, explosions, or release, the emergency co-ordinator must monitor for leaks, pressure build up, gas generation, or ruptures in valves, pipes or other equipment whenever this is appropriate;

ruptures in valves, pipes or other equipment whenever this is appropriate;

(h) Immediately after an emergency, the emergency co-ordinator must provide for treating, storing, or disposing of recovered waste, contaminated soil or surface water; or any other material that results from a release, fire or explosion at the facility;

(i) the emergency co-ordinator shall ensure that, in the affected area(s) of the facility:

(i) no waste that may be incompatible with the released materials is treated, stored, or disposed of until clean up rocedure are completed; and

(ii) all emergency equipment listed in the contingency plan are cleaned and made fit for their intended use before operations are resumed.

(j) The Owner or operator shall notify FEPA appropriate local authorities and the nearest community nearest, that the facility is in compliance with section (i) of this subsection before operation are resumed in the affected area(s) of the facility;

(k) The owner or operator shall note in the operating record the time, date and details of any incident that requires implementing the emergency procedures within fifteen days after the incident, he shall submit a written report on the incident, to the FEPA office. The report shall include:

(i) name, address and telephone number of the owner or operator;

(ii) name address and telephone number of the facility;

(iii) date, time, and type of incident (e.g. fire, explosion);

(iv) name and quantity of material(s) involved.

(v) the extent of injuries if any;

(vi) an assessment of actual or potential hazards to human health or the environment, where this is applicable;

(vii) estimated quantity and disposition of recovered materials that resulted from the incident;

(viii) cause of incident; and

(ix) description of connective action taken to prevent reoccurrence of the incident.

2.9. Facility Record Keeping

2.9.1. Operating Record.-The owner or operator of a facility shall keep a written operating record at his facility. The following information shall be recorded, as it becomes available and maintained in the operating record until closure of the facility:

(a) a description of and the quantity of each hazardous waste received or managed on-site, and the method(s) and date(s) of its treatment, storage, or disposal at the facility as required by subsection (2) of this section, record keeping instructions;

(b) the location of each hazardous waste within the facility and the quantity of each hazardous waste must be recorded on a map or diagram of each cell or disposal area. For all facilities, this

information must include cross references to specific manifest document numbers. Every hazardous consignment must be accompanied by a manifest;

(c) records and results of waste analysis;

(d) summary reports and details of all incidents that require implementing the contingency plan;

(e) general inspection except such information need be kept only for three years;

(f) monitoring, testing or analytical data where required for interim status facilities, and for final status facilities.

2.9.2. Record Keeping Instructions:

This section provides instruction for recording the portions of the operating guideline which are related in describing the types, quantities, and management of hazardous wastes at the facility. This information shall be kept in the operating record as follows:

(a) each hazardous waste received or managed shall be described by its common name and by its hazardous waste number(s). Where a hazardous waste contains more than one process waste or waste constituent the waste description must include all applicable hazardous waste numbers. If the hazardous waste number is not listed then the waste description shall include the process which generated the waste;

(b) the waste description shall include the waste's physical form (i.e. liquid, solid, sludge, or gas);

(c) the weight, or volume and density, of the hazardous waste shall be recorded, using one of the units of measure specified in Table 2.1. below:

TABLE 2.1

UNIT OF MEASURE

Unit of Measure	Symbol	Density
Kilograms	Kg	
Tonnes (1,000 Kg)	M	
Litres	L	K/L
Cubic Meters	C	M/C

(d) add, the date(s) and method(s) of management for each hazardous waste received or managed (e.g. treated, recycled, stored, or disposed of) shall be recorded, using the handling code(s) specified in Table 2.2.

TABLE 2.2.

HANDLING CODES FOR HAZARDOUS/DANGEROUS WASTE MANAGEMENT

1. Storage

FS01 Container (barrel, drum, etc.)

FS02 Tank
FS03 Waste pile
FS04 Surface impoundment
FS05 Other (specify)

2. Treatment

(a) Thermal Treatment

FT06 Liquid injection incinerator
FT07 Rotary kiln incinerator
FT08 Fluidized bed incinerator
FT09 Multiple hearth incinerator
FT10 Infrared furnace incinerator
FT11 Molten salt destructor
FT12 Pyrolysis
FT13 Wet air oxidation
FT14 Calcinator
FT15 Microwave discharge
FT16 Cement kiln
FT17 Lime kiln
FT18 Other (specify)

(b) Chemical Treatment

FT19 Absorption mound
FT20 Absorption field
FT21 Chemical fixation
FT22 Chemical oxidation
FT23 Chemical precipitation
FT24 Chemical reduction
FT25 Chlorination
FT26 Chlorinolysis
FT27 Cyanide destruction
FT28 Degradation
FT29 Detoxification
FT30 Ion exchange
FT31 Neutralization
FT32 Ozonation
FT33 Photolysis
FT34 Other (specify)

(c) Physical Treatment

(i) Separation of Components

FT35 Centrifugation
FT36 Clarification
FT37 Coagulation
FT38 Decanting
FT39 Encapsulation
FT40 Filtration
FT41 Flocculation
FT42 Flotation

FT43 Foaming
FT44 Sedimentation
FT45 Thickening
FT46 Ultrafiltration
FT47 Other (specify)

(ii) Removal of specific Component

FT48 Absorption-molecular sieve
FT49 Activated carbon
FT50 Blending
FT51 Catalysis
FT52 Crystallization
FT53 Dialysis
FT54 Distillation
FT55 Electrodialysis
FT56 Electrolysis
FT57 Evaporation
FT58 High gradient magnetic separation
FT59 Leaching
FT60 Liquid ion exchange
FT61 Liquid-liquid extraction
FT62 Reserve osmosis
FT63 Solvent recovery
FT64 Stripping
FT65 Sand filter
FT66 Other (specify)

(d) Biological Treatment

FT67 Activated sludge
FT68 Aerobic lagoon
FT69 Aerobic tank
FT70 Anaerobic lagoon or tank
FT71 Composting
FT72 Septic tank
FT73 Spray irrigation
FT74 Thickening filter
FT75 Trickling filter
FT76 Waste stabilisation pond
FT77 Other (specify)
FT78-79 (Reserved)

(e) Disposal

FD80 Underground injection
FD81 Landfill
FD82 Land treatment
FD83 Ocean disposal
FD84 Surface impoundment (to be closed as a landfill)
FD85 Others (specify)

2.9.3. Availability, Retention and Disposition of Records:

(a) All facility records, including plans, required by this section must be furnished upon request, and made available at all reasonable times for inspection, by any designated officer, employee or representative of FEPA.

(b) The retention period for all facility records required under this section is extended automatically during the course of any unresolved enforcement action regarding the facility or as requested by FEPA.

(c) A copy of records of waste disposal locations and quantities under this section must be submitted to the FEPA Zonal Office, the State located at, and the local land use and planning authority upon closure of the facility.

CHAPTER THREE

GROUND WATER PROTECTION

3.1. Applicability

(a) Except as provide in (b) of this section, the guideline in this subsection apply to owners and operators of facilities that treat, store, or dispose of dangerous waste in surface impoundments, waste piles, land treatment units, or landfills. The owner or operator shall satisfy the requirements of this subsection for all wastes (or constituents thereof) contained in any such waste management unit at the facility that is a "regulated unit". Any waste or waste constituent migrating beyond the waste management area under section 3.6(b) of this chapter, is assumed to originate from a regulated unit unless the owner or operator can prove to the satisfaction of the Agency that such waste or waste constituent originated from another source.

(b) The owner or operator is not subject to guideline under this subsection if:

(i) he designs and operates a surface impoundment as in chapter 4 or a landfill as in chapter 7;

(ii) FEPA finds, that the treatment zone of a land treatment unit does not contain levels of dangerous constituents that are above background levels of those constituents by an amount that is statistically significant. An exemption under this subsection can only relieve an owner or operator of responsibility to meet the requirements of this section during the postclosure care period; or

(ii) FEPA finds that there is no potential for migration of liquid from a regulated unit to the uppermost aquifer during the active life of the regulated unit (including the closure period) and the postclosure care period. This demonstration must be certified by a qualified geologist or geotechnical engineer.

(c) The regulations under this chapter apply during the active life of the regulated unit (including the closure period). After closure of the regulated unit, the guidelines in this chapter:

(i) do not apply if all waste, waste residues, contaminated containment system components, and contaminated subsoils are removed or decontaminated at closure;

(ii) apply during the postclosure care period if the owner or operator is conducting a detection monitoring programme under section 3.9; and

(iii) apply during the compliance period under section 3.7, if the owner or operator is conducting

a compliance monitoring programme under section 3.10, or a corrective action program under section 3.11.

3.2. Required Programme

(a) Owners and operators subject to this section must conduct monitoring and response programmes as specified in this chapter.

3.3. Ground Water Protection Standard

The owner or operator shall comply with conditions specified in the facility permit that are designed to ensure that dangerous constituents entering the ground water from regulated unit do not exceed the concentration limits in the uppermost aquifer underlying the waste management area during the compliance period. To the extent practicable, FEPA will established this ground water protection standard in the facility permit at the time the permit is issued. If FEPA discovers that an established standard is not protective enough,or if it decides that it is not practical to establish standards at the time of permit issuance, FEPA will establish the groundwater protection standard in the facility permit when dangerous constituents have entered the groundwater from a regulated unit.

3.4. Dangerous Constituents:

(a) FEPA shall specify in the facility permit the dangerous constituents to which the ground water protection standard of section 3.3 of this chapter, applies. Dangerous constituents are constituents identified in FAC 000-000-9905, and any other constituents not listed there which have caused a waste to be regulated under this chapter, that may be or have been detected in ground water in the uppermost aquifer underlying a regulated unit and that are reasonably expected to be in, or derived from waste contained in a regulated unit, unless FEPA has excluded them under subsection 3.4 (b)

FEPA may also specify in the permit indicator parameters (e.g. specific conductance, pH, total organic carbon (TOC), total organic halogen (TOX), or heavy metals, waste constituents or reaction products) as identified in the detection monitoring programme under subsection 3.9 (a), that provide a reliable indication of the presence of dangerous constituents in the ground water.

(b) FEPA shall exclude a constituent in FAC 000-000-9905 or other identified constituent from the list of dangerous constituents specified in the facility permit if it finds that the constituent is not capable of posing a substantial present or potential hazard to human health or the environment. In deciding whether to grant an exemption, FEPA will consider the following:

(i) potential adverse effects on ground water quality;

(ii) potential adverse effects on hydraulically-connected surface water quality;

(iii) any other identification of underground sources of drinking water and aquifers.

3.5. Concentration Limits:

(a) FEPA shall specify in the facility permit concentration limits in the ground water for dangerous constituents established under Section 3.4. The concentration of a dangerous constituents:

(i) shall not exceed the background level of that constituents in the ground water at the time that limit is specified in the permit; or

(ii) for any of the constituents listed in Table 3.1 shall not exceed the respective value given in that table if the background level of the constituent is below the value given in Table 3.1; or

(iii) shall not exceed an alternative limit established by FEPA under subsection 3.5 (b).

TABLE 3.1

MAXIMUM CONCENTRATION OF CONSTITUENTS FOR GROUND WATER PROTECTION

Constituent	Maximum Concentration (mg/l)
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Selenium	0.01
Silver	0.05
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2, 4-D	0.1
2, 4, 5-TP Silvex (Tree killer)	0.01

(b) FEPA may establish an alternative concentration limit for a dangerous constituent if it finds that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded, in establishing alternate concentration limits. FEPA may consider the same factors listed in subsections (4) (b) (i) (ii) and (iii).

3.6. Point of Compliance:

(a) FEPA shall specify in the facility permit the point of compliance at which the ground water protection standard of section 3.3 applies and at which monitoring must be conducted. The point of compliance is a vertical surface located at the hydraulically down gradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units. Alternatively, the point of compliance may be any closer points identified by FEPA at the time the permit is issued, considering the risks of the facility, the wastes and constituents managed there, the potential for waste constituents to have already migrated past the alternate compliance point, and the potential threats to ground and surface waters.

(b) The waste management area is the limit projected in the horizontal plane of the area on which waste will be placed during the active life of a regulated unit. The waste management area includes horizontal space taken up by any liner, dike, or other barrier designed to contain waste in a regulated unit. If the facility contains more than one regulated unit, the waste management area is described by an imaginary line circumscribing the several regulated units.

3.7. Compliance Period

(a) FEPA shall specify in the facility permit the compliance period during which the ground water protection standard of subsection 3.3 applies. The compliance period is the number of years equal to the active life of the waste management area (including any waste management activity prior to permitting, and the closure period).

(b) The compliance period begins when the owner or operator initiates a compliance monitoring programme meeting the requirements of subsection 3.10.

(c) If the owner or operator is engaged in a corrective action programme at the end of the compliance period in subsection 3.7 (a), the compliance period is extended until the owner or operator can demonstrate that the ground water protection standard of section 3.3 has not been exceeded for a period of three consecutive years.

3.8. General Ground Water Monitoring Requirements:

The owner or operator shall comply with the requirements of this subsection for any ground water monitoring programme developed to satisfy sections 3.9, 3.10, or 3.11.

(a) The ground water monitoring system must consist of a sufficient number of wells,installed at appropriate locations and depths to yield ground water samples from the uppermost aquifer that:

(i) represent the quality of background water that has not been affected by leakage from a regulated unit; and

(ii) represent the quality of ground water passing the point of compliance.

(b) If a facility contains more than one regulated unit, separate ground water monitoring systems are not required for each regulated unit, provided that provisions for sampling the ground water in the uppermost aquifer will enable detection and measurement at the compliance point of dangerous constituents from the regulated units that have entered the ground water in the uppermost aquifer.

(c) All monitoring wells shall be cased in a manner that maintains the integrity of the monitoring well borehole. This casing shall allow collection of representative ground water samples. Wells shall be constructed in such a manner as to prevent contamination of the samples, the sampled strata, the layers between aquifers and water bearing strata.

(d) The ground water monitoring programme shall include at a minimum, procedures and techniques for:

(i) decontamination of drilling and sampling equipment;

(ii) sample collection;

(iii) sample preservation and shipment;

(iv) analytical procedures and quality assurance; and

(v) control and custody and distribution of samples.

(e) The ground water monitoring programme shall include consistent sampling and analytical methods that ensure reliable ground water sampling, accurately measure dangerous constituents and indicator parameters in ground water samples, and provide a reliable indication of ground water quality below the waste management area.

(f) The ground water monitoring programme shall include a determination of the ground water surface elevation each time ground water is sampled.

(g) Where appropriate, the ground water monitoring programme shall establish background ground water quality for each of the dangerous constituents or monitoring parameters or constituents specified

in the permit.

(h) The owner or operator shall use statistical procedures in determining whether background values or concentration limits have been exceeded; as specified by FEPA in the facility permit.

3.9. Detection Monitoring programme

An owner or operator required to establish a detection monitoring programme under this section shall, at a minimum, discharge the responsibilities described as follows: the owner or operator shall monitor the ground water for indicator parameters (e.g. total organic carbon (TOC), total organic halogen (TOH), or heavy metals), waste constituents, or reaction products that provide a reliable indication of the presence of dangerous constituents in ground water, FEPA shall specify the parameters or constituents to be monitored in the facility permit.

3.10. Compliance Monitoring Programme

An owner or operator required to establish a compliance monitoring programme under this section shall, at a minimum, discharge the responsibilities described as follows:

(a) the owner or operator shall monitor the ground water to determine whether regulated units are in compliance with the ground water protection standard under subsection 3.3. FEPA shall specify the ground water protection standard in the facility permit;

(b) the owner or operator shall install a ground water monitoring system at the compliance point as specified under subsection 3.6;

(c) where a concentration limit established under 3.10 (a) is based on background water quality, FEPA shall specify the concentration limit in the permit;

(d) the owner or operator shall determine the concentration of dangerous constituents and parameters in ground water at each monitoring well at the compliance point at least quarterly during the compliance period. The owner or operator shall express the concentration at each monitoring well in a form necessary for the determination of statistically significant increases;

(e) the owner or operator shall determine the rate and direction of ground water flow in the upper most aquifer at least annually;

(f) the owner or operator shall analyse samples from all monitoring wells at the compliance point for constituents identified in FAC 000-000-9905, and any other dangerous constituents not listed IN FAC 000-000-9905 but which are specified in the facility permit pursuant to subsection 3.4.(a) at least annually to determine whether additional dangerous constituents are present in the uppermost aquifer. If the owner or operator finds constituents identified in FAC 000-000-9905, and any other dangerous constituents not listed in FAC 000-0009905 but which are specified in the facility permit pursuant to subsection 3.4.(a) at least annually to determine whether additional dangerous constituents are present in the uppermost aquifer. If the owner or operator finds constituents identified in FAC 000-00-9905, and any other dangerous constituents not listed in FAC 000-000-9905 but which are specified in the facility permit pursuant to subsectiion 3.4.(a) as dangerous constituents, he shall report the concentration of these additional constituents to within seven days after completion of the analysis;

(g) the owner or operator shall use procedures and methods for sampling and analysis that meet the requirements of subsection 3.8.(c) and (d);

(h) the owner or operator shall determine whether there is a statistically significant increase

over the concentration limits for any dangerous constituents specified in the permit each time he determines the concentration of dangerous constituents in ground water at the compliance point;

(i) if the owner or operator determines, pursuant to subsection (h) that the ground water protection standard is being exceeded at any monitoring well at the point of compliance, he shall:

(i) notify FEPA of the finding in writing within seven days. The notification shall indicate what concentration limits have been exceeded;

(ii) submit to FEPA an application for a permit modification to establish a corrective action programme meeting the requirements of section 3.11 of this section, within ninety days or within sixty days if an engineering feasibility study has been previously submitted to FEPA under subsection 3.9 (h). For regulated units managing EHW, time frames of sixty days and forty-five days respectively will apply.

(j) if the owner or operator determines, pursuant to subsection (h), that the ground water protection standard is being exceeded at any monitoring well at the point of compliance, he may demonstrate that a source other than a regulated unit caused the increase or that the increase resulted from error in sampling, analysis, or evaluation. While the owner or operator may make a demonstration under this subsection in addition to, or in lieu of, submitting a permit modification application 3.10(i) and (ii) he is not relieved of the requirement to submit a permit modification application within the time specified in this subsection;

(k) if the owner or operator determines that the compliance monitoring programme no longer satisfies the requirements of this section, he shall, within forty-five days, submit an application for a permit modification to make any appropriate changes to the programme;

(l) the owner or operator shall assure FEPA that monitoring and corrective action measures necessary to achieve compliance with the ground water protection standard under subsection 3.3. are taken during the term of the permit.

3.11. Corrective Action Programme

An owner or operator required to establish a corrective action programme under this section shall, at a minimum, discharge the responsibilities described in this section.

(a) The owner or operator shall take corrective action to ensure that regulated units are in compliance with the ground water protection standard under subsection 3.3. FEPA shall specify the ground water protection standard in the facility permit.

(b) The owner or operator shall implement a corrective action programme that prevents dangerous constituents and parameters from exceeding their respective concentration limits at the compliance point by removing the dangerous waste constituents and parameters or treating them in place. The permit will specify the specific measures that will be taken.

(c) Where the ground water protection standard is exceeded, the owner or operator shall begin corrective action within the time period specified in the facility permit issued by FEPA.

(d) In conjunction with the corrective action programme the owner or operator shall establish and implement a ground water monitoring programme to demonstrate the effectiveness of the corrective action programme.

(e) In addition to the other requirements of this section, the owner or operator shall conduct a corrective action programme to remove or in-situ dangerous constituents or parameters under

section 3.4, that exceed concentration limits specified under section 3.5 in ground water between the compliance point and the down gradient facility property boundary. The permit shall specify the measures to be taken.

(f) The owner or operator shall continue corrective action measures during the compliance period to the extent necessary to ensure that the ground water protection standard is not exceeded. If the owner or operator is conducting corrective action at the end of the compliance period, he shall continue that corrective action for as long as necessary to achieve compliance with the ground water protection standard. The owner or operator may terminate corrective action measures taken beyond the period equal to the active life of the waste management area (including the closure period) if he can demonstrate, based on data from the ground water monitoring program under (d) of this subsection, that the ground water protection standard of subsection 3.3 has not been exceeded for a period of three consecutive years.

(g) The owner or operator shall report in writing to on the effectiveness of the corrective action programme. The owner or operator shall submit these reports semi-annually.

(h) If the owner or operator determines that the corrective action programme no longer satisfied the requirements of this section, he shall, within forty-five days, submit an application for a permit modification to make any appropriate changes to the programme.

CHAPTER FOUR

SURFACE IMPOUNDMENTS

4.1. Applicability

The regulations in this section apply to owners and operators of facilities that use surface impoundments to treat, store, or dispose of dangerous waste.

4.2. Design and Operating Requirements

(a) (i) A surface impoundment shall have a liner that is designed, constructed, and installed to prevent any migration of wastes out of the impoundment to the adjacent subsurface soil or ground water or surface water at any time during the active life (including the closure period) of the impoundment. The liner may be constructed of materials that may allow wastes to migrate into the liner (but not into the adjacent subsurface soil or ground water or surface water) during the active life of the facility, provided that the impoundment is closed in accordance with subsection 4.6 (a) (i). For impoundments that will be closed in accordance with subsection 4.6 (a) (ii) of this section, the liner must be constructed of materials that can prevent wastes from migrating into the liner during the active life of the facility. The liner shall be:

(a) constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;

(b) placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift;

(c) installed to cover all surrounding earth likely to be in contact with the waste or leachate; and

(d) for EHW management, the owner or operator shall submit an engineering report with his permit application stating the basis for selecting the liner(s). The report shall be certified by a licensed professional engineer.

(ii) The owner or operator of a surface impoundment in which liquid EHW is managed shall:

(a) install a double lined system which incorporates the specifications of subsection 4.3 (a), (b) and (c); and

(b) shall comply with the ground water monitoring requirements.

(b) The owner or operator may be exempted from the requirements of subsection 4.2 (a) if FEPA finds, based on a demonstration by the owner or operator, that alternate design and operating practices, together with location characteristics, will prevent the migration of any dangerous constituents listed in FAC 000-000-9905 or which otherwise cause his wastes to be regulated, into the ground water or surface water at any future time.

(c) A surface impoundment shall be designed, constructed, maintained, and operated to prevent overtopping resulting from normal or abnormal operations; and overfilling; and take into account the effect of wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms, and other equipment: and human error.

(d) A surface impoundments shall be designed so that any flow of waste into the impoundment can be immediately shut off in the event of overtopping or liner failure.

(e) A surface impoundment shall be designed to repel birds.

(f) A surface impoundment shall have dikes that are designed, constructed, and maintained with sufficient structural integrity to prevent their failure. In ensuring structural integrity, it shall not be presumed that the liner system will function without leakage during the active life of the unit.

(g) Earthen dikes shall be kept free from burrowing mammals which could weaken its structural integrity or create leaks through burrows.

(h) Earthen dikes shall have a protective cover, such as grass, shale or rock to minimize wind and water erosion and to preserve their structural integrity.

(i) FEPA shall specify in the permit all design and operating practices that are necessary to ensure that the requirements of this section are satisfied.

4.3. Double-lined Surface Impoundments

(a) Except as provided in subsection 4.2 (a) (ii) the owner or operator of a double lined surface impoundment is not subject to this subject to this guideline if the following conditions are met:

(i) the impoundment (including its underlying liners) shall be located entirely above the seasonal high water table;

(ii) the impoundment shall be underlain, by two liners which are designed and constructed in a manner that prevents the migration of liquids into or out of the space between the liners. Both liners shall meet all the specifications of subsection (2) (a) (i);

(iii) a leak detection system shall be designed, constructed, maintained, and operated between the liners to detect any migration of liquids into the space between the liners; and

(iv) a leachate detection, collection and removal system shall be designed and operated to remove accumulated liquids from the system as quickly as possible to avoid unnecessary buildup of hydrostatic pressure in the system.

(b) If liquid leaks into the leak detection system, the owner or operator shall:

(i) notify FEPA of the leak in writing within seven days after detecting the leak; and

(ii) (a) within a period of time specified in the permit, remove accumulated liquid, repair or replace the liner which is leaking to prevent the migration of liquids through the liner, and obtain a certification from a qualified engineer that, the leak has been stopped; or

(b) begin to comply with any detection monitoring programmes specified in the permit.

(c) FEPA shall specify in the permit all design and operating practices that are necessary to ensure that the requirements of this section are satisfied.

4.4. Monitoring and Inspection

(a) During construction and installation, liners and cover systems (e.g. membranes, sheets, or

coatings) shall be inspected for uniformity, damage, and imperfections (e.g. holes, cracks, thin spots, or foreign materials. Immediately after construction or installation:

(i) synthetic liners and covers shall be inspected to ensure tight seams and joints and the absence of tears, punctures, or blisters; and

(ii) soil based and admixed liners and covers must be inspected for imperfections including lenses, cracks, channels, root holes, or other structural non-uniformities that may cause an increase in the permeability of the liner or cover.

(b) While a surface impoundment is in operation, it shall be inspected weekly and after storms to detect evidence of any of the following:

(i) deterioration, malfunctions, or improper operation of overtopping control system;

(ii) sudden drops in the level of the impoundment's contents;

(iii) the presence of liquids in leak detection systems, where installed to comply with section 4.3;

(iv) severe erosion or other signs of deterioration in dikes or other containment devices.

(c) Prior to the issuance of a permit, and after any extended period of time (at least six months) during which the impoundment was not in service, the owner or operator shall obtain a certification from a qualified engineer that impoundment's dike, including that portion of any dike which provides freeboard, has structural integrity. The certification shall establish, in particular, that the dike:

(i) will withstand the stress of the pressure exerted by the types and amounts of wastes to be placed in the impoundment; and

(ii) will not fail due to scouring or piping, without dependence on any liner system included in the surface impoundment constructed.

4.5. Emergency repairs, contingency plans

(a) A surface impoundment shall be removed from service in accordance with subsection 4.5 (b) if:

(i) unexpected changes of liquid levels occur; or

(ii) the dike leaks.

(b) When a surface impoundment is to be removed from service as required by subsection 4.5 (a) the owner or operator shall:

(i) immediately shut off the flow or stop the addition of wastes into the impoundment;

(ii) immediately contain any surface leakage which has occurred or is occurring;

(iii) immediately stop the leak;

(iv) take any other necessary steps to stop or prevent catastrophic failure;

(v) empty the impoundment, if a leak cannot be stopped by any other means; and

(vi) notify the Agency of the problem in writing within seven days after detecting the problem.

(c) As part of the contingency plan in with the owner or operator shall specify:

(i) a procedure for complying with the requirements of (b) of this subsection; and

(ii) a containment system evaluation and repair plan describing: testing and monitoring techniques; procedures to be followed to evaluate the integrity of the containment system in the event of a possible failure; description of a schedule of actions to be taken in the event of a possible failure: and the repair techniques and materials (and their availability) to be used in the event of leakage due to containment system failure or deterioration which does not require the impoundment to be removed from service.

(d) no surface impoundment that has been removed from service in accordance with the requirements of this section may be restored to service unless the portion of the impoundment which was failing is required and the following steps was taken:

(i) if the impoundment was removed from service as the result of actual or imminent dike failure, the dike's structural integrity shall be recertified in accordance with subsection 4.4.(c);

(ii) if the impoundment was removed from service as the result of a sudden drop in the liquid level, then

(a) for any existing portion of the impoundment, a liner shall be installed in compliance with subsection 4.2 (a) (i) subsection 4.3; and

(b) for any other portion of the impoundment, the repaired liner system shall be certified by a qualified engineer as meeting the design specifications approved in the permit.

(e) A surface impoundment that has been removed from service in accordance with the requirements of this section and that is not being repaired shall be closed in accordance with the provisions of section 4.6.

4.6. Closure and post-closure care

(a) At closure, the owner of operator shall:

(i) remove or decontaminate all dangerous waste and dangerous waste residues, contaminated system components (liners, etc.), contaminated subsoils and structures and equipment contaminated with dangerous waste and leachate, and manage them as dangerous waste: or

(ii) if the surface impoundment will be closed as a landfill, except that this option is prohibited if EHW would remain in the closed unit(s);

(a) eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues;

(b) stabilize remaining wastes to a bearing capacity sufficient to support a final cover; and

(c) cover the surface impoundment with final cover designed and constructed to provide long term minimization of the migration of liquids through the closed impoundment function with minimum maintenance; promote drainage and minimize erosion or abrasion of the final cover; and accommodate settling and subsidence so that the cover's integrity is maintained.

(b) If some waste residues or contaminated materials are left in place at final closure (except that

no EHW may ever be left in place), the owner or operator shall comply with all post-closure requirements including maintenance and monitoring throughout the post-closure care period (specified in the permit). The owner or operator may:

(i) maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;

(ii) maintain and monitor the leak detection system in accordance with subsection 4.3 where such a system is present between double liner systems;

(iii) maintain and monitor the ground water monitoring system;

(iv) Prevent run-on and run-off from eroding or otherwise damaging the final cover.

(c) (i) If an owner or operator plans to close a surface impoundment in accordance with subsection 4.6 (a) (i) and the impoundment does not comply with the liner requirements of subsection 4.2 (a) (i) and is not exempted from them in accordance with subsection 4.2 (b) then:

(a) the closure plan shall include both a plan for complying with subsection 4.6 (a) (i) and a contingent plan for complying with subsection 4.6 (a) (i) in case not all contaminated subsoils can be practicably removed at closure; and

(b) the owner or operator shall prepare a contingent postclosure plan for complying with subsection 4.6 (b) in case not all contaminated subsoils can be practically removed at closure; and

(d) During the postclosure care period, if liquids leak into a leak detection system installed under section 4.3. the owner or operator shall notify FEPA of the leak in writing within seven days after detecting the leak. The Agency will then modify the permit to require compliance with applicable requirements of or if so requested by the owner or operator, to require removal of all materials in accordance with subsection 4.6 (a) (i).

4.7 Special requirements for ignitable or reactive waste

Ignitable or reactive waste shall not be placed in a surface impoundment, unless:

(a) the waste is treated, or mixed before or immediately after placement in the impoundment so that the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste;

(b) the waste is managed in such a way that it is protected from any material or conditions which may cause it to ignite or react; or

(c) the surface impoundment is used solely for emergencies.

4.8 Special requirements for incompatible wastes

Incompatible wastes and materials shall not be placed in the same surface impoundments.

4.9. Special requirements for dangerous wastes

(a) The wastes with code numbers FEF020, FEF021, FEF023, FEF026 or FEF027 shall not be placed in a surface impoundment unless the owner or operator operates the surface impoundment in accordance with a management plan for these wastes that is approved by FEPA pursuant these guidelines and in accordance with all other applicable requirements. The factors to be considered are:

(i) the volume, physical and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(ii) the attenuative properties of underlying and surrounding soils or other materials;

(iii) the mobilizing properties of other materials so disposed with these wastes; and

(iv) the effectiveness of additional treatment, design, or monitoring techniques.

(b) FEPA may determine that additional design, operating and monitoring requirements are necessary in order to reduce the possibility of migration of these wastes to ground water, surface water, or air so as to protect human health and the environment.

CHAPTER FIVE

LAND TREATMENT

5.1. Applicability

The guidelines in this chapter apply to owners and operators of facilities that treat or dispose of dangerous waste in land treatment units.

5.2. Treatment programme

(a) An owner or operator subject to this section shall establish a land treatment programme that is designed to ensure that dangerous constituents placed in, or on the treatment zone are degraded, transformed, or immobilized within the treatment zone. FEPA shall specify in the facility permit the elements of the treatment programme.

(b) FEPA shall specify in the facility permit the dangerous constituents that must be degraded, transformed, or immobilized as specified in this chapter. Dangerous constituents are constituents identified in FAC 000-000-9905, and any other constituents which, although not listed in FAC 000-000-9905 cause a waste to be regulated under this chapter, that are reasonably expected to be in, or derived from, waste placed in or on the treatment zone.

(c) FEPA shall specify the vertical and horizontal dimensions of the treatment zone in the facility permit. The treatment zone is the portion of the unsaturated zone below, and including, the land surface in which the owner or operator intends to maintain the conditions necessary for effective degradation, transformation, or immobilization of dangerous constituents. The maximum depth of the treatment zone shall be:

(i) no more than 1.5 meters below the initial soil surface; and

(ii) more than 3 meters above the seasonal high water table; except that the owner or operator is able to demonstrate to the satisfaction of FEPA that a distance of less than 3 meters will be adequate. However, in no case shall the distance be less than 1 meter.

5.3. Treatment demonstration

(a) For each waste that will be applied to the treatment zone, the owner or operator shall demonstrate, prior to application of the waste, that dangerous constituents in the waste can be

completely degraded, transformed, or immobilized in the treatment zone.

(b) In making this demonstration, the owner or operator may use field tests, laboratory analyses, available data, or, in the case of existing units, operating data. If the owner or operator intends to conduct field tests, laboratory analyses in order to make the demonstration required under subsection 5.3. (a), of this subsection, he shall obtain a land treatment demonstration permit.

(c) Any field test or laboratory analysis conducted in order to make a demonstration under subsection 5.3 (a) shall:

(i) accurately simulate the characteristics and operating conditions for the proposed land treatment unit including:

(a) the characteristics of the waste and of dangerous constituents present;

(b) the climate in the area;

(c) the topography of the surrounding area;

(d) the characteristics and depth of the soil in the treatment zone; and

(e) the operating practices to be used at the unit;

(ii) be expected to show that dangerous constituents in the waste to be tested will be completely degraded, transformed, or immobilized in the treatment zone of the proposed land treatment, unit; and

(iii) be conducted in a manner that protects human health and the environment.

5.4. Design and operating requirements

FEPA shall specify in the facility permit how the owner or operator will design, construct, operate, and maintain the land treatment unit in compliance with this section.

(a) The owner or operator shall design, construct, operate, and maintain the unit to maximize the degradation, transformation, and immobilization of dangerous constituents in the treatment zone. The owner or operator must design, construct, operate, and maintain the unit in accordance with all design and operating conditions that were used in the treatment demonstration under section 5.3.

(b) The owner or operator shall design, construct, operate, and maintain the treatment zone to minimize run-off of dangerous constituents during the active life of the land treatment unit.

(c) The owner or operator shall design, construct, operate, and maintain a run-on control system capable of preventing flow onto the treatment zone during peak discharge from at least a twenty-five-year storm.

(d) The owner or operator shall design, construct, operate and maintain a run-off management system to collect and control at least the water volume resulting from a twenty-four-hour, twenty-five-year storm.

(e) Collection and holding facilities (e.g. tanks or basins) associated with run-on and run-off control systems after storm shall be emptied or otherwise managed expeditiously in accordance with these guidelines.

(f) If the treatment zone contains particulate matter which may be subject to wind dispersal, the owner or operator must control wind dispersal.

(g) The owner or operator shall inspect the unit weekly and after storms to detect evidence of:

(i) deterioration, malfunctions, or improper operation of run-on and run-off control system; and

(ii) Improper functioning of wind dispersal control measures:

5.5. Food Chain Crops

FEPA may allow the growth of food chain crops in, or on the treatment zone only if the owner or operator satisfies the conditions of this section. FEPA may specify in the facility permit the specific food chain crops which may be grown.

(a) (i) The owner or operator shall demonstrate that there is no substantial risk to human health caused by the growth of such crops in or on the treatment zone by demonstrating, prior to the planting of such crops, that dangerous constituents other than cadmium:

(a) will not be transferred to the food or food portions of the crop by plant uptake or direct contact, and will not otherwise be ingested by food chain animals (e.g. by grazing); or

(b) will not occur in grater concentrations in or on the food or food portions of crops grown on the treatment zone than in or on identical portions of the same crops grown on untreated soils under similar conditions in the same region.

(ii) The owner or operator shall make the demonstration required under subsection 5.5 (a) (i) of this prior to the planting of crops at the facility for all dangerous constituents that are reasonably expected to be in, or derived from, waste placed in or on the treatment zone.

(iii) In making such a demonstration, the owner or operator may use field, trests, greenhouse studies available data, or, in the case of existing units, operating data, and shall;

(a) base the demonstration on conditions similar to those present in the treatment zone, including soil characteristics (e.g., pH, cation exchange capacity), specific wastes, application rates, application methods and crops to be grown; and

(b) describe the procedures used in conducting any tests including the sample selection criteria, sample size, analytical methods, and statistical procedures;

(iv) if the owner or operator intends to conduct field tests or greenhouse studies in order to make the demonstration, he shall obtain a permit for conducting such activities.

(b) The owner or operator shall comply with the following conditions if cadmium is contained in wastes applied to the treatment zone.

(i) (a) the pH of the waste and soil mixture must be 6.5 or greater at the time of each waste application, except for waste containing cadmium at concentrations of 2 mg/kg (dry weight) or less;

(b) the annual application of cadmium from waste shall not exceed 0.5 kilograms per hectre (kg/ha) on land used for production of tobacco, leafy vegetables, or root crops grown for human consumption. For other food chain crops, the annual cadmium application rate must not exceed 1kg/ha;

(c) the cumulative application of cadmium from waste shall not exceed 5kg/ha if the waste and soil mixture has a pH of less than 6.5; and

(d) if the waste and soil mixture originally has or is maintained at a pH of 6.5 or greater during crop growth, the cumulative application of cadmium from waste shall not exceed. 5 kg/ha if soil Cation Exchange Capacity (CEC) is less than 5meq/100g; 10kg/ha if soil CEC is 5-15 meq/100; and 20kg/ha if soil CEC is greater tan 15meq/100g; or

(ii) (a) animal feed shall be the only food chain crop produced;

(b) the pH of the waste and soil mixture must be 6.5 or greater at the time of waste application or at the time the crop is planted, whichever occurs later, and this pH level shall be maintained whenever food chain crops are grown;

(c) there shall be an operating plan which demonstrates how the animal feed will be distributed to preclude ingestion by humans. The operating plan shall describe the measures to be taken to safeguard against possible health hazards from cadmium entering the food chain, which may result from alternative land uses; and

(d) future property owners shall be notified by a stipulation in the land record or property deed which states that the property has received waste at high cadmium application rates and that food chain crops shall not be grown except in compliance with 5.5 (b) (ii).

5.6. Unsaturated zone monitoring

An owner or operator subject to this section shall establish an unsaturated zone monitoring programme to discharge the responsibilities described in this section.

(a) the owner or operator shall monitor the soil and soil-pore liquid to determine whether dangerous constituents migrate out of the treatment zone.

(i) FEPA specify the dangerous constituents be monitored in the facility permit. The dangerous constituents to be monitored are those specified under subsection 5.2 (b).

(ii) FEPA may require monitoring for principal dangerous constituents (PDCs) in lieu of the constituents specified under subsection 5.2 (b).

(b) The owner or operator shall install an unsaturated zone monitoring system that includes soil monitoring soil cores and soil-pore liquid monitoring using devices such as lysimeters. The unsaturated zone monitoring system shall consist of a sufficient number of sampling points at appropriate locations and depths to yield samples that;

(i) represent the quality of background soil-pore liquid quality and the chemical make-up of soil that has not been affected by leakage from the treatment zone; and

(ii) indicate the quality of soil-pore liquid and the chemical make-up of the soil below the treatment zone.

(c) The owner or operator shall establish a background value for each dangerous constituent to be monitored under subsection 5.6 (a)

(d) The owner or operator shall conduct soil monitoring and soil-pore liquid monitoring immediately below the treatment zone. FEPA shall specify the frequency and timing of soil and soil-pore liquid monitoring in the facility permit after considering the frequency, timing, and rate of

waste application, and the soil permeability.

(e) The owner or operator shall use consistent sampling and analysis procedures that are designed to ensure sampling results that provide a reliable indication of soil-pore liquid quality and the chemical make-up of the soil below the treatment zone. The owner or operator shall implement procedures and techniques for:

(i) sample collection;

(ii) sample preservation and shipment;

(iii) analytical procedures; and

(iv) control of custody and distribution of sample.

(f) The owner or operator shall determine whether there is a statistically significant change over background values for any dangerous constituent to be monitored under subsection 5.6 (a) below the treatment zone each time he conducts soil monitoring and soil pore liquid monitoring.

(g) If the owner or operator determines, pursuant to subsection 5.6 (f), that there is a statistically significant increase of dangerous constituents below the treatment zone, he shall:

(i) notify FEPA of his finding in writing within seven days. The notification shall indicate what constituents have shown statistically significant increases;

(ii) within forty-five days, submit to FEPA an application for a permit modification to amend the operating practices at the facility in order to maximize the success of degradation, transformation, or immobilization processes in the treatment zone; and

(iii) continue to monitor in accordance with the unsaturated zone monitoring programme established under this section.

(h) If the owner or operator determines, pursuant to subsection 5.6(f), that there is a statistically significant increase of dangerous constituents below the treatment zone, he may demonstrate that a source other than regulated units caused the increase or that the increase resulted from an error in sampling, analysis, or evaluation. While the owner or operator may make a demonstration under this subsection, he is not relieved of the requirement to submit concurrently a permit modification application within the forty-five-day period, unless the demonstration made under this subsection successfully shows that a source other than regulated units caused the increase or that the increase resulted from an error in sampling, analysis, or evaluation.

5.7. Record-keeping

The owner or operator shall include dangerous waste application dates and rates in the operating record.

5.8. Closure and postclosure care

(a) During the closure period the owner or operator shall:

(i) continue all operations (including pH control) necessary to maximize degradation, transformation, or immobilization of dangerous constituents within the treatment zone as required under sections 5.4, 5.5 and 5.6. except to the extent such measures are inconsistent with subsection 5.8 (a) (iii);

(ii) continue unsaturated zone monitoring in except that soil-pore liquid monitoring may be terminated ninety days after the last application of waste to zone; and

(iii) establish a vegetative cover on the portion of the facility being closed at such time that the cover will not substantially impede degradation, transformation, or immobilization of dangerous constituents in the treatment zone. The vegetative cover must be capable of maintaining growth without extensive maintenance.

(b) When closure is completed, the owner or operator may submit to FEPA a certification by an independent qualified soil scientist, or a licensed professional engineer, that the facility has been closed in accordance with the specifications in the approved closure plan.

(c) During the post-closure care period the owner or operator shall:

(i) continue all operations as specified in subsection 5.8 (a).

(ii) except that soil-pore liquid monitoring may be terminated one hundred and eighty days after the last application of waste to the treatment zone.

(d) The owner or operator is not subject to guidelines under subsection 8(a) (ii) and 5.8 (c) if FEPA finds that the level of dangerous constituents in the treatment zone soil does not exceed the background value of those constituents by an amount that is statistically significant. The owner or operator may submit such a demonstration to the FEPA at any time during the closure or post-closure care periods. For the purpose of the section:

(i) the owner or operator shall establish background soil values and determine whether there is a statistically significant increase over those values for all dangerous constituents specified in the facility permit under subsection 5.2 (b);

(ii) in taking samples used in the determination of background and treatment zone values, the owner or operator shall take samples at a sufficient number of sampling points and at appropriate locations and depths to yield samples that represent the chemical make-up of soil that has not been affected by leakage from the treatment zone and the soil within the treatment zone, respectively;

(iii) in determining whether a statistically significant increase has occurred, the owner or operator shall compare the value of each constituent in the treatment zone to the background value for that constituent using a statistical procedure that provides reasonable confidence that constituent presence in the treatment zone will be identified.

(e) The owner or operator is not subject to guideline if NEPA finds that he satisfies subsection 5.8 (d) and if unsaturated zone monitoring under section 5.6, indicates that dangerous constituents have not migrated beyond the treatment zone during the active life of the land treatment unit.

5.9. Special requirements for ignitable or reactive waste

The owner or operator shall not apply ignitable or reactive waste to the treatment zone unless:

(a) the waste is immediately incorporated into the soil so that the resulting waste, mixture, or dissolution of material no longer meets, the definition of ignitable or reactive waste;

(b) the waste is managed in such a way that it is protected from any material or conditions which may cause it to ignite or react.

5.10. Special requirements for incompatible wastes

The owner or operator shall not place incompatible wastes, or incompatible wastes and materials, in or on the same treatment zone, unless:

5.11. Special requirements for extremely hazardous waste

Under no circumstances will EHW be allowed to remain in a closed land treatment unit after concluding the postclosure care period. If EHW remains at the end of the scheduled postclosure care period specified in the permit, then FEPA shall either extend the postclosure care period, or require that all EHW be disposed of off-site or that it be treated. In deciding whether to extend postclosure care or require disposal or treatment, the Agency will take into account the likelihood that the waste will or will not continue to degrade in the land treatment unit to the extent that it is no longer EHW. For the purposes of this subsection, EHW will be considered to remain in a land treatment unit if representative samples of the treatment zone are designated as EHW. Procedures for representative sampling and testing will be specified in the permit.

5.12. Special requirements for dangerous wastes

(a) Dangerous wastes with code nos, FEF020, FEF021, FEF022, FEF023, FEF026, or FEF027 must not be placed in a land treatment unit unless the owner or operator operates the facility in accordance with a management plan for these wastes that is approved by FEPA pursuant to the guidelines set out in this section and in accord with all other applicable requirements. The factors to be considered are as specified in subsection 4.9 (a).

CHAPTER SIX

WASTE PILES

6.1. Applicability

(a) The guidelines in this section apply to owners and operators of facilities that store or treat dangerous waste in piles.

(b) They do not apply to owners or operators of waste piles that will be closed with wastes left in place. Such waste piles are subject to guidelines in Chapter Seven.

(c) The owner or operator of any waste pile that is inside or under a structure that provides protection from precipitation so that neither run-off nor leachate is generated is not subject to guidelines under section 6.2, provided that:

(i) liquids or materials containing free liquids are not placed in the pile;

(ii) the pile is protected from surface water run-on by the structure or in some other manner;

(iii) the pile is designed and operated to control dispersal of the waste by wind, by means other than wetting; and

(iv) the pile will not generate leachate through decomposition or other reactions;

(d) All EHW and respiratory carcinogens stored in waste piles must be protected from dispersal by precipitation or wind (e.g. covered, stored inside a building etc.)

6.2. Design and operating requirements

(a) A waste pile shall have:

(i) a liner that is designed, constructed installed and maintained to prevent any migration of wastes out of the pile into the adjacent subsurface soil or ground water or surface water at any time during the active life (including the closure period) of the waste pile. The liner may be constructed of materials that may allow waste to migrate into the liner itself (but not into the adjacent subsurface soil or ground water or surface water) during the active life of the facility. The liner shall be as specified in section 4.2.;

(ii) a leachate collection and removal system immediately above the liner that is designed, constructed, maintained, and operated to collect and remove leachate from the pile. FEPA shall specify design and operating conditions in the permit to ensure that the leachate depth over the liner does not exceed 30 cm. The leachate collection and removal system shall conform to the specification in subsection 4.2 (a).

(b) A liner and leachate collection and removal system shall be protected from plant growth which could adversely affect any; component of the system.

(c) For EHW management, the owner or operator shall submit an engineering report with his permit application stating the basis for selection the liner required in subsection 6.2. (a) (i) The statement shall be certified by a licensed professional engineer.

(d) The owner or operator may be exempted from the requirements of Subsection 6.2 (a), (b) and (c), if FEPA finds, based on demonstration by the owner or operator, that alternate design

and operating practices, together with location characteristics, will prevent the migration of any dangerous constituents into the ground water or surface water at any future time.

(e) The owner or operator shall design, construct, operate and maintain a run-on control system and a run-off management system to conform with subsections 5.4 (d) (e) and (f).

6.3. Double-lined piles

(a) The owner or operator of a double-lined waste pile is not subject to these guidelines if the conditions specified in subsection 4.3 (a) (i) for impoundment are satisfied.

(b) If liquid leaks into the leak detection system the owner or operator shall comply with the guidelines specified in subsection 4.3 (b).

(c) FEPA shall specify in the permit all design and operating practices that are necessary to ensure that the requirements of this section are satisfied.

6.4. Inspection of liners

(a) The owner or operator of a pile is subject to the following guideline:

(i) the pile (including its underlying liner) must be located entirely above the seasonal high water table;

(ii) the pile must be underlain by a liner (base) that meets all the specifications of subsection 6.2 (a) (i);

(iii) the wastes in the pile shall be removed periodically, and the liner must be inspected for deterioration, cracks, or other conditions that may result in leaks. The frequency of inspection plan shall be based on the potential for the liner (base) to crack or otherwise deteriorate under the conditions of operation;

(iv) the liner shall be of sufficient strength and thickness to prevent failure due to puncture, cracking, tearing, or other physical damage from equipment used to place waste in or on the pile or to clean and expose the liner surface for inspection; and

(v) the pile shall have a leachate collection and removal system above the liner that is designed, constructed, maintained and operated in accordance with subsection 6.2 (a) (ii).

(b) If deterioration, cracking, or other condition is identified that is causing or could cause a leak, the owner and/or operator shall:

(i) notify FEPA of the condition in writing within seven days after detecting the condition; and

(ii) (a) repair or replace the liner (base) and obtain a certification from a qualified engineer that the liner (base) has been repaired and leakage will not occur; or

(b) if a detection monitoring programme has already been defined in the permit begin to comply with that programme and any other applicable requirements.

6.5. Monitoring and Inspection

(a) During construction or installation, liners and over systems shall be inspected for uniformity, damage, and imperfections as specified in subsection 4.4 (a) (b) for surface impoundments.

6.6. Containment system repairs-Contingency plans

(a) Whenever there is any indication of a possible failure of the containment system, that system shall be inspected in accordance with the provisions of the containment system evaluation and repair plan required by subsection 6.6 (d). Indications of possible failure of the containment system include liquid detected in the leachate detection system, evidence of leakage or the potential for leakage in the base, erosion of the base, or apartment or potential deterioration of the liner(s) based on observation or test samples of the liner materials.

(b) Whenever there is a positive indication of a failure of the containment system, the waste pile shall be removed from service. Indications of positive failure of the containment system include waste detected in the leachate detection system, or a breach (e.g., a hole, tear, crack, or separation) in the base.

(c) If the waste pile is to be removed from service as required by subsection 6.6 (b) the owner or operator shall:

(i) immediately stop adding wastes to the pile);

(ii) immediately contain any leakage which has occurred or is occurring;

(iii) immediately cause the leak to be stopped; and

(iv) if the leak cannot be stopped by any other means remove the waste from the base.

(d) As part of the contingency plan the owner or operator shall specify:

(i) a procedure for complying with the requirements of subsection 6.6 (c); and

(ii) a containment system evaluation and repair plan describing: testing and monitoring techniques; procedures to be followed to evaluate the integrity of the containment system in the event of a possible failure; a schedule of actions to be taken in the event of a possible failure; and a description of the repair techniques and materials (and their availability) to be used in the event of leakage due to containment system failure or deterioration which does not require the waste pile to be removed from service;

(ii) for EHW piles, the owner or operator shall submit with his permit application a statement signed by a licensed professional engineer of the basis on which the evaluation and repair plan has been established.

(e) No waste pile that has been removed from service pursuant to subsection 6.6 (b), may be restored to service unless the containment system has been:

(i) repaired;

(ii) certified by a qualified engineer as meeting the design specifications approved in the permit.

(f) A waste pile which has been removed from service pursuant to subsection 6.6 (b) and will not be repaired, shall be closed in accordance with section 6.9.

6.7. Special requirements for ignitable or reactive waste

Ignitable or reactive waste shall be treated as specified in section 4.7.

6.8. Special requirements for incompatible wastes

(a) Incompatible wastes, or incompatible wastes and materials shall not be placed in the same pile.

(b) A pile of dangerous waste that is incompatible with any waste or other material stored nearby, other containers, piles, open tanks, or surface impoundments shall be separated from the other materials, or protected from them by means of a dike, barm, wall, or other device. Piles of incompatible wastes shall not be served by the same containment system.

(c) Dangerous waste shall not be piled on the same base where incompatible wastes or materials were previously piled unless the base has been decontaminated sufficiently.

6.9. Closure and postclosure care

At closure, the owner or operator shall comply with the requirements specified in section 4.6.

6.10. Special requirements for dangerous wastes

Dangerous wastes with code nos FEF020, FEF021, FEF022, FEF023, FEF026 and FEF027 shall not be placed in waste piles that are not enclosed as defined in subsection 6.1 (c) unless the owner or operator operates the waste pile in accordance with a management plan for these wastes that is approved by FEPA pursuant to these guidelines. The factors to be considered are specified in section 4.9.

CHAPTER SEVEN

LANDFILLS

7.1. Applicability

The guidelines in this chapter apply to owners and operators of facilities that dispose of dangerous waste in landfills.

7.2. Design and Operating Requirements

(a) A landfill shall have the requirements specified in subsection 4.2 (a) (i). The design, construction, maintenance and operation of a leachate collection and removal system shall conform to specification in subsections 4.2 (a) and 6.2 (a) (ii).

(b) The owner or operator shall be exempted from the requirements as specified in subsection 6.2 (d).

(c) The owner or operator shall design, construct, operate, and maintain a run-on control system of the landfill during peak discharge from at least a twenty-five-year storm, and a run-off management system to conform with subsections 5.4 (c) (d) (e) and (f).

7.3. Double-lined Landfills

(a) The owner or operator of a double-lined landfill is not subject to these guidelines specified in subsection 4.3 (a) (for impoundments) are satisfied.

7.4 Monitoring and Inspection

During construction or installation, liners and cover systems shall be inspected for uniformity, damage, and imperfections as specified in sub-sections 4.4 (a) (b) (for surface impoundments).

7.5. Surveying and Record-keeping

The owner or operator of a landfill shall maintain the following items in the operating record:

(a) on a map, the exact location and dimensions, including depth, of each cell with respect to permanently surveyed benchmarks; and

(b) the contents of each cell and the approximate location of each dangerous waste type within each cell.

7.6. Closure and Postclosure Care

(a) At final closure of the landfill or upon closure of any cell, the owner or operator shall comply with specifications in subsection 4.6 (a) on surface impoundments:

(i) provide long-term minimization of migration of liquids, through the closed landfill;

(ii) function with minimum maintenance;

(iii) promote drainage and minimize erosion or abrasion of the cover;

(iv) accommodate settling and subsidence so that the cover's integrity is maintained; and

(v) have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

(b) After final closure, the owner or operator shall comply with all postclosure requirements as specified in subsection 4.6 (b). In addition, he shall continue to operate the leachate collection and removal system until leachate is no longer detected;

(ii) protect and maintain surveyed benchmarks used in complying with section 7.5.

(c) During the postclosure care period, if liquid leaks into a leak detection system, the owner or operator shall notify FEPA as specified in subsection 4.3 (d).

7.7. Special requirements for incompatible waste

Incompatible wastes, or incompatible wastes and materials shall be treated in accordance with section 5.10.

CHAPTER EIGHT

INCINERATORS

8.1. Applicability

(a) The guidelines in this chapter apply to owners and operators of facilities that incinerate solid and dangerous waste and to owners and operators who burn solid and dangerous waste in boilers or industrial furnaces in order to destroy them, for any recycling purpose shall be regulated under this chapter.

(b) FEPA may, in establishing permit conditions, exempt the facility from all requirements of this chapter except section 8.2 and section 8.8 if it finds, after an examination of the waste analysis included with Part B of the owner/operator's permit application, that the waste to be burned:

(i) (a) is either listed as a dangerous waste only because it is ignitable or, is designated only as an ignitable dangerous waste; or

(b) is designated solely because it is reactive or the characteristics described in subsection 1.8.1.3. and will not be burned when other dangerous wastes are present in the combustion zone; and

(ii) contains none of the dangerous constituents listed in FAC 000-000-9905 above significant concentration limits; and

(iii) contains none of toxic dangerous wastes, nor of persistent dangerous wastes, nor of carcinogenic dangerous wastes as listed in sections 1.5, 1.6 and 1.7 respectively.

(c) The owner or operator of an incinerator shall conduct trial burns.

8.2. Waste Analysis

(a) As a portion of a trial burn plan, the owner or operator shall have included an analysis of his waste feed sufficient to provide all chemical and physical information.

(b) Throughout normal operation the owner or operator shall conduct sufficient waste analysis to verify that waste feed to the incinerator is within the physical and chemical composition limits specified in his permit (under subsection 8.6 (b)).

8.3. Designation of principal organic dangerous constituents and dangerous combustion by-products

Principal Organic Dangerous Constituents (PODCs) and Dangerous Combustion By-products (DCBD) must be treated to the extent required by the performance's standards specified in subsection 8.4. of this section. For each waste feed to be burned, one or more PODCs and Dangerous Combustion By-products will be specified in the facility's permit from among those constituents listed in FAC 000-000-9905 and, to the extent practical, from among those constituents which contribute to the toxicity, persistence, or carcinogenicity of wastes designated under sections 1.4 or 1.5 to 1.7. This specification will be based on the degree of difficulty of incineration of the organic constituents of the waste feed and its combustion by-products and their concentration or mass, considering the results of waste analyses and trial burns. Organic constituents or by-products which represent the greatest degree of difficulty of incineration will be those most likely to be designated PODCs and DCBP's. Constituents are more likely to be so designated if they are present in large quantities or concentrations.

8.4. Performance Standards

An incinerator burning dangerous waste shall be designed, constructed, and maintained so that, when operated in accordance with operating requirements specified under section 8.6, it will meet the following performance standards:

(a) (i) except as provided in subsection 8.4 (a) (ii) an incinerator burning dangerous waste must achieve a Destruction and Removal Efficiency (DRE) of 99.99 percent for each PODC designated in its permit for each waste fed. DRE is determined for each PODC from the following equation:

$$DRE = \frac{{}^{w}in - {}^{W}out \times 100\%}{{}^{w}in}$$

Where

${}^{w}in$ = Mass feed rate of one PODC in the waste stream feeding the incinerator, and ${}^{w}out$ = Mass emission rate of the same PODC present in exhaust emissions prior to release to the atmosphere;

(ii) an incinerator burning dangerous wastes FEF020, FEF021, FEF022, FEF023, FEF026, or FEF027 shall achieve DRE of 99.999 per cent for each PODCs designated in its permit. This performance must be demonstrated on PODCs that are more difficult to incinerate than tetrapentadioxins, and hexachlorodibenz-p-dioxins and dibenzofurans. DRE is determined for each PODCs from the equation in subsection 8.4 (a) (i). In addition, the owner or operator of the incinerator shall notify the FEPA of his intent to incinerate dangerous wastes FEF020, FEF022, FEF023, FEF026, or FEF027.

(b) Incinerators burning dangerous waste shall destroy dangerous combustion by-products designated under subsection 8.3 that the total mass emission rate of these by-products emitted from the stack is no more than 01 per cent of the total mass feed rate of PODCs fed into the incinerator.

(c)(i) Incinerator burning dangerous waste and producing stack emissions of more than 1.8 kilograms per hour of hydrogen chloride (HC1) shall control HC1 emissions such that the rate of emission is no greater than the larger of either 1.8 kilograms per hour or one percent of the HC1 in the stack gas prior to entering any pollution control equipment.

(ii) Incinerator burning dangerous waste shall not emit particulate matter in excess of 180 milligrams per dry standard cubic meter when corrected for the amount of oxygen in the stack gas according to the formula:

$$Pc = \frac{Pm \times 14}{21 - Y}$$

Where Pc is the corrected concentration of particulate matter, Pm is the measured concentration of particulate matter, and Y is the measured concentration of oxygen in the stack gas, using the Orsat method for oxygen analysis of dry flue gas. This correction procedure is to be used by all dangerous waste incinerators except those operating under conditions of oxygen enrichment. For these facilities, FEPA will select an appropriate correction procedure to be specified in the facility permit.

(d) The emission standard specified in subsection 8.3 (c) shall be met when no other more stringent standards exist. Where a state or local air pollution control authority has jurisdiction and has more stringent emission standards, an incinerator burning dangerous wastes shall comply with the applicable air pollution control authority's emission standards (including limits based on best available control technology).

(e) For purposes of permit enforcement, compliance with the operating requirements specified in the permit (under section 8.6), will be regarded as compliance with section 8.4. However, evidence that compliance with those permit conditions is insufficient to ensure compliance with the performance requirements of section 8.4, may be evidence justifying modification, revocation, or reissuance of a permit.

8.5. Trial burns, and permit modifications

(a) The owner or operator of a dangerous waste incinerator shall burn only wastes specified in his permit and only under operating conditions specified for those wastes under section 8.6 except:

(i) in approved trial burns; or

(ii) under exemptions created under section 8.1.

(b) New dangerous wastes may be burned only after operating conditions have been specified in a trial burn permit or a permit modification has been issued, as applicable. Operating requirements for new wastes shall be based on trial burn results or included with a permit application.

(c) The permit for a new dangerous waste incinerator shall establish appropriate conditions for each of the applicable requirements of this section, including but not limited to allowable waste feeds and operating conditions necessary to meet the requirements of section 8.6, but sufficient to comply with the following standards:

6/7 for the period beginning with initial introduction of dangerous waste to the incinerator and ending with initiation of the trial burn, shall not exceed 1020 hours operating time for treatment of dangerous waste;

(ii) during the trial burn, the operating requirements shall be sufficient to demonstrate compliance with the performance standards of section 8.4, and shall be in accordance with the approved trial burn plan;

(iii) in the period immediately following completion of the trial burn, and only for the minimum period sufficient to allow sample analysis data computation, and submission of the trial burn results by the applicant, and review of the trial burn results and modification of the facility permit by the FEPA, the operating requirements shall be those most likely to ensure compliance with the performance standards of section 8.4.

(iv) for the remaining duration of the permit, the operating requirements shall be those demonstrated, in a trial burn.

8.6. Operating Requirements

(a) An incinerator shall be operated in accordance with operating requirements specified in the permit. These will be specified on a case-by-case basis as those demonstrated in a trial burn.

(b) Each set of operating requirements shall specify the composition of the waste feed. For each such waste feed, the permit shall specify acceptable operating limits including the following conditions:

(i) carbon monoxide (CO) level in the stack exhaust gas;

(ii) waste feed rate;

(iii) combustion temperature;

(iv) an appropriate indicator of combustion gas velocity;

(v) allowable variations in incinerator system designed or operating procedures; and

(vi) such other operating requirements as are necessary to ensure that the performance standards of section 8.4. are met.

(c) During start-up and shut-down of an incinerator, dangerous waste (except waste exempted in accordance with subsection 8.1 (b) shall not be fed into the incinerator unless the incinerator is operating within the conditions of operation (temperature, air feed rate, etc.) specified in the permit.

(d) Fugitive emissions from the combustion zone shall be controlled by:

(i) keeping the combustion zone totally sealed against fugitive emissions;

(ii) maintaining a combustion zone pressure lower than atmospheric pressure; or

(iii) providing of an alternate means for fugitive emissions control, equivalent to maintenance of combustion zone pressure lower than atmospheric pressure.

(e) An incinerator shall be operated with a functioning system to automatically cut off waste feed to the incinerator when operating conditions deviate from limits established under subsection 8.6 (a).

(f) An incinerator shall cease operation when changes in waste feed, incinerator design, or operating conditions exceed limits designated in its permit.

8.7. Monitoring and Inspections

(a) The owner or operator shall conduct, as a minimum, the following monitoring while incinerating dangerous waste:

(i) combustion temperature waste feed rate, and the indicator of combustion gas velocity specified in the facility permit on a continuous basis;

(ii) carbon monoxide (CO) on a continuous basis at a point in the incinerator down-stream of the combustion zone and prior to release to the atmosphere; and

(iii) as required by the FEPA sampling and analysis of the waste and exhaust emissions to verify that the operating requirements established in the permit achieve the performance standard of section 8.4.

(b) The incinerator and associated equipment (pumps, valves, conveyors, pipes, etc.) shall be completely inspected at least daily for looks, spills, fugitive emissions, and signs of tampering. all emergency waste feed cutoff controls and system alarms must be tested at least weekly to verify proper operation, unless the owner or operator demonstrates to FEPA that weekly inspections will unduly restrict or upset operations and that less frequent inspection will be adequate. At a minimum, emergency cutoff and alarms system shall be tested at least monthly.

(c) Monitoring and inspection data shall be recorded and the records shall be placed in the operating log.

8.8. Closure

At closure the owner or operator shall remove all dangerous waste and dangerous waste residues (including, but not limited to, ash, scrubber liquids, and from scrubber site). The remaining equipment,

bases, liners, soil and debris containing, or contaminated with dangerous waste or waste residues shall be decontaminated or removed, and disposal in an environmentally safe manner.

CHAPTER NINE

HARMFUL/DANGEROUS/HAZARDOUS/TOXIC WASTES TRACKING PROGRAMME

9.1. The Tracking Programme

The tracking programme shall:

(a) provide for tracking of the collection, transportation and treatment of the wastes from generation to the disposal;

(b) include a system for providing the generator of the waste with assurance that the waste is received by the disposal facility;

(c) use a uniform format for tracking;

(d) include the following requirements:

(i) for segregation and/or recovery of the waste at the point of generation where practicable;

(ii) for placement of the waste in containers that will protect waste handlers and the public from exposures.

(iii) for appropriate labelling of containers of the wastes.

9.1.1. The waste that is incinerated need not be tracked after incineration except for the disposal of the ash;

9.2. Medical Wastes and Laboratory Waste Tracking Programme

The following types of Harmful/Dangerous/Hazardous/Medical Wastes to be tracked include, but are not limited to the following types of solid waste:

(a) cultures and stock of infections agents and associated biological materials, including cultures from medical and pathological laboratories, cultures and stock of infectious agents, from research and industrial laboratories, wastes from the production of biologicals, discarded live and attenuated vaccines, and culture dishes and devices used to transfer, inoculate and mix cultures;

(b) pathological wastes; including tissues, organs and body parts that are removed during surgery and autopsy;

(c) wastes of after birth (placenta), human blood and products of blood including serum, plasma and other blood components;

(d) sharp instruments that have been used in patient care or in medical, research, or industrial laboratories, including hypodermic needles, syringes, pasteur pipettes, broken glass, and scalpel blades;

(e) contaminated animal carcasses, body parts, and cages used for animals that were exposed to infectious agents during research, production of biologicals, or testing of pharmaceuticals;

(f) wastes from surgery or autopsy that were in contact with infectious agents, including soiled dressings, sponges, drapes, lavage-tubes, drainage sets, under-pads, and surgical gloves;

(g) laboratory wastes from medical, pathological, pharmaceutical, or other research, commercial, or industrial laboratories that were in contact with infectious agents, including slides and cover slips, disposable gloves, laboratory coats and aprons;

(h) dialysis wastes that were in contact with the blood of patients undergoing haemodialysis, including contaminated disposable equipment and supplies such as tubing, filters, disposable sheets, towels, gloves, aprons and laboratory coats;

(i) discarded medical equipment and parts that were in contact with infectious agent;

(j) biological wastes and discarded materials contaminated with blood, faecal matter, exudates or secretion from human beings or animals who are isolated to protect others from communicable diseases;

(k) such other waste materials that result from the administration of medical care to a patient by a health care provider and is found by FEPA to pose a threat to human health or the environment; and

(l) radioactive medical wastes.

9.3. Inspection

Any person who generates, stores, treats, transports, disposes of, or otherwise handles or has handled medical/hazardous, toxic or harmful wastes shall upon request of any officer, employee or representative duly designated by FEPA furnish information relating to such wastes, including any tracking forms required to be maintained according to the provision of these guidelines, conduct monitoring or testing, and permit such persons at all reasonable times, to have access to, and to copy all records relating to such waste. For such purposes, such persons are authorised to:

(a) enter, at reasonable time, any establishment, or other place, where medical or harmful/dangerous/hazardous wastes have been generated, stored, treated or transported from;

(b) conduct monitoring or testing; and

(c) inspect and obtain samples from any bonafide staff or representative of the establishment of any such wastes and samples of any container or labelling for such wastes.

9.4. Procedure

Each inspection under this section shall be commenced and completed within a reasonable period. If the official from FEPA obtains and samples, prior to leaving the premises, he shall give to the owner, operator, or agent in charge a receipt describing the sample obtained and if requested, a portion of each such sample in volume or weight to the portion retained if giving such an equal portion is feasible. If analysis is made of such samples, a copy of the result of such analysis shall be furnished promptly to the owner, operator or agent in charge of the premises concerned. The mechanism for implementation and enforcement shall be co-ordinated by FEPA in collaboration with relevant federal and state ministries and parastatals.

9.5. Enforcement

The procedure for compliance order and violations shall be as contained with the provision of Decree 42 of November, 1988 and Decree 58 of December, 1988 in addition to any other laws for the time being in force including appropriate penalties.

BIBLIOGRAPHY

State of Washington, U.S.A., (1988). Dangerous Waste Regulations. Department of Ecology, Washington, U.S.A.

PART III

EXCLUSIVE LISTS OF HAZARDOUS/DANGEROUS CHEMICALS

PART III

EXCLUSIVE LISTS OF HAZARDOUS/DANGEROUS CHEMICALS

01. Introduction

These exclusive lists are a compilation of chemicals and substances (including waste) and discarded chemicals which are known, based on scientific evidence to be hazardous to public health and environment. These lists represent the following categories:

(a) Hazardous/Dangerous/Chemical Product.

(b) Hazardous/Dangerous/Waste Sources.

(c) Infectious/Hazardous/Dangerous Wastes

(d) Hazardous/Dangerous Waste Mixtures.

The chemicals listed here can only be imported into the country or produced locally after clearance with FEPA and other relevant agencies. FEPA may exclude from these lists any categories or items which it determines do not represent potential hazard to human health or the environment when properly treated, stored, transported, disposed of, or otherwise managed. other chemicals could be added to these lists based on new knowledge.

These exclusive lists form the basis of FEPA's tracking programme to monitor and control and management of these substances from "cradle to grave".

CHAPTER ONE

1.0. HAZARDOUS (DANGEROUS) CHEMICAL PRODUCTS (FAC 000-9903)

1.1. ACUTELY HAZARDOUS (DANGEROUS) CHEMICAL PRODUCTS LIST

Hazardous (Dang-erous) Waste No.	Substance	FEPA* Hazard Desig-nation	Reason for Desig-nation
FA023	Acetaldehyde, chloro-	EHW	BH
FB001	Acetaldehyde	EHW	C
FB034	Acetaldehyde, trichloro-	EHW	H
FA002	Acetamide, N-(aminothioxomethyl)-	EHW	B
FA057	Acetamide, 2-fluoro-	EHW	BH
FA058	Acetic acid, fluoro-, sodium salt	EHW	AH
FB144	Acetic acid, lead salt	EHW	DEP
FA066	Acetimidic acid, N-[(methylcarbamoyl) oxy] thio-, methyl ester	EHW	B
FB003	Acetonitrile	EHW	C1
FA001	3-(alpha-Acetonyl-benzyl)-4-hydroxycoumarin and salts	EHW	A
FA002	1-Acetyl-2-thiourea	EHW	B
FB006	Acetyl chloride	EHW	CHOR
FA003	Acrolein	EHW	X1
FB007	Acrylamide	EHW	C
FB008	Acrylic acid	EHW	COL
FB009	Acrylonitrile	EHW	C+1
FA070	Aldicarb	EHW	B
FA004	Aldrin	EHW	XH
FA005	Allyl alcohol	EHW	B1
FA006	Aluminium phosphide	EHW	BR
FA007	5 (Aminomethyl)-3 isoxazolol	EHW	B
FA008	4-Aminopyridine	EHW	B
FA009	Ammonium picrate	EHW	B
FA119	Ammonium vanadate	EHW	B
FB012	Aniline	EHW	C1
FA010	Arsenic acid	EHW	B
FA012	Arsenic (III) oxide	EHW	B+
FA011	Arsenic (V) oxide	EHW	B
FA011	Arsenic pentoxide	EHW	B
FA012	Arsenic trioxide	EHW	B+
FA038	Arsine, diethyl-	EHW	B
FB015	Azaserine	EHW	C+
FA054	Aziridine	EHW	B+
FB010	Azirino (2, 3 : 3, 4) pyrrolo (1, 2a) indole 4, 7-dione, 6-amino-8 [(aminocarbonyl) oxy) methyl] -1, 1a, 2, 8a, 8b-hexahydro-8a methoxy-5-methyl-	EHW	B+

Hazardous (Dang-erous) Waste No.	*Substance*	*FEPA* Hazard Desig-nation*	*Reason for Desig-nation*
FA013	Barium cyanide	EHW	A
FB157	Benz[j] aceanthrylene, 1, 2-dihydro-3-methyl-	EHW	HP
FB017	Benzal chloride	EHW	DH
FB018	Benz [a] anthracene	EHW	P+
FB018	1, 2-Benzanthracene	EHW	P+
FB094	1, 2-Benzanthracene, 7, 12-dimethyl-	EHW	CP
FB012	Benzenamine	EHW	C1
FA024	Benzenamine, 4-chloro	EHW	CH
FB049	Benzenamine, 4-chloro-2-methyl-	EHW	H
FB093	Benzenamine, N, N-dimethyl-4(phenylazo)-	EHW	C+
FB158	Benzenamine, 4, 4-methylenebis (2-chloro	EHW	H+
FA077	Benzxenamine, 4-nitro-	EHW	D?
FA028	Benzene, (chloromethyl)-	EHW	BH+
FB019	Benzene	EHW	C+1
FB038	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha- hydroxy, ethyl	EHW	H
FB030	Benzene, 1-bromo-4-phenoxy-	EHW	H
FB037	Benzene, chloro-	EHW	BH1
FB190	1, 2-Benzenedicarboxylic acid anhydride	EHW	C
FB070	Benzene, 1, 2-dichloro	EHW	BH
FB071	Benzene, 1, 3-dichloro	EHW	BH
FB072	Benzene, 1, 4-dichloro	EHW	BH
FB017	Benzene, 1, 3-dichloromethyl)-	EHW	DH
FB223	Benzene, 1, 3-diisocyanatomethyl-	EHW	BR
FB239	Benzene, dimethyl-	EHW	C1
FB201	1, 3-Benzenediol	EHW	C
FB127	Benzene, hexachloro-	EHW	H
FB056	Benzene, hexahydro-	EHW	C1
FB188	Benzene, hydroxy	EHW	C
FB220	Benzene, methyl	EHW	C1
FB105	Benzene, 1-methyl-1, 2, 4 dinitro	EHW	C
FB106	Benzene, 1-methyl-2, 6-dinitro-	EHW	C
FB055	Benzene, (1, methlethyl)-	EHW	C1
FB169	Benzene, nitro-	EHW	C1
FB183	Benzene, pentachloro	EHW	H
FB185	Benzene, pentachloronitro-	EHW	DH+
FB020	Benzenesulphonic acid chloride	EHW	DHOI
FB020	Benzenesulphonyl chloride	EHW	DH0I
FB207	Benzene, 1, 2, 4, 5 tetrachloro-	EHW	DH
FB023	Benzene, (trichloromethyl)-	EHW	HOR
FA042	1, 2-Benzenediol, 4-[1-hydroxy-2-(methyl-amino ethyl)-	EHW	B
FA014	Benzenethiol	EHW	A
FB021	Benzidine	EHW	B+
FB022	Benzo[a]pyrene	EHW	P+
FB022	3, 4-Benzopyrene	EHW	P_
FB197	p-Benzoquinone	EHW	C
FB023	Benzotrichloride	EHW	HOR
FB050	1, 2-Benzphenanthrene	EHW	P+

Hazardous (Dang-erous) Waste No.	*Substance*	*FEPA* Hazard Desig-nation*	*Reason for Desig-nation*
FA028	Benzyl chloride	EHW	PH+
FA015	Beryllium dust	EHW	C+
FB085	2, 2-Bioxirane	EHW	B1
FB021	'1, 1''-Biphenyl)-4, 4'-diamine	EHW	B+
FB073	(1,1'-Biphenyl)-4 4'-diamine, 3, '3-dichloro-	EHW	H+
FB095	(1,1'-Biphenyl)-4 4'-diamine, 3, 3-dimethyl-	EHW	C+
FB024	Bis (2-chloroethoxy) methane	EHW	CH
FB027	Bis (2-chloroisopropyl) ether	EHW	CHO
FA016	Bis (chloromethyl) ether	EHW	CH+
FB246	Bromine cyanide	EHW	CH
FA017	Bromoacetone	EHW	CH
FB225	Bromoform	EHW	H
FB030	4-Bromophenyl phenyl ether	EHW	H
FA018	Brucine	EHW	A
FB128	1, 3-Butadiene, 1, 1, 2, 3, 4, 4-hexachloro-	EHW	CH
FB035	Butanoic acid 4-[bis (2-chloroethyl) amino] benzene-	EHW	H+
FB160	2-Butanone peroxide	EHW	BR
FB074	2-Butene, 1, 4-dichloro	EHW	B1
FB053	2-Butenal	EHW	B1
FB074	2-Butene, 1, 4-dichloro	EHW	CH1
FB032	Calcium chromate	EHW	C+EP
FA021	Calcium cyanide	EHW	B
FA123	Camphene, octachloro-	EHW	XH
FA097	Camphur	EHW	A
FA178	Carbamic acid, methylnitroso-ethyl ester	EHW	C+
FB176	Carbamide, N-ethyl-N-nitroso-	EHW	C+
FB177	Carbamide, N-methyl-N-nitroso	EHW	C+
FB219	Carbamide, thio-	EHW	C+
FA103	Carbamimidoselenoic acid	EHW	B
FB097	Carbamoyl Chloride, dimethyl-	EHW	DH+
FAO22	Carbon bisulphide	EHW	D1?
FAO22	Carbon disulfphide	EHW	D1?
FB156	Carbonocholoridic acid, methyl ester	EHW	BH1
FB033	Carbon oxyfluoride	EHW	BHR
FB211	Carbon tetrachloride	EHW	CH+
FA095	Carbonyl chloride	EHW	BH
FB033	Carbonyl Fluoride	EHW	BHR
FB035	Chlorambucil	EHW	H+
FB036	Chlordane, technical	EHW	XH
FA033	Chlorine cyanide	EHW	AH
FB026	Chloronaphazine	EHW	H+
FA023	Chloroacetaldehyde	EHW	BH
FA024	p-Chloroaniline	EHW	CH
FB037	Chlorobenzene	EHW	BH1
FB039	4-Chloro-m-cresol	EHW	H
FB041	1-Chloro-2, 3-epoxypropane	EHW	CH+1
FB042	2-Chloroethyl vinyl ether	EHW	CH
FB044	Chloroform	EHW	CH+
FB046	Chloromethyl methyl ether	EHW	DH+1

Hazardous (Dang-erous) Waste No.	*Substance*	*FEPA* Hazard Desig-nation*	*Reason for Desig-nation*
FB047	beta-Chloronaphthalene	EHW	DH
FB048	o-Chlorophenol	EHW	DH
FA026	1-(o-Chlorophenyl) thiourea	EHW	AH
FA027	3-Chloropropionitrile	EHW	BH
FB049	4-Chloro-o-toluidine, hydrochloride	EHW	H
FB032	Chromic acid, calcium salt	EHW	C+EP
FB050	Chrysene	EHW	P+
FA029	Copper cyanides	EHW	B
FB052	Cresols	EHW	B
FB052	Cresylic acid	EHW	B
FB053	Crotonaldehyde	EHW	B1
FB055	Cummene	EHW	C1
FA030	Cyanides (soluble cyanide salts), not elsewhere specified	EHW	A
FA031	Cyanogen	EHW	B1
FB246	Cyanogen bromide	EHW	CH
FA033	Cyanogen chloride	EHW	AH
FB197	1, 4-Cyclohexadienedione	EHW	C
FB056	Cyclohexane	EHW	C1
FB057	Cyclohexanone	EHW	C1
FB130	1, 3-Cyclopentadiene, 1, 2, 3, 4, 5, 5,-hexachloro-	EHW	XH
FB058	Cyclophosphamide	EHW	CH+1
FB240	2, 4-D, salts and esters	EHW	BH
FB060	DDD	EHW	CH+
FB061	DDT	EHW	XH+
FB142	Decachlorooctahydro-1, 3, 4-metheno-2H cyclobuta [c, d]-pentalen-2-one	EHW	XH
FB062	Diallate	EHW	CH+
FA133	Diamine	EHW	B+R
	beta-C		
FB063	Dibenz [a, h] anthracene	EHW	AP+
FB063	1, 2 : 5, 6-Dibenzanthracene	EHW	P+A
FB064	1, 2 : 7, 8-Dibenzopyrene	EHW	P+
FB064	Dibenz [a, i] pyrene	EHW	P+
FB066	1, 2-Dibromo-3-Chloropropane	EHW	CH+
FB062	S-(2, 3-Dichloroally) diisopropylthio carbamate	EHW	CH+
FB070	o-Dichlorobenzene	EHW	BH
FB071	m-Dichlorobenzene	EHW	BH
FB072	p-Dichlorobenzene	EHW	BH
FB073	3, 3'-Dichlorobenzidine	EHW	B+
FB074	1, 4-Dichloro-2-butene	EHW	CH1
FB075	Dichlorodifluoromethane	EHW	H
FB060	Dichloro diphenyl dichloroethane	EHW	CH+
FB061	Dichloro diphenyl trichloroethane	EHW	XH+
FB078	1, 1-Dichloroethylene	EHW	CH+
FB079	1, 2-Dichloroethylene	EHW	DH
FB025	Dichloroethyl ether	EHW	CH
FB081	2, 4-Dichlorophenol	EHW	DH
FB082	2, 6-Dichlorophenol	EHW	DH
FB240	2. 4-Dichlorophenoxyacetic acid, salts and esters	EHW	BH

Hazardous (Dang-erous) Waste No.	*Substance*	*FEPA* Hazard Desig-nation*	*Reason for Desig-nation*
FA036	Dichlorophenylarsine	EHW	BH
FB083	1, 2-Dichloropropane	EHW	CH1
FA037	Dieldrin	EHW	XH+
FB085	1, 2, 3, 4-Diepoxybutane	EHW	B1
FA038	Diethylarsine	EHW	B
FA039	0, 0-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate	EHW	A
FB087	0,0-Diethyl-S-methyl-dithiophosphate	EHW	B
FA041	Diethyl-p-nitrophenyl phosphate	EHW	A
FA040	0, 0,-Diethyl O-pyrazenyl phosphorothioate	EHW	A
FA043	Diisopropyl fluorophosphate	EHW	BH
FA044	Dimethoate	EHW	A
FB092	Dimethylamine	EHW	C1
FB093	Dimethylaminoazobenzene	EHW	C+
FB094	7, 12-Dimethylbenz[a]anthracene	EHW	CP
FB095	3, 3-Dimethylbenzidine	EHW	C+
FB096	alpha, alpha-Dimethylbenzylhydroperoxide	EHW	CR
FB097	Dimethylcarbamoyl chloride	EHW	DH+
FB099	1, 2-Dimethylhydrazine	EHW	C+1
FA045	3, 3-Dimethyl-l-(methylthio)-2-butanone,	EHW	B
	0-[(methylamino)carbonyl] oxime	EHW	
FA071	0, 0-Dimethyl 0-p-nitrophenyl phosphorothioate	EHW	A
FA082	Dimethylnitrosamine	EHW	B+
FA046	alpha, alpha-Dimethylphenethylamine	EHW	C
FB103	Dimethyl sulphate	EHW	CO+
FA047	4, 6-Dinitro-o-cresol and salts	EHW	B
FA034	4, 6-Dinitro-o-cyclohexylphenol	EHW	C
FA048	2, 4-Dinitrophenol	EHW	B
FB105	2, 4-Dinitrotoluene	EHW	C
FB106	2, 6-Dinitrotoluene	EHW	C
FA020	Dinoseb	EHW	B
FB109	1, 2-Diphenylhydrazine	EHW	C
FB035	Diphosphoramide, octamethyl	EHW	?
FB110	Dipropylamine	EHW	C1
FB111	Di-n-propylnitrosamine	EHW	C+
FA039	Disulphoton	EHW	A
FA049	2, 4-Dithiobiuret	EHW	A
FA109	Dithiopyrophosphoric acid, tetraethyl ester	EHW	A
FA050	Endosulphan	EHW	XH
FA088	Endothiol	EHW	B
FA051	Endrin	EHW	XH
FA042	Epinephrine	EHW	B
FB001	Ethanol	EHW	C
FB174	Ethanamine, N-ethyl-N-nitroso	EHW	C+
FA046	Ethanamine, 1, 1-dimethyl-W-phenyl-	EHW	C
FB067	Ethane, 1, 2-dibromo-	EHW	CH+
FB076	Ethane, 1, 1-dichloro-	EHW	DH
FB077	Ethane, 1, 2-dichloro-	EHW	DH
FB114	1, 2-Ethanediylbiscarbamodithioic acid	EHW	B

Hazardous (Dang-erous) Waste No.	*Substance*	*FEPA* Hazard Desig-nation*	*Reason for Desig-nation*
FB131	Ethane, 1, 1, 1, 2, 2, 2,-hexachloro-	EHW	H
FB024	Ethane, 1, 1[1]-[methylenebis (oxy)] bis [2-chloro-	EHW	CH
FB247	Ethane, 1, 1, 1-trichloro-2-2-bis (p-mettoxy pheny)	EHW	DH
FB003	Ethanenitrile	EHW	C
FB025	Ethane, 1, 1,-oxybis [2-chloro-	EHW	CH
FB184	Ethane, pentachloro-	EHW	AH
FB208	Ethane, 1, 1, 1, 2-tetrachloro-	EHW	H
FB209	Ethane, 1, 1, 2, 2-tetrachloro-	EHW	H
FB227	Ethane, 1, 1, 2-trichloro-	EHW	CH
FA084	Ethenamine, N-methyl-N-nitroso	EHW	B+
FB043	Ethane, chloro-	EHW	DH+
FB042	Ethane, 2-chloroethoxy-	EHW	CH
FB078	Ethane, 1, 1-dichloro-	EHW	CH+
FB079	Ethane, trans-1, 2-dichloro-	EHW	DH
FB210	Ethane, 1, 1, 2, 2-tetrachloro-	EHW	CH
FB006	Ethanoyl chloride	EHW	CHOR
FA101	Ethyl cyanide	EHW	B
FB038	Ethyl 4, 4'-dichlorobenzilate	EHW	DH
FB114	Ethylenebis (dithiocarbamic acid), salts and esters	EHW	B
FB067	Ethylene dibromide	EHW	CH
FB077	Ethylene dichloride	EHW	DH
FB115	Ethylene oxide	EHW	C1
FA054	Ethylenimine	EHW	B+
FB076	Ethylidene dichloride	EHW	DH
FA056	Fluorine	EHW	B
FA057	Fluoroacetamide	EHW	BH
FA058	Fluoracetic acid, sodium salt	EHW	AH
FB122	Formaldehyde	EHW	C
FA065	Fulminic acid, mercury (II) salt	EHW	R?
FB125	2-Furancarboxaldehyde	EHW	C1
FB147	2, 5-Furandione	EHW	C
FB125	Furfural	EHW	C1
FB126	Glycidylaldehyde	EHW	C+
FB163	Guanidine, N-nitroso-N-methyl-N'nitro-	EHW	C+
FA059	Heptachlor	EHW	XH+
FB127	Hexachlorobenzene	EHW	H
FB128	Hexachlorobutadiene	EHW	CH
FB130	Hexachlorocyclopentadiene (gamma isomer)	EHW	XH
FA051	1, 2, 3, 4, 10, 10-Hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-endo, endo-1, 4, 5, 8-dimethanophthalene	EHW	XH
FA037	1, 2, 3, 4, 10, 10-Hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-endo, exo-1, 4, 5, 8-dimethanonaphthalene	EHW	XH+
FB131	Hexachloroethane	EHW	H
FA060	1, 2, 3, 4, 10, 10-Hexachloro-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4 : 5, 8-endo endo-dimethanonaphthalene	EHW	BH
FA004	1, 2, 3, 4, 10, 10-Hexachloro-1, 4, 4a, 5, 8, 8a-		

Hazardous (Dangerous) Waste No.	*Substance*	*FEPA* Hazard Designation*	*Reason for Designation*
	hexahydro-1, 4, 5, 8-endo, exodimethanonaphthalene	EHW	BH
FA060	Hexachlorohexahydro-endo, endo-dimethanonaphthalene	EHW	BH
FB132	Hexachlorophene	EHW	CH
FB243	Hexachloropropone	EHW	H
FA062	Hexaethyl tetraphosphate	EHW	B
FB133	Hydrazine	EHW	B+R
FA116	Hydrazinecarbothioamide	EHW	B
FB099	Hydrazine, 1, 2-dimethyl-	EHW	C+1
FB109	Hydrazine, 1, 2-diphenyl-	EHW	C
FA068	Hydrazine, methyl-	EHW	A1
FA063	Hydrocyanic acid	EHW	A
FA063	Hydrogen cyanide	EHW	A
FA096	Hydrogen phosphide	EHW	B1
FB135	Hydrogen sulphide	EHW	B1
FB096	Hydroperoxide l-methyl-l-phenylethyl-	EHW	CR
FB245	Indomethacin	EHW	BH
FA064	Isocyanic acid, methyl ester	EHW	1?
FA007	3 (2H)-Isoxazolone, 5-(aminomethyl)-	EHW	B
FB142	Kepone	EHW	XH
FB143	Lasiocarpine	EHW	C+
FB144	Lead acetate	EHW	DEP
FB129	Lindane	EHW	H+
FB147	Maleic anhydride	EHW	C
FB149	Malononitrile	EHW	C
FB151	Mercury	EHW	EP
FA092	Mercury (acetato-O), phenyl-	EHW	B
FA065	Mercury fulminate	EHW	R?
FB152	Methacrylonitrile	EHW	B1
FB092	Methanamine, N-methyl-	EHW	C1
FA016	Methane, oxybis (chloro)-	EHW	BH+
FA112	Methane, tetranitro-	EHW	AR
FB029	Methane, bromo	EHW	H
FB045	Methane, chloro-	EHW	H1
FB046	Methane, chloromethyoxy-	EHW	DH+1
FB068	Methane, dibromo-	EHW	CH+
FB080	Methane, dichloro-	EHW	CH
FB075	Methane, dichlorodifluoro-	EHW	H
FB138	Methane, iodo-	EHW	H+
FB211	Methane, tetrachloro-	EHW	CH+
FA118	Methanethiol, trichloro-	EHW	H
FB153	Methanethiol	EHW	B1
FB225	Methane, tribromo	EHW	H
FB121	Methane, trichlorofluoro-	EHW	H
FB044	Methane, trichloro-	EHW	CH+
FA059	4, 7-Methano-1H-indene, 1, 4, 5, 6, 7, 8, 8-heptachloro-3a, 4, 7, 7a-tetrahydro-		
FB036	4, 7-Methanoindan, 1, 2, 4, 5, 6, 7, 8, 8-octa-		

Hazardous (Dang-erous) Waste No.	*Substance*	*FEPA* Hazard Desig-nation*	*Reason for Desig-nation*
	chloro-3a, 4, 7, 7a-tetrahydro-	EHW	XH
FA066	Methomyl	EHW	B
FA067	2-Methylaziridine	EHW	B+1
FA068	Methyl hydrazine	EHW	A1
FA064	Methyl isocyanate	EHW	1?
FA069	2-Methyllactonitrite	EHW	A
FA071	Methyl parathion	EHW	A
FB029	Methyl bromide	EHW	H
FB045	Methyl chloride	EHW	H1
FB156	Methyl chlorocarbonate	EHW	GH1
FB226	Methylchloroform	EHW	CH
FB157	3-Methylcholanthrene	EHW	HP
FB158	4, 4'-Methylenebis (2-chloroanailine)	EHW	H+
FB132	2, 2'-Methylenebis (3, 4, 6-trichlorophenol)	EHW	CH
FB068	Methylene bromide	EHW	CH+
FB080	Methylene chloride	EHW	CH
FB122	Methylene oxide	EHW	C
FB160	Methyl ethyl ketone peroxide	EHW	BR
FB138	Methyl iodide	EHW	H+
FB163	N-Methyl-N'-nitro-N-nitrosoquanidine	EHW	C+R
FB010	Mitomycin C	EHW	B+
FB165	Naphthalene	EHW	B
FB047	Naphthalene, 2-chloro-	EHW	DH
FB166	1, 4-Naphthalenedione	EHW	C
FB236	2, 7-Naphthalenedisulphonic acid, 3, 3'-[(3, 3' dimethyl-(1, 1'-biphenyl)-4, 4' diyl)]-bis (azo) bis (5-amino-4 -hydroxy-, tetrasodium salt	EHW	H+
FB166	1, 4, Naphthaquinone	EHW	C
FB167	1-Naphthylamine	EHW	B+
FB168	2-Naphthylamine	EHW	B+
FB167	alpha-Naphthylamine	EHW	B+
FB168	beta-Naphthylamine	EHW	B+
FB026	2-Naphthylamine, N, N'-bis (2-chloromethyl)-	EHW	H+
FA072	alpha-Naphthylthiourea	EHW	B
FA073	Nickel carbonyl	EHW	B
FA074	Nickel cyanide	EHW	DR?
FA074	Nickel (II) cyanide	EHW	DR?
FA073	Nickel tetracarbonyl	EHW	B
FA075	Nicotine and salts	EHW	B
FA076	Nitric oxide	EHW	B
FA077	p-Nitroaniline	EHW	D?
FB169	Nitrobenzene	EHW	C1
FA078	Nitrogen dioxide	EHW	A
FA076	Nitrogen (II) oxide	EHW	B
FA078	Nitrogen (IV) oxide	EHW	A

Hazardous (Dangerous) Waste No.	*Substance Designation*	*FEPA* Designation*	*Hazard Designation*	*Reason*	
FA081	Nitroglycerine	EHW	R ?		
FB170	P-Nitrophenol	EHW	C		
FB171	2-Nitropropane		EHW	C1	
FB174	N-Nitrosodiethylamine		EHW	C+	
FA082	N-Nitrosodimethylamine		EHW	B+	
FB176	N-Nitroso-N-ethylurea		EHW	C+	
FB177	N-Nitroso-N-methylurea		EHW	C+	
FB178	N-Nitroso-N-methylurethane		EHW	C+	
FA084	N-Nitrosomethylvinylamine			EHW	B+
FB179	N-Nitrosopiperidine			EHW	C+
FB111	N-Nitroso-N-propylamine			EHW	C+
FA050	5-Norbornene-2, 3, -dimethanol, 1, 4, 5, 6, 7, 7-hexachloro, cyclic sulphite		EHW	XH	
FA085	Octamethylpyrophosphoramide		EHW	A	
FA087	Osmium oxide		EHW	B	
FA087	Osmium tetroxide		EHW	B	
FA088	7-Oxabicyclo [2.2.1] heptane-2, 3-dicarboxylic acid	EHW	B		
FB058	2H-1, 3, 2-Oxazaphosphorine, 2-[bis (2-chloro-ethyl) amino] tetrahydro-, oxide 2-		EHW	CH1+	
FB115	Oxirane	EHW	X		
FB041	Oxirane, 2-(chloromethyl)-			EHW	CH+1
FA089	Parathion	EHW	X		
FB183	Pentachlorobenzene			EHW	H
FB184	Pentachloroethane			EHW	AH
FB185	Pentachloronitrobenzene		EHW	DH	
See	FEF027 Pentachlorophenol			EHW	AH
FB188	Phenol	EHW	C		
FA034	Pehnol, 2-Cyclohexyl-4, 6-dinitro-		EHW	C	
FA048	Phenol, 2, 4-dinitro-			EHW	B
FA047	Phenol, 2, 4-dinitro-6-methyl-, and salts		EHW	B	
FA020	Phenol, 2, 4-dinitro-6 (1 methylpropyl)-		EHW	B	
FA009	Phenol, 2, 4, 6-trinitro-, ammonium salt		EHW	R	
FB048	Phenol, 2-chloro-		EHW	DH	
FB039	Phenol, 4-chloro-3-methyl-			EHW	H
FB081	Phenol, 2, 4-dichloro-		EHW	DH	
FB082	Phenol, 2, 6-dichloro-		EHW	DH	
FB170	Phenol, 4-nitro-		EHW	C	
See	FEF027 Phenol, pentachloro		EHW	AH	
See	FEF027 Phenol, 2, 3, 4, 6-tetrachloro-		EHW	CH	
See	FEF027 Phenol, 2, 4, 5-trichloro-			EHW	AH
See	FEF027 Phenol 2, 4, 6-trichloro-		EHW	AH	
FA036	Phenyl dichloroarsine		EHW	BH	
FA092	Phenylmercuric acetate		EHW	B	
FA093	N-Phenylthoiurea		EHW	A	
FA094	Phorate	EHW	X		
FA095	Phosgene	EHW	BH		

Hazardous (Dangerous) Waste No.	*Substance*	*FEPA* Designation*	*Hazard Designation*	*Reason*	
FA096	Phosphine	EHW		BI	
FA041	Phosphoric acid, diethyl p-nitrophenyl ester		EHW	A	
FA044	Phosphorodithioic acid, O, O-dimethyl 2-[2-(methylamino)-2-oxoethyl] ester		EHW	A	
FA043	Phosphorofluoridic acid, bis (1-methyl-ethyl) -ester	EHW		BH	
FA094	Phosphorothiac acid, O, O-diethyl S-(ethylthio) methyl ester		EHW	X	
FA097	Phosphorothioic acid, O, O-dimethyl O-[p-(dimethylamino)-sulphonyl) phenyl] ester		EHW	A	
FA089	Phosphorothioic acid, O, O-diethyl O-(p-ni-trophenyl) ester			EHW	X
FA040	Phosphorothioic acid, O, O-diethyl O-pyrazinyl ester		EHW	A	
FB189	Phosphorous sulphide		EHW	BIR	
FB190	Phthalic anhydride			EHW	C
FB191	2-Picoline	EHW		C	
FA110	Plumbane, tetraethyl-		EHW	A	
FA098	Potassium cyanide			EHW	A
FA099	Potassium silver cyanide		EHW	A	
FA070	Propanal, 2-methyl-2 (methylthio)-O-[methylamino) carbonyl] oxime		EHW	B	
FB194	1-Propanamine		EHW	C1	
FB110	1-Propanamine, N-Propyl-			EHW	CI
FB066	Propane, 1, 2-dibromo-3-chloro-		EHW	CH+	
FB149	Propanedinitrile		EHW	C	
FA101	Propanenitrile	EHW		B	
FA027	Propanenitrile, 3-chloro-		EHW	BH	
FA079	Propanenitrile, 2-hydroxy-2-methyl-		EHW	A	
FB171	Propanen, 2-nitro		EHW	CI	
FB027	Propane, 2,2' oxybis [2-chloro-]		EHW	CHO	
FA081	1,2,3-Propanetriol, trinitrate-		EHW	R?	
FB235	1-Propanol, 2;3-dibromo-, phosphate (3 : 1)		EHW	DH	
FB126	1-Propanol, 2,3-epoxy-		EHW	C+	
FA017	2-Propanone, 1-bromo-		EHW	CH	
FA102	Propargyl alcohol		EHW	X	
FA003	2-Propenal		EHW	X	
FB007	2-Propenamide		EHW	C	
FB084	Propene, 1,3-dichloro-		EHW	CH	
FB243	1-propene, 1,1,2,3,3,3-hexachloro-			EHW	H
FB009	2-Propenenitrile		EHW	C+I	
FB152	2-Propenenitrile, 2-methyl-			EHW	BI
FB008	2-Propenoic acid		EHW	COI	
FA005	2-Propen-1-o1		EHW	BI	
See FEF027	Propionic acid, 2-(2,4,5-trichlorophenoxy)-			EHW	BH
FB194	n-Propylamine		EHW	CI	

Hazardous (Dangerous) Waste No.	*Substance*	*FEPA* Designation*	*Hazard Designation*	*Reason*
FB083	Propylene dichloride		EHW	CHI
FA067	1,2-Propylenimine		EHW	B+I
FA102	2-Propyn-1-o1		EHW	X
FA008	4-Pyridinamine		EHW	B
FA075	Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)- and salts		EHW	B
FB196	Pyridine	EHW	CI	
FB179	Pyridine, hexahydro-N-nitroso-		EHW	C+
FB191	Pyridine, 2-methyl-		EHW	C
FA111	Pyrophosphoric acid, tetraethyl ester		EHW	A
FB201	Resorcinol	EHW	C	
FA103	Selenourea		EHW	B
FB015	L-Serine, diazoacetate (ester)		EHW	C+
FA104	Silver cyanide	EHW	C	
See	FEF027 Silvex		EHW	BH
FA105	Sodium azide		EHW	A
FA106	Sodium cyanide		EHW	A
FA107	Strontium sulphide		EHW	R
FA108	Strychnidin-10-one, and salts		EHW	B
FA018	Strychnidin-10,2,3-dimethoxy-		EHW	A
FA108	Strychnine and salts		EHW	B
FB135	Sulphur hydride		EHW	BI
FB103	Sulphuric acid, dimethyl ester		EHW	CO+
FA115	Sulphuric acid, thallim (I) salt		EHW	B
FB189	Sulphur phosphide		EHW	BIR
See	FEF027 2,4,5-T		EHW	BH+
See	FEF027 1,2,4,5-Tetrachlorobenzene		EHW	DH
FB208	1,1,1,2-Tetrachloroethane		EHW	H
FB209	1,1,2,2-Tetrachloroethane		EHW	H
FB210	Tetrachlorethylene		EHW	CH+
FB212	2,3,4,6-Tetrachlorophenol		EHW	CH
FB109	Tetraethyldithiopyrophosphate		EHW	A
FA110	Tetraethyl lead		EHW	A
FA111	Tetraethylpyrophosphate		EHW	A
FA112	Tetranitromethane		EHW	AR
FA062	Tetraphosphoric acid, hexaethyl ester		EHW	B
FA113	Thallic oxide		EHW	B
FA113	Thallium (III) oxide		EHW	B
FA114	Thallium (I) selenide		EHW	C
FA115	Thallium (I) sulphate		EHW	B
FA045	Thiofanox	EHW	B	
FA049	Thioimidodicarbonic diamide		EHW	A
FB153	Thiomethanol		EHW	BI
FA014	Thiophenol		EHW	A
FA116	Thiosemicarbazide		EHW	BH+
FB219	Thiourea	EHW	C+	
FA026	Thiourea, (2-chlorophenyl)-		EHW	AH
FA072	Thiourea, 1-naphthalenyl-		EHW	B

Hazardous (Dangerous) Waste No.	*Substance Designation*	*FEPA* Designation*	*Hazard Designation*	*Reason*
FA093	Thiourea, phenyl-		EHW	A
FB220	Toluene	EHW		CI
FB223	Toluene diisocyanate		EHW	BR
FA123	Toxaphene		EHW	XH
FB226	1, 1, 1-Trichloroethane		EHW	CH
FB227	1, 1, 2-Trichloroethane		EHW	CH
FB228	Trichlorothene		EHW	CH+
FB228	Trichloroethylene		EHW	CH+
FA118	Trichloromethanethiol		EHW	H
FB121	Trichloromonofluoromethane		EHW	H
See	FEF027 2, 4, 5-Trichlorophenol		EHW	AH
See	FEF027 2, 4, 6-Trichlorophenol		EHW	AH
See	FEF027 2, 4, 5-Trichlorophenoxyacetic acid		EHW	BH+
FB235	Tris (2, 3-disbromopropyl) phosphate		EHW	DH
FB236	Trypan blue		EHW	H+
FB237	Uracil, 5[bis (2-chloromethyl) amino]-		EHW	BH+
FB237	Uracil mustard		EHW	BH+
FA119	Vanadic acid, ammonium salt		EHW	B
FA120	Vanadium pentoxide		EHW	B
FA120	Vanadium (V) oxide		EHW	B
FB043	Vinyl chloride	EHW	DH+	
FA001	Warfarin	EHW	A	
FB239	Xylene	EHW	CI	
FA121	Zinc cyanide		EHW	C
FA122	Zinc phosphide		EHW	BR

1.II MODERATELY HAZARDOUS/DANGEROUS CHEMICAL PRODUCTS

FB187	Acetamide, N-(4-ethoxyphenyl)-		DW	D+	
FB005	Acetamide, N-9H-fluoren-2-yl-		DW	?	
FB112	Acetic acid, ethyl ester		DW	DI	
FB214	Acetic acid, thallium (I) salt		DW	?	
FB002	Acetone	DW	DI		
FB004	Acetophenone		DW	D	
FB005	2-Acetylaminofluorene		DW	?	
FB150	Alanine, 3-[p-bis (2-chloroethl) amino] phenyl-, L-		DW	+	
FB328	2-Amino-1-methylbenzene		DW	D+	
FB353	4-Amino-1-methylbenzene		DW	D	
FB011	Amitrole	DW	D+		
FB014	Auramine	DW	+		
FB016	Benz[c] acridine		DW	+	
FB016	3, 4-Benzacridine		DW	+	
FB014	Benzenamine, 4, 4-carbonimidoylbis (N, N-dimethyl-		DW	+	
FB223	Benzenamine, 2-methyl-hydrochloride		DW	D+	
FB181	Benzonamine, 2-methyl-5-nitro		DW	D	
FB028	1, 2-Benzenedicarboxylic acid, [bis				

Hazardous (Dangerous) Waste No.	*Substance Designation*	*FEPA* Designation*	*Hazard Designation*	*Reason*	
	(2-ethyl-hexy)] ester		DW	?	
FB069	1, 2-Benzenedicarboxylic acid, dibutyl ester		DW	D	
FB088	1, 2-Benzenedicarboxylic acid, diethyl estser		DW	?	
FB102	1, 2-Benzenedicarboxylic acid, dimethyl ester		DW	?	
FB107	1, 2-Benzenedicarboxylic acid, di-n-octyl ester		DW	?	
FB203	Benzene, 1, 2-methylenedioxy-4-allyl-		DW	D+	
FB141	Benzene, 1, 2-methylenedioxy-4-propenyl-		DW		D+
FB090	Benzene, 1, 2-methylenedioxy-4-propyl-		DW	D+	
FB234	Benzene, 1, 3, 5-trinitro-		DW	DR	
FB202	1, 2-Benzisothiazolin-3-one, 1 1-dioxide, and salts	DW	+		
FB120	Benzo[j, k] fluoreno		DW		D
FB091	(1, 1'-Biphenyl)-4' diamine, 3, 3'-dimeth-oxy-		DW	D+	
FB244	Bis (dimethylthiocarbomoyl) disulfide		DW	D	
FB028	Bis (2-ethythoxyl) phthalate		DW		?
FB172	1-Butanamine, N-butyl-N-nitroso-		DW		D+
FB031	1-Butanol	DW	DI		
FB159	2-Butanone		DW	DI	
FB031	n-Butyl alcohol		DW	DI	
FB136	Cacodylic acid		DW	D	
FB238	Carbamic acid, ethyl ester		DW		+
FB215	Carbonic acid, dithallium (I) salt		DW	?	
FB051	Creocote	DW	D		
FB059	Daunomycin		DW	+	
FB221	Diaminotoluene		DW	?	
FB069	Dibutyl phthalate		DW	D	
FB192	3, 5-Dichloro-N-(1, 1-dimethyl-2-propynyl) benzamide		DW	?	
FB108	1, 4-Diethylene dioxide		DW	D+	
FB086	N,N-Diethylhydrazine		DW	+	
FB088	Diethyl phthalate		DW	?	
FB089	Diethylstilbestrol		DW	+	
FB148	1, 2-Dihydro-3-6-pyridizinedione		DW	D+	
FB090	Dihydrosafrole		DW	D+	
FB091	3, 3'-Dimethoxybensidine		DW	D+	
FB098	1, 1'-dimethylhydrazine		DW	+1	
FB101	2, 4-Dimethylphenol			DW	?
FB102	Dimethyl phthalate			DW	?
FB107	Di-n-octyl phthalate			DW	?
FB108	1, 4-Dioxane		DW	D+	
FB117	Ethane, 1, 1'-oxybis			DW	DI
FB218	Ethanethioamide		DW	+	
FB173	Ethanol, 2, 2-(nitrosoimino) bis-		DW	+	
FB004	Ethanone, l-phenyl-			DW	D
FB112	Ethyl acetate		DW	DI	
FB113	Ethyl acrylate	DW	DI		
FB238	Ethyl carbamate (urethan)			DW	+
FB116	Ethylene thiourea		DW	D+	

Hazardous (Dangerous) Waste No.	*Substance Designation*	*FEPA* Designation*	*Hazard Designation*	*Reason for Designation*	
FB117	Ethyl ether		DW	DI	
FB118	Ethyl methacrylate		DW		I
FB119	Ethyl methanesulphonate		DW	+	
FB139	Ferric dextran	DW	+		
FB120	Fluoranthene		DW	D	
FB123	Formic acid		DW	DO	
FB124	Furan	DW	I		
FB213	Furan, tetrahydro-		DW		I
FB124	Furfuran	DW	I		
FB206	D-Glucopyranose, 2-deoxy-2 (3-methyl-3-nitrosoureido)-		DW	+	
FB086	Hydraxine, 1, 2-diethyl-		DW	+	
FB098	Hydrazine, 1, 1-dimethyl-		DW	+I	
FB134	Hydrofluoric acid		DW	DO	
FB134	Hydrogen fluoride			DW	DO
FB136	Hydroxydimethylarsine oxide		DW	D	
FB116	2-Imidazolidinethione		DW	D+	
FB137	Indeno[1, 2, 3-cd] pyrene		DW	+	
FB139	Iron dextran		DW	+	
FB140	Isobutyl alcohol		DW	DI	
FB141	Isosafrole	DW	D+		
FB145	Lead phosphate		DW	+	
FB146	Lead subacetate		DW	+	
FB148	Maleic hydrazide		DW	D	
FB150	Melphalan	DW	+		
FB119	Methanesulphonic acid, ethyl ester		DW		+
FB123	Methanoic acid		DW	DO	
FB154	Methanol	DW	DI		
FB155	Methapyrilene		DW	D	
FB154	Methyl alcohol		DW	DI	
FB186	1-Methylbutadiene			DW	DI
FB159	Methyl ethyl ketone			DW	DI
FB161	Methyl isobutyl ketone		DW	DI	
FB162	Methyl methacrylate			DW	DI
FB161	4-Methyl-2-pentanone		DW	+	
FB164	Mewthylthiouracil			DW	+
FB059	5, 12-Naphthacenedione, (8S-cis)-8-acetyl-10-[(3-amino-2, 3, 6-trideoxy-alpha-l-lyxo-hexopyranosyl) oxyl]-7, 8, 9, 10-tetrahydro-6, 8, 11-trihydroxy-l-methoxy-		DW	+	
FB172	N-Nitrosodi-n-butylamine			DW	D+
FB173	N-Nitrosodiethanolamine		DW	+	
FB180	N-Nitrosopyrrolidine			DW	D+
FB181	5-Nitro-o-toluidine			DW	D
FB193	1, 2-Oxathiolane, 2, 2-dioxide		DW	+	
FB182	Paraldehyde		DW	DI	
FB186	1, 3-Pentadiene		DW	DI	

Hazardous (Dangerous) Waste No.	*Substance Designation*	*FEPA* Designation*	*Hazard Designation*	*Reason*	
FB187	Phenacetin		DW	D+	
FB101	Phenol, 2, 4-dimethyl-		DW	D	
FB137	1, 10-(1, 2-phenylene) pyrene		DW	+	
FB145	Phosphoric acid, Lead salt		DW		+
FB087	Phosphorodithioic acid, O,O-diethyl-S-methyl ester		DW	?	
FB192	Pronamide		DW	?	
FB193	1, 3-Propaane sultone		DW	+	
FB140	1-Propanol, 2-methyl-		DW	DI	
FB002	2-Propanone		DW	DI	
FB113	2-Propenoic acid, ethyl ester		DW	DI	
FB118	2-Propenoic acid, 2-methyl-, ethyl ester		DW	I	
FB162	2-Propenoic acid, 2-methyl-methyl ester		DW	DI	
FB155	Pyridine, 2- [(2-dimethylamino)-2-thenylamino		DW	D	
FB164	4 (IH)-Pyrimidinone, 2, 3-dihydro-6 methyl-2-thioxo-		DW	+	
FB180	Pyrrole, tetrahydro-N-nitroso-		DW	D+	
FB200	Reserpine	DW	?		
FB202	Saccharin and salts		DW		+
FB203	Safrole	DW	D+		
FB204	Seleniousacid		DW	O	
FB204	Selenium dioxide		DW	O	
FB205	Selenium disulude		DW	R	
FB089	4, 4'-Stilbenediol, alpha, alpha'-diethyl-		DW	+	
FB206	Streptozotocin	DW	+		
FB205	Sulphur selenide		DW	R	
FB213	Tetrahydrofuran		DW	I	
FB214	Thallium (I) acetate		DW		?
FB215	Thallium (I) carbonate		DW	?	
FB216	Thallium (I) chloride		DW	?	
FB217	Thallium (I) nitrate		DW		?
FB218	Thioacetamide		DW	+	
FB244	Thiran	DW	D		
FB221	Toluenediamine		DW	?	
FB328	o-Toluidine		DW	D+	
FB353	p-Toluidine		DW	D	
FB222	O-Toluidine hydrochloride		DW		D+
FB011	IH-1, 2, 4-Triazol-3-amine		DW		D+
FB234	sym-Trinitrobenzene		DW		DR
FB182	1, 3, 5-Trioxane, 2, 4, 5-trimethyl-	DW	DI		
FB200	Yohimban-16-carboxylic acid, 11, 17-di-methoxy-18-[3,4, 5-trimethoxy-benzoyl) oxy]-, methyl ester		DW		?

KEY

*EHW = Extremely Hazardous Waste

Hazardous (Dangerous) Waste No.	*Substance Designation*	*FEPA* Designation*	*Reason for Hazard Designation*

DW = Dangerous Waste
X = Toxic, Category X
A = Toxic, Category A
B = Toxic, Category B
C = Toxic, Category C
D = Toxic, Category D
H = Persistent, halogenated Hydrocarbon
O = Corrosive
P = Persistent, Polycyclic Aromatic Hydrocarbon
+ = IARC Animal or Human, Positive or Suspected Carcinogen
I = Ignitable
R = Reactive
EP = Extraction Procedure Toxicity
? = Inconclusive

Dangerous Waste No.	Sources
2.1.1 Generic	
FEF001	The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; and sludges from the recovery of these solvents in degreasing operations. (See footnote 1, below).
FEF002	The following spent halogenated solvents: Tetrachloroethylene, methylene chloride, trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, and trichlorofluoromethane; and the still bottoms from the recovery of these solvents. (See footnote 1, below).
FEF003	The following spent nonhalogenated solvents: Zylene, acetone, ethyl, acetate, ethylbenzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; and the still bottoms from the recovery of these solvents.
FEF004	The following spent nonhalogenated solvents: Cresols and crylic acid, nitrobenzene; and the still bottoms from the recovery of these solvents.
FEF005	The following spent nonhalogenated solvents: Toluene, methyl ethyl ketone, carbon disulphide, isobutanol, pyridine; and the still bottoms from the recovery of these solvents.
FEF006	Waste water treatment sludges from electro-plating operations except from the following processes: (1) Sulphuric acid anodizing of aluminium; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminium or zinc-aluminium plating on carbon steel; (5) cleaning/stripping associated with tin, zinc, and aluminium plating on carbon steel; and (6) chemical etching and milling of aluminium.
FEF019	Waste water treatment sludges from the chemical conversion coating of aluminium.
FEF007	Spent cyanide plating bath solutions from electroplating operations.

Dangerous Waste No.	*Sources*
FEF008	Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process.
FEF009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process.
FEF010	Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process.
FEF011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.
FEF012	Quenching waste water treatment sludges from metal heat-treating operations where cyanides are used in the process.
FEF020	Wastes (except waste water and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives. (This listing does not include wastes from the production of hexachlorophene from highly purified 2, 4 5-trichlorophenol.) (See footnote 2 below).
FEF021	Wastes (except waste water and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce its derivatives. (See footnote 2 below).
FEF022	Wastes (except waste water and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions. (See footnote 2, below).
FEF023	Wastes (except waste water and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- and tetrachlorophenols. (See footnote 2, below). (This listing does not include wastes from equipment used only for the production or use of hexachlorophene from highly purified 2, 4 5 trichlorophenol).
FEF026	Wastes (except waste water and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-penta- or hexachlorobenzene under alkaline conditions. (See footnote 2, below).
FEF027	Discarded unused formulations containing tri-, tetra- or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. (See footnote 2, below). (This listing does not include formulations containing hexachlorophene synthesized from prepurified 2, 4 5-trichlorophenol as the sole component).
FEF028	Residues resulting from the incineration or thermal treatment of soil contaminated with non-specific sources wastes FEF027.

Dangerous Waste No.	*Sources*

FEF024 Wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor cleanout wastes from the production of chlorinated aliphatic hydrocarbons, having carbon content form one to five, utilizing free radical catalysed processes. (See footnote 1, below) (This listing does not include light ends, spent filters and filter aids, spent dessicants, waste water, waste water treatment sludges, spent catalysts, and wastes listed under specific sources, below).

2.11 SPECIFIC SOURCES

2.11.1 Wood Preservation

FEK001 Bottom sediment sludge from the treatment of waste waters from wood preserving process that use creosote and/or pentachlorophenol. (See footnote 1, below).

2.11.2 Inorganic Pigments

FEK002 Waste water treatment sludge from the production of chrome yellow and orange pigments.

FEK003 Waste water treatment sludge from the production of molybdate orange pigments.

FEK004 Waste water treatment sludge from the production of zinc yellow pigments.

FEK005 Waste water treatment sludge from the production of chrome green pigments.

FEK006 Waste water treatment sludge from the production of chrome oxide green pigments (anhydrous and hydrated).

FEK007 Waste water treatment sludge from the production of iron blue pigments.

FEK008 Oven residue from the production of chrome oxide green pigments.

2.11.3 Organic Chemicals

FEK009 Distillation bottoms from the production of acetaldehyde from ethylene.

FEK010 Distillation side cuts from the production of acetaldehyde from ethylene.

FEK011 Bottom stream from the waste water stripper in the production of acrylonitrile.

FEK013 Bottom stream from the acetonitrile column in the production of acrylonitrile.

FEK 104 Bottoms from the acetonitrile purification column in the production of acrylonitrile.

FEK015 Still bottoms from the distillation of benzyl chloride. (See footnote 1, below).

FEK016 Heavy ends or distillation residues from the production of carbon tetrachloride. (See footnote 1, below).

FEK017 Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin. (See footnote 1 below).

Dangerous Waste No.	*Sources*
FEK018	Heavy ends from the fractionation column in ethyl chloride production (see footnote 1, below).
FEK019	Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production. (See footnote 1, below).
FEK020	Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production. (See footnote 1, below).
FEK021	Anqueous spent antimony catalyst waste from fluoromethanes production. (See footnote 1, below).
FEK022	Distillation bottom tars from the production of phenol/acetone from cumene.
FEK023	Distillation light ends from the production of phthalic anhydride from naphthalene.
FEK024	Distillation bottoms from the production of phthalic anhydride from naphthalene.
FEK093	Distillation light ends from the production of phthalic anhydride from ortho-xylene.
FEK094	Distillation bottoms from the production of phthalic anhydride from ortho-xylene.
FEK025	Distillation bottoms from the production of nitrobenzene by the nitration of benzene.
FEK026	Stripping still tails from the production of methyl ethyl pyridines.
FEK027	Centrifuge and distillation residues from toluene diisocyanate production.
FEK028	Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane. (See footnote 1, below).
FEK029	Waste from the product steam stripper in the production of 1,1,1-trichloroethane. (See footnote 1, below).
FEK095	Distillation bottoms from the production of 1,1,1-trichloroethane. (See footnote 1, below).
FEK096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane. (See footnote 1, below).
FEK030	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene. (See footnote 1, below).
FEK083	Distillation bottoms from aniline production.
FEK103	Process residues from aniline extraction from the production of aniline.
FEK104	Combined waste water streams generated from nitrobenzene/aniline production.
FEK085	Distillation of fractionation column bottoms from the production of chlorobenzenes. (See footnote 1, below).

Dangerous Waste No.	*Sources*

FEK105 Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes. (See footnote 1, below).

FEK111 Product wash waters from the production of dinistrotoluene via nitration of toluene.

FEK112 Reaction bye-product water from the drying column in the production of toluenediamine via hydrogenation of dinitrotoluene.

FEK113 Condensed liquid light ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.

FEK114 Vicinals from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.

FEK115 Heavy ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.

FEK116 Organic condensate from the solvent recovery column in the production of toluene diisocyanate via phosgenation of toluenediamine. (See footnote 1, below).

2.11.4 Explosives

FEK044 Waste water treatment sludges from the manufacturing and processing of explosives.

FEK045 Spent carbon from the treatment of waste water containing explosive.

FEK046 Waste water treatment sludges from the manufacturing formulation and loading of lead based initiating compounds.

FEK047 Pink/red water from TNT operations.

2.11.5 Inorganic Chemicals

FEK071 Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used.

FEK073 Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production (See footnote 1, below).

FEK106 Waste water treatment sludge from the mercury cell process in chlorine production.

2.11.6 Petroleum Refining

FEK048 Dissolved Air Flotation (DAF) float from the petroleum refining industry.

FEK049 Slop oil emulsion solids from the petroleum refining industry.

FEK050 Heat exchanger bundle cleaning sludge from the petroleum refining industry.

FEK051 API separator sludge from the petroleum refining industry.

Dangerous Waste No.	*Sources*

FEK052 Tank bottoms (leaded) from the petroleum refining industry.

2.11.7 Iron and Steel

FEK061 Emission Control dust/sludge from the primary production of steel on electric furnace.

FEK062 Spent pickle liquor generated by steel finishing operations of facilities within the iron and steel industry (SIC Codes 331 and 332).

2.11.8 Pesticides

FEK031 Bye-product salts generated in the production of MSMA and cacodylic acid.

FEK032 Waste water treatment sludge from the production of chlordane. (See footnote 3, below).

FEK033 Waste water and scrub water from the chlorination of cyclopentadiene in the production of chlordane. (See footnote 3, below).

FEK034 Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane. (See footnote 3, below).

FEK097 Vacuum stripper discharge from the chlordane. (See footnote 3, below).

FEK035 Waste water treatment sludges generated in the production of creosote.

FEK036 Still bottoms from toluene reclamation distillation in the production of disulphoton.

FEK037 Waste water treatment sludges from the production of disulphoton.

FEK038 Waste water from the washing and stripping of phorate production. (See footnote 3, below).

FEK039 Filter cake from the filtration of diethylphosphorodithioic acid in the production of phorate. (See footnote 3, below).

FEK040 Waste water treatment sludge from the production of phorate. (See footnote 3, below).

FEK041 Waste water treatment sludge from the production of toxaphene. (See footnote 3, below).

FEK098 Untreated process waste water from the production of toxaphene. (See footnote 3, below).

FEK042 Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2, 4 5-T. (See footnote 1, below).

FEK043 2, 6-Dichlorophenol waste from the production of 2, 4-D. (See footnote 1, below).

FEK099 Untreated waste water from the production of 2, 4-D. (See footnote 1, below).

FEK123 Process waste water (including supernates, filtrates, and waste waters) from the production of ethylenebisdithiocarbamic acid and its salts.

FEK124 Reactor vent scrubber water from the production of ethylenebisdithiocarbamic acid and its

Dangerous Waste No.	*Sources*

salts.

FEK125 Filtration, evaporation and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts.

FEK126 Baghouse dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts.

2.11.9 Secondary Lead

FEK069 Emission control dust/sludge from the secondary lead smelting.

FEK100 Waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting.

2.11.10 Veterinary Pharmaceuticals

FEK084 Waste water treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.

FEK101 Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.

FEK102 Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.

2.11.11 Ink Formulation

FEK086 Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead.

2.11.12 Coking

FEK060 Ammonia still-lime sludge from coking operations.

FEK087 Decanter tank tar sludge from coking operations.

Notes:

1. These wastes contain or may contain halogenated hydrocarbons. Although 1.2 states that these wastes are DW, special knowledge, requires generators who know that their waste contains greater than one per cent of these listed halogenated hydrocarbons to designate their waste EHW.

2. For wastes listed with the dangerous waste numbers FEF020, FEF021, FEF022, FEF023, FEF026, or FEF027 the quantity exclusion limit is 1 kg per month or per batch.

3. These wastes contain or may contain X Category toxic constituents. Although Section 1.2

Dangerous Waste No.	*Sources*

states that these wastes are DW, special knowledge, requires generators who know that their waste contains greater than 0.1 per cent of these listed toxic constituents to designate their waste EHW.

CHAPTER THREE

3. OTHER SOURCES

FEW001 Wastes generated from the salvaging, rebuilding, or discarding of transformers or capacitors which contain polychlorinated biphenyls (PCB).

Cooling and insulating fluids; cores, including core papers, from unrinsed transformers and capacitors; transformers and capacitors which will no longer be used for their intended use, except for those transformers or capacitors which have been rinsed; and, rinsate from the rinsing of transformers and capacitors.

Note: The rinsing of PCB containing items shall be conducted as following:

(a) the item is drained of all free flowing liquid;

(b) the item is filled with solvent and allowed to stand for at least eighteen hours;

(c) the item is drained thoroughly and the solvent is collected. Solvents may include kerosene, xylene, toluene and other solvents in which PCB are readily soluble.

CHAPTER FOUR

4. HAZARDOUS/DANGEROUS WASTE CONSTITUENTS LIST (FAC 000-000-9905)

Acetonitrile (Ethanenitrile)
Acetophonone (Ethanone, 1-phenyl)
-(alpha-Acetonylbenzyl)-4-hydroxycoumarin and salts (Warfarin)
2-Acetylaminofluorene (Acetemide, N-9H-fluoren-2-yl)-)
Acetyl chloride (Ethanoyl chloride)
1-Acetyl-2-thiorea (Acetamide, N-(aminothioxomethyl)-)
Acrolein (2-propenal)
Acrylamide (2-Propenamide)
Acrylonitrile (2-Propenenitrile)
Acrylonitrile (2-Propenenitrile)
Aflatoxins
Aldrin (1, 2, 3, 4, 10, 10-Hexachloro-1, 4, 4a, 5, 8, 8a, 8b- hexahydro-endo, exo-1, 4: 5,8-Dimethanonaphthalene)
Allyl alcohol (2-Propen-1-ol)
Aluminium phosphide
4-Aminobiphenyl ([1, 1,'-Biphenyl]-4-amine)
6-Amino-1, 1a, 2, 8, 8a, 8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5methyl-carbamatae azirino [2', 3' : 3, 4]pyrrolo[1,2-a]indole-4, 7-dione, (ester) (Mitomysin C)
(Azirino[2', 3' : 3, 4] pyrrolo (1, 2-a) indole-4, 7-dione,6-amino-8[

Barium and compounds, N.O.S.*
Barium cyanide
Benz [c] acridine (3, 4-Benzacridine)
Benz [a] anthracene (1, 2-Benzanthracene)
Benzene (Cyclohexatriene)
Benzenearsonic acid (Arsonic acid, phenyl-)
Benzene, 2-amino-1-methyl (o-Toluidine)
Benzene, 4-amino-1-methyl (p-Toluidine)
Benzene, dichloromethyl- (Benzal chloride)
Benzenethoil (Thiophenol)
Benzidine ([1, 1' -Biphenyl-4, 4' diamine)
Benzol [b] fluoranthene (2, 3-Benzofluoranthene)
Benzo [j] fluoranthene (7, 8-Benzofluoranthene)
Benzo [a] pyrene (3, 4-Benzophyrene)
p Benzoquinone (1, 4-Cyclohexadienedione)
Benzotrichloride (Benzene, trichloromethyl-)
Benzyl chloride (Benzene, chloromethyl)-
Beryllium and compounds, N.O.S.*
Bis (2-Chloroethyoxy) methane (Ethane, 1, 1½-[methylenebis (oxy)] bis [2-chloro-])
Bis (2-chloroethyl) ether (Ethane, 1, 1½-oxybis [2-chloro-])
N, N-Bis (2-chloroethyl)-2-napthylamine Chlornaphazine)
Bis (2-choroisoprophyl) ether (propane, 2, 2½-oxybis [2-chloro-])
Bis (chloromethyl) ether (Methane, oxybis [chloro-]
Bis (2-ethyhexyl) phthalate (1, 2-Benzenedicarboxylic acid, bis (2-ethylhexyl) ester)
Bromoacetone (2-Propanone, 1-bromo-)
Bromomethane (Methyl bromide)
4-Bromophenyl phenyl ether (Benzene, 1-bromo-4-phenoxy-)
Brucine (Strychnidin 10-one, 2, 3-dimethoxy-)
2-Butanone peroxide (Methyl ethyl ketone, peroxide)
Butyl benzyl phthalata (1, 2-Benzenedicarboxylic acid, butyl phenylmethyl ester)
2-sec-Butyl-4, 6-dinitrophenol (DNBP) (Phenol, 2, 4-dinitro-6-(1-methylpropyl)-)
Cadmium and compounds, N.O.S.*
Calcium chromate (Chromic acid, calcium salt)
Calcium cyanide
Carbon disulphide (Carbon bisulphide)
Carbon oxyfluoride (Carbonyl fluoride)
Chloral (Acetaldehyde, trichloro-)
Chlorambucil (Butanoic acid, 4-[bis (2-Chloroethyl) amino] benzene-)
Chlordane (alpha and gamma isomers) (4, 7-Methanoindan, 1, 2, 4, 5, 6, 7, 8, 8-octachloro-

3, 4, 7, 7a-tetrahydro-) (alpha and gamma isomers)
Chlorinated benzenes, N.O.S.*
Chlorinated ethane, N.O.S.*
Chlorinated fluorocarbons, N.O.S.*
Chlorinated naphthalene, N.O.S.*
Chlorinated phenol, N.O.S.*
Chloroacetaldehyde (Acetaldehyde, chloro-)
Chloroalkyl ethers, N.O.S.*
P-Chloroaniline (Benzenamine, 4-Chloro-)
Chlorobenzene (Benzene, chloro-)
Chlorobenzilate (Benzeneacetic acid, 4-chloro-alpha- (4-chlorophenyl)-alpha-hydroxy-, ethyl ester)
2-Chloro-1, 3-butadiene
p-Chloro-m-cresol (Phenol, 4-Chloro-3-methyl)
1-Chloro-2, 3-epoxypropane (Oxirane, 2-(chloromethyl)-)
2-Chloroethyl vinyl ether (Ethene, (2-chloroethoxy) -)
Chloroform (Methane, trichloro-)
Chloromathane (Methyl, chloride)
Chloromethyl methyl ether (methane, chloromethoxy-)
2-Chloronaphthalene (Napthalene, beta-chloro-)
2-Chlorophenol (Phenol, o-chloro-)
1-(o-Chlorophenyl) thiourea (Thiourea, (2-chlorophenyl) -)
3-Chloropropene
3-Chloropropionitrile (Propanenitrile, 3-chloro-)
Chromium and compounds, N.O.S.*
Chrysene (1,2-Benzphenanthrene)
Citrus red No. 2 (2-Naphthol, 1-[(2, 5-dimethoxyphenyl) azol]-)
Coal tars
Copper cyanide
Creosote (Creosote, wood)
Cresols (Cresylic acid) (Phenol, methyl-)
Crotonaldehyde (2-Butenal)
Cyanides (soluble salts and complexes), N.O.S.*
Cyanogen (Ethanedinitrile)
Cyanogen bromide (Bromine cyanide)
Cyanogen chloride (Chlorine cyanide)
Cycasin (beta-D-Glucopyranoside, (methyl-ONN-azoxy) methyl-)
2-Cyclohexyl-4-6-dinitrophenol (Phenol, 2-cyclohezyl-4, 6-dinitro-)
Cyclophosphamide (2H-1, 3, 2,-Oxazaphosphorine, [bis (2-chloroethyl) amino]-tetrahydro, 2-oxide)
Daunomycin (5, 12-Naphthacenedione, (8S-

cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy)-
alpha-L-lyxo-hexopyranosyl) oxy]-7, 8, 9, 10-tetrahydro-6, 8, 11-trihydroxy-1-methoxy-)
DDD (Dichlorodiphenyldichloroethane)
(Ethane, 1, 1-dichloro-2, 2-bis (p-
chlorophenyl)-)
DDE (Ethylene, 1, 1-dichloro-2, 2-bis (4-chlorophenyl)-)
DDT (Dichlorodiphenyltrichloroethane)
(Ethane, 1, 1, 1-trichloro-2-2 bis (p-
chlorophenyl)-)
Diallate (S-(2, 3-dichloroallyl)
diisopropylthiocarbamate)
Dibenz [a,h] acridine (1, 2, 5, 6-Dibenzacridine)
Dibenz [a,j] acridine (1, 2, 7, 8-Dibenzacridine)
Dibenz [a,h] anthracene (1, 2, 5, 6-
Dibenzanthracene)
7-H-Dibenzl [c,g] carbazole (3, 4, 5, 6-
Dibenzcarbazole)
Dibenzo [a,e] pyrene (1, 2, 4, 5-Dibenzpyrene)
Dibenzo [a,h,] pyrene (1,2,5,6-Dibenzpyrene)
Dibenzo [a,i] pyrene (1, 2, 7, 8-Dibenzpyrene)
1, 2-Dibromo-3-choropropane (Propane, 1, 2-
dibromo-3-chloro-)
1,2-Dibromoethane (Ethylene dibromide)
Dibromomethane (Methylene bromide)
Di-n-butyl phthalate (1, 2-Benzenedicarboxylic
acid, dibutyl ester)
o-Dichlorobenzene (Benzene, 1, 2-dichloro-)
m-Dichlorobenzene (Benzene, 1, 3-dichloro-)
p-Dichlorobenzene (Benzene, 1, 4-dichloro-)
Dichlorobenzene, N.O.S.* (Benzene,
dichloro-, N.O.S*
3, 3' -Dichlorobenzidine ([1, 1' -Bephenyl]-4, 4' -
diamine, 3, 3' -dichloro-)
1, 4-Dichloro-2-butene (2-Butene, 1, 4-Butene, 1, 4-
dichloro-)
Dichlorodifluoromethane (Methane,
dichlorodifluoro-)
1, 1-Dichloroethane (Ethylidene dichloride)
1, 2-Dichloroethane (Ethylene dichloride)
trans-1, 2-Dichloroethene (1, 2-
Dichloroethylene)
Dichloroethylene, N.O.S.* (Ethene, dichloro-,
N.O.S.*
1, 1-Dichloroethylene (Ethene, 1, 1-dichloro-)
Dichloromethane (Methylene chloride)
2, 4-Dichlorophenol (Phenol, 2, 4-dichloro-)
2, 6-Dichlorophenol (Phenol, 2, 6-dichloro
2, 4-Dichlorophenoxyacetic acid (2, 4-D), salts
and esters (Acetic acid, 2, 4-
dichlorophenoxy-, salts and esters)
Dichlorophenylarsine (Phenyl dichloroarsine)
Dichloropropane, N.O.S.* (Propane, dichloro-,
N.O.S.*)
1, 2-Dichloropropene (Propylene dichloride)

Dichloropropanol, N.O.S.* (Propanol, dichloro-, N.O.S.*)
Dichloropropene, N.O.S.* (Propene, dichloro-, N.O.S.*)
1, 3-Dichloropropene, (1-Propene, 1, 3-dichloro-)
Dieldrine (1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octa-hydro-endo, exo-1, 4 : 5, 8-Dimethanonaphthalene)
1, 2 : 3, 4-Diepoxybutane (2, 2½-Bioxirane)
Diethylarsine (Arsine, diethyl-)
N, N-Diethyhlydrazine, 1, 2-diethyl)
O, O-Diethyl S-methyl ester of phosphorodithioic acid (Phosphorodithioic acid, O, O-diethyl S-methyl ester O, O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosphoric acid, diethyl p-nitrophenyl ester)
Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)
O, O-Diethyl O-2-pyraxinyl phosphorothioate (Phosphorothioic acid, O, O-diethyl O-pyrazinyl ester
Diethylstilbesterol (4, 4' -Stilbenediol, alpha, alpha-diethyl, bis (dihydrogen phosphate, (E)-)
Dihydrosafrole (Benzene, 1,2-methylenedioxy-4-propyl-)
3,4-Dihydroxy-alpha-(methylamino) methyl benzyl alcohol (1, 2-benzenediol, 4-[1-hydroxy-2-(methylamino) ethyl]-)
Diisopropylfluorophosphate (DFP) (Phosphorofluoridic acid, bis (l-methylethyl) ester)
Dimethoate (Phosphorodithiotic acid, O, O-dimethyl S-[2-methylamino)-2oxoethyl] ester
3, 3½-Dimethoxybenzidine/]1, 1½-Biphenyl]-4, 4½dimamine, 3-3 dimethoxy-)
p-Dimethylaminoazobenzene (Benzenamine, N,N-dimethyl-4-(phenylazo)-)
7,12-Dimethylbenz [a] anthracene (1, 2-Benzanthracene, 7, 12--dimethyl-)
3, 3½ Dimethylbenzidine ([1, 1½-Biphenyl]-4, 4½-diamine, 3, 3½-dimethyl-)
Dimethylcarbamoyl Chloride (Carbamoyl] chloride, dimethyl-)
1, 1-Dimethylhydrazine (Hydrazine, 1,1-dimethyl-)
1, 2-Dimethylhydrazine (Hydrazine, 1, 2-dimethyl-)
3, 3-Dimethyl-(methylthio)-2-butanone, O-[(methylamino) carbonyl]oxime (Thiofanox)

alpha, alpha-Dimethylphenethylamine] (Ethanamine, 1, 1-dimethyl-2-phenyl)
2, 4-Dimethylphenol (Phenol, 2, 4-dimethyl-)
Dimethyl phthalate (1, 2-Benzenedicarboxylic, acid, dimethyl ester)
Dimethyl sulfate (Sulphuric acid, dimethyl ester)
Dinitrobenzene, N.O.S.* (Benzene, dinitro-, N.O.S*
4, 6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6--methyl-, and salts)
2, 4-Dinitro-o-cresol and salts (Phenol, 2, 4-dinitro-)
2, 4-Dinitrotoluene (Benezene, l-methyl-2-4-dinitro-)
2, 6-Dinitrotoluence (Benzene, l-methyl -2, 6-dinitro-)
Di-n-octyl phthalate (1, 2-Benzenedicarbozylic] acid, Dioctyl ester)
1, 4-Dioxane (1, 4-Diethylene oxide)
Diphenylamine (Benzenamine, N-Phenyl-)
1, 2-Diphenylhydrazine (Hydrazine, 1,2-diphendyl-)
Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)
Disulphoton (O, O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate)
2, 4-Dithiobiuret (Thioimidodicarbonic diaminde)
Endosulphan (5-Norbornene, 2, 3-dimethanol, 1, 4, 5, 6, 7, 7-hexachloro-, cyclic sulphite)
Endrin and metabolites (1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-endo, endo-1, 4 : 5, 8-dimethanonaphthalene, and metabolites)
Ethyl carbamate (Urethan) Carbamic acid, ethyl ester)
Ethyl cyanide (propanenitrile)
Ethylenebisdithiocarbamic acid, salts and esters (1, 2-Ethanediylbiscarbamodithioic acid, salts and esters.
Ethyleneimine (Aziridine)
Ethylene oxide (Oxirane)
Ethylenethiourea (2-Imidazo-hidinethione)
Ethylmethacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)
Ethylmethanesulphonate (Methanesulphonic acid, ethyl ester)
Fluoranthene (Benzo [j, k] fluorene)
Fluorine
2-Fluoroacetamide (Acetamide, 2-fluoro-)
Fluoroactic acid, sodium salt (Acetic acid, fluorine, sodium salt)
Formaldehyde (Methylene, oxide)

Formic acid (Methanoic acid)
Glycidylaldehyde (1-Propanol-2-3-epoxy)
Halomethane, N.O.S.*
Heptachlor (4, 7-methano-lH-indene, 1, 4, 5, 6, 7 8, 8-heptachloro-3a, 4, 7, 7a-tetrahydro-)
Heptachlor epoxide (alpha, beta, and gamma isomers) (4, 7-Methano-1H-indene, 1, 4, 5, 6, 7, 8, 8-heptachloro-2, 3-epoxy-3a, 4, 7, 7-tetrachydro-, alpha, beta, and gamma isomers
Hexachlorobenzene (Benzene, hexachloro-)
Hexachlorobutadiene (1, 3-Butadiene, 1, 1, 2, 3, 4, 4-hexachloro-)
Hexachlorocyclohexane (all isomers) (Lindane and isomers)
Hexachlorocylopentadiene (1, 3-Cyclopentadiene, 1, 2, 3, 4, 5, 5-hexachloro-)
Hexachlorodibenzo-p-dioxins
Hexachloroethane (Ethane, 1, 1, 1, 2, 2, 2-hexachloro-)
1, 2, 3, 4, 10, 10-Hexachloro-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4: 5, 8-endo, endo-dimethanonaphthalene (Hexachlorohexahydro-endo, endo-dimethanonaphthalene)
Hexachlorophene (2, 2'-Methylenebis (3, 4, 6-trichlorophenol))
Hexachloropropene (1-Propene, 1, 1, 2, 3, 3, 3,-hexachloro-)
Hexaethyl tetraphosphate (Tetraphosphoric acid, hexaethyl ester)
Hydrazine (Diamine)
Hydrazine (Diamine)
Hydrocyanic acid (Hydrogen cyanide)
Hydrophluoric acid (Hydrogen fluoride)
Hydrogen suphide (Sulphur hydride)
Hydroxydimethylarsine oxide (Cacodylic acid)
Indeno (1, 2, 3-cd) pyrene (1, 10-(1, 2-phenylene) pyrene)
Iodomethane (methyl iodide)
Iron Dextran (Ferric dextran)
Isocyanic acid, methyl ester (Methyl isocyanate)
Isobutyl alcohol (1-Propanol, 2-methyl-)
Isosafrole (Benzene, 1, 2-methylenedioxy-4-allyl-)
Kepone (Decachlorooctahydro-1, 3, 4,-Methano-2H-Cyclobuta[cd]pentalen-2-one)
Lasiocarpine (2-Butenoic acid, 2-methyl-, 7-[(2, 3-dihydroxy-2-(1-methoxyethyl)-3 methyl-l-oxobutoxy) methyl]-2, 3, 5, 7a-tetrahydro-1H-pyrolizin-1-yl ester)
Lead and compounds, N.O.S.*

Lead acetate (Acetic acid, lead salt)
Lead phosphate (Phosphoric acid, lead salt)
Lead subacetate (Lead, bis (acetato-O) tetrahydroxytri-)
Maleic anhydride (2, 5-Furandione)
Maleic hydrazide (1, 2-Dihydro-3, 6-pyridazinedione)
Malononitrile (Propanedinitrile)
Melphalan (Alanine, 3-[p-bis (2-chloroethyl) amino] phenyl-, L-)
Mercury Fulminate (Fulminic acid, mercury salt)
Mercury and compounds, N.O.S.*
Methacrylonitrile (2-Propenenitrile, 2-methyl-)
Methanethiol (Thiomethanol)
Methapyrilene (Pyridine, 2-[2-dimethylamino) ethyl]-2-thenylamino-)
Metholonyl (Acetimidic acid, N-[(methylcarbamoyl) oxy] thio-, methyl ester
Methoxychior (Ethane, 1, 1, 1-trichloro-2, 2'-bis (p-methoxyphenyl)-)
2-Methylaziridine (1, 2-Propylenimine)
3-Methylcholanthrene (Benz [j] aceanthrylene, 1, 2-dihydro-3-methyl-)
Methyl chlorocarbonate (Carbonochloridic acid, methyl ester)
4, 4'-Methylenebis (2-chloroaniline) (Benzenamine, 4, 4'-methylenebis-(2-chloro-)
Methyl ethyl ketone (MEK) (2-Butanone)
Methyl hydrazine (Hydrazine, methyl-)
2-Methyllactonitrile (Propanenitrile, 2-hydroxy-2-methyl-)
Methyl methacrylate (2-Propenoic acid, 2-methyl-, methyl ester)
Methyl methanesulphonate (Methanesulphonic acid, methyl ester)
2-Methyl-2-(methylthio) propionaldehyde-o-(methycarbonyl) oxime (Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino) carbonyl] oxime)
N-Methyl-N' -nitro-N-nitrosoguanidine (Guanidine, N-nitros-N-methyl-N½ nitro-)
Methyl parathion (O, O-dimethyl O-(4-nitrophenyl) phosphorothioate)
Methylthiouracil (4-1H-Pyrimidinone, 2, 3-dihydro-6-methyl-2-thioxo-)
Mustard gas (Sulphide, bis (2-chloroethyl)-)
Naphthalene
1, 4-Naphthoquinone (1, 4-Naphthalenedione)
1-Naphthylamine (alpha-Naphthylamine)
2-Naphthylamine (beta-Naphthylamine)
1-Naphthyl 2-thiourea (Thiourea, 1-naphthalenyl-)
Nickel and compounds, N.O.S.*
Nickel carbonyl (Nickel tetracarbonyl)

Nickel cyanide (nickel (II) cyanide)
Nicotine and salts, Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)
Nitric oxide (Nitrogen (II) oxide)
p-Nitroaniline Benzenamine, 4-nitro-)
Nitrobenzine (Benzene, nitro-)
Nitrogen dioxide (Nitrogen (IV) oxide)
Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)
Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)
Nitroglycerine (1, 2, 3-Propanetriol, trinitrate)
4-Nitrohenol (Phenol, 4-dinitro-)
4-Nitroquinoline-1-oxide (Quinoline, 4-nitro-1-oxide)
Nitrosamine, N.O.S.*
N-Nitrosodi-n-butylamine (1-Butanamine, N-butyl-N-nitroso-)
N-Nitrosodiethanolamine (Ethanol, 2, 2'-(nitrosoimino) bis-)
N-Nitrosodiethylamine (Ethanamine, N-Ethyl-N-nitroso-)
N-Nitrosodimethylamine (Dimethylnitrosamine)
N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)
N-Nitrosodimethylamine (Dimethylnitrosamine)
N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)
N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)
N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)
N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)
N-Nitrosomethyl-virylamine (Ethenamine, N-methyl-N-nitroso)
N-Nitrosomorpholine (Morpholine, N-nitroso-)
N-Nitrosonornicotine (Nornicotine, N-nitroso-)
N-Nitrosopiperidine (Pyridine, hexahydro-, N-nitroso-)
Nitrosopyrrolidine (Pyrrole, tetrahydro-, N-nitroso-)
Nitrosopyrrolidine (pyrrole, tetrahydro-, N-nitroso-
N-Nitrososacrosine (Sarcosine, N-nitroso-)
5-Nitro-o-toludine (Benzenamine, 2-methyl-5-nitro-)
Octamethylpyrophosphoramide (Diphosphoramide, octamethyl-)
Osmium tetroxide (Osmium (VIII) oxide)

7-Ocabicyclo [2, 2, 1] heptane-2, 3-dicarbonxylic acid (Enodothal)
Paraldehyde (1, 3, 5-Trioxane, 2, 4, 6- triethyl-)
Parathion (Phosphorothioic acid, O, O-diethyl O-(P-nitrophenyl ester
Pentachlorobenzene (Benzene, pentachloro-)
Pentachlorodibenzo-p-dioxins
Pentachlorodibenzofurans
Pentachloroethane (Ethane, pentachloro-)
Pentachloronitrobenzene (PCNB) (Benzene, pentachloronitro-)
Pentachlorophenol (Phenol, pentachloro-)
Phenacetin (Acetamide, N-(4-ethoxyphenyl)-)
Phenol (Benzene, hydroxy-)
Phenylenediamine (Benzenediamine)
Phenylmercury acetate (Mercury, acetatophenyl-)
N-Phenylthiourea (Thiourea, phenyl-)
Phosgene (Carbonyl chloride)
Phosphine (Hydrogen phosphide)
Phosphrodichioic acid, O, O-diethyl S-[(ethylthio) methyl] ester (Phorate)
Phosphorothioic acid, O, O-dimethyl O-[P-(dimethlamino)sulphonyl) phenyl] ester
(camphur)
Phthalic acid esters, N.O.S* (Benzene, 1,2-dicarboxylic acid, esters, N.O.S.*
Phthalic anhydride (1, 2-Benzenedicarboxylic acid anhydride)
2-Picoline (Pyridine, 2-methyl-)
Polychlorinated biphenyl, N,O.S.*
Potassium cyanide
Potassium silver cyanide (Argentate (1-), dicyano-, potassium)
Pronamide (3, 5-Dichloro-N-(1, 1-dimethyl-2-propynyl) benzamide)
1, 3-Propanesultone (1, 2-Oxathiolane, 2, 2-dioxide)
n-Propylamine (1-Propane)
Propylthiouracil (Undecamethylenediamine,
N, N½-bis (2-chlorobenzyl)-, dihydrochloride)
2-Propyn-l-ol (Progargyl alcohol)
Pyridine
Reserpine (Yohimban-16-carboxylic acid, 11, 17-dimethoxy-18-[(3, 4, 5-trimethoxybenxoyl)oxy]-, methyl ester)
Resorcinol (1, 3-benzenediol)
Saccharin and salts (1, 2-Benzoisothiazolin-3-one, 1, 1-dioxide, and salts)
Safrol (Benzene, 1, 2-methylenedioxy-4-allyl-)
Selenious acid (Selenium dioxide)
Selenium and compounds, N.O.S.*
Selenium sulphide (Sulphur selenide)
Selenourea (Carbamimidoselenoic acid)

Silver and compounds N.O.S.*
Silver cyanide
Sodium cyanide
Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)
Strontium sulphide
Strychnine and salts (Strychnidin-10-one, and salts)
1, 2, 4, 5-Tetrachlorobenzene (Benzene, 1, 2, 4, 5-tetrachloro-)
Tetrachlorodibenzo-p-dioxins
Tetrachlorodibenzofurans
2, 3, 7, 8-Tetrachlorodibenzo-p-dioxin (TCDD) Dibenzo-p-dioxin, 2, 3, 7, 8-tetrachloro-)
Tetrachloroethane, N.O.S.* (Ethane, Tetrachloro-, N.O.S.*)
1, 1, 1, 2-Tetrachlorethane (Ethane, 1, 1, 1, 2 tetrachloro-)
Tetrachlorethylene (Ethane, 1, 1, 2, 2-tetrachloro-)
Tetrachloromethane (Carbon tetrachloride)
2, 3, 4, 6-Tetrachlorophenol (Phenol, 2, 3, 4, 6-tetrachloro-)
Tetraethyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethyl-ester)
Tetraethyl lead (Plumbane, tetraethyl-)
Tetraethylpyrophosphate (Pyrophosphoric acid, tetraethyl ester)
Tetranitromethane (Methane, tetranitro-)
Thallium and compounds, N.O.S.*
Thallic oxide (Thallium (III) oxide)
Thallium (I) acetate (Acetic acid, thallium (I) salt)
Thallium (I) carbonate (Carbonic acid, dithallium (I) salt)
Thallim (I) chloride
Thallium (I) nitrate (Nitric acid, thallium (I) salt)
Thallium selenite
Thallium (I) sulphate (Sulphuric acid, thallium (I) salt)
Thioacetamide (Ethanethioamide)
Thiosemicarbazide (Hydrazinecarbothioamide)
Thiourea (Carbamide thio-)
Thiuram (Bis (dimethylthioucarbamoyl) disulphide)
Toluene (Benzene, methyl-)
Toluenediamine, N.O.S. (Diaminotoluene)
2, 4-Toluenediamine
2, 6-Toluenediamine
3, 4-Toluenediamine
o-Toluidine hydrochloride (Benzanamine, 2-methyl-, hydrochloride)

Tolylene diisocyanate (Benzene, 1, 3-diisocyanatomethyl-)
Toxaphene (Camphene, octachloro-)
Tribromomethane (Bromoform)
1, 2, 4-Trichlorobenzene (Benzene, 1, 2, 4-trichloro-)
1, 1, 1-Trichloroethane (Methyl chloroform)
1, 1, 2-Trichloroethane (Ethane, 1, 1, 2-trichloro-)
Trichloroethane (Trichloroethylene)
Trichloromethanethiol (Methanethiol, trichloro-)
Trichloromonofluoromethane (Methane, trichlorofluoro-)
2, 4, 5-Trichlorophenol (Phenol, 2, 4, 5-trichloro-)
2, 4, 6-Trichlorophenol (Phenol, 2, 4, 6-trichloro-)
2, 4, 5-Trichlorophenoxyacetic acid (2, 4, 5-T) Acetic acid, 2, 4 5-trichlorophenoxy-)
2, 4, 5-Trichlorophenoxyacetic acid (2, 4, 5-TP) (Silvex) (Porpionoic acid, 2-(2, 4, 5-trichlorophenoxyl)-)
Trichloropropane, N.O.S.* (Propane, trichloro-, N.O.S.*
1, 2, 3-Trichloropropane (Propane, 1, 2, 3-trichloro-)
O, O, O-Triethyl phosphorothioate (Phosphorothioic acid, O, O, O-triethyl ester)
Sym-Trinitrobenzene (Benzene, 1, 3, 5-trinitro-)
Tris (l-aziridinyl) phosphine sulphide (Phosphine sulphide, tris (l-ariridinlyl-)
Tris (2, 3-dibromopropyl) phosphate (l-Propanol, 2, 3-dibromo-, phosphate)
Trypan blue (2, 7-Naphathalenedisulfonic acid, 3, 3' -[3, 3' -dimethyl (1, 1' -biphenyl)-4, 4'-diyl) bis (azo)] bis (5-amino-4-hydroxy-, tetrasodium salt)
Uracil mustard (Uracil 5-[bis (2-chlorethyl) amino]-)
Vanadic acid, ammonium salt (ammonium vanadate)
Vanadium pentoxide (Vanadium V) oxide)
Vinyl chloride (Ethane, chloro-)
Zinc cyanide
Zinc phosphide

*The abbreviation N.O.S. signifies those members of general class "not otherwise specified" by name in listing.

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PART IV

GLOSSARY OF ENVIRONMENTAL TERMS

GLOSSARY OF TERMS

A

Abandoned Well: A well whose use has been permanently discontinued or which is in a state of disrepair such that it cannot be used for its intended purpose.

Abatement: Reducing the degree or intensity of, or eliminating, pollution.

Absorption: The passage of one substance into or through another, e.g., an operation in which one or more sosuble components of a gas mixture are dissolved in a liquid.

Accelerator: In radiation science, a device that speeds up charged particles such as electrons or protons.

Accident site: the location of an unexpected occurrence, failure or loss, either at a plant or along a transportation route, resulting in a release of hazardous materials.

Acclimatization: the physiological and behavioural adjustments of an organism to changes in its environment.

Acetylcholine: A substance in the human body having important neurotransmitter effects on various internal systems; often used as a bronchoconstrictor.

Acid Deposition: A complex chemical and atmospheric phenomenon that occurs when emissions of sulfur and nitrogen compounds and other substances are transformed by chemical processes in the atmosphere, often far from the original sources, and then deposited on earth in either a wet or dry form. The wet forms, popularly called "acid rain", can fall as rain, snow, or fog. The dry forms are acidic gases or particulates.

Acid Rain: (See acid deposition).

Activated carbon: A highly adsorbent form of carbon used to remove odors and toxic substances from liquid or gaseous emissions. In waste treatment it is used to remove dissolved organic matter from waste water. It is also used in motor vehicle evaporative control systems.

Activated sludge: Sludge that results when primary effluent is mixed with bacteria-laden sludge and then agitated and aerated to promote biological treatment. This speeds breakdown of organic matter in raw sewage undergoing secondary waste treatment.

Active Ingredient: In any pesticide product, the component which kills, or otherwise controls, target pests. Pesticides are regulated primarily on the basis of active ingredients.

Active Life of facility: The period from the initial receipt of dangerous waste at a facility until FEPA issues a certificate of final closure.

Acute Exposure: A single exposure to a toxic substance which results in severe biological harm or death. Acute exposures are usually characterized as lasting no longer than a day.

Acute Toxicity: The ability of a substance to cause poisonous effects resulting in severe biological harm or death soon after a single exposure or dose. Also, any severe poisonous effect resulting from a single short-term exposure to a toxic substance. (See: chronic toxicity, toxicity).

Acutely Hazardous Waste: Dangerous waste sources (listed in FAC 173-303-9904 FO20, F022,

F023, F026, or F027, and discarded Chemical Products (listed in FAC 173-303-9903) that are identified with a dangerous waste number beginning with a "P" or that shows an "X" or "A" in the reason for designation column.

Adaptation: Changes in an organism's structure or habit that help it adjust to its surroundings.

Add-on Control Device: An air pollution control device such as carbon absorber or incinerator which reduces the pollution in an exhaust gas. The control device usually does not affect the process being controlled and thus is "add-on" technology as opposed to a scheme to control pollution through making some alteration to the basic process.

Adhesion: Molecular attraction which holds the surfaces of two substances in contract.

Adsorption 1: Adhesion of molecules of gas, liquid, or dissolved solids to a surface. 2. An advanced method of treating wastes in which activated carbon removes organic matter from waste water.

Adulterants: Chemical impurities or substances that by law do not belong in a food, or in a pesticide.

Advanced Waste Water Treatment: Any treatment of sewage that goes beyond the secondary or biological water treatment stage and includes the removal or nutrients such as phosphorus and nitrogen and a high percentage of suspended solids. (See primary, secondary treatment).

Advisory: A non-regulatory document that communicates risk information to persons who may have to make risk management decisions.

Aeration: A process which promotes biological degradation of organic water. The process may be passive (as when waste is exposed to air), or active (as when a mixing or bubbling device introduces the air).

Aerobic: Life or processes that require, or rare not destroyed by, the presence of oxygen (See anaerobic).

Aerobic Treatment: Process by which microbes decompose complex organic compounds in the presence of oxygen and use the liberated energy for reproduction and growth. Types of aerobic processes include extended aeration, trickling filtration, and rotating biological contractors.

Aerosol: A suspension of liquid or solid particles in a gas.

Afterburner: In incinerator technology, a burner located so that the combustion gases are made to pass through its flame in order to remove smoke and odours. It may be attached to or be separated from the incinerator proper.

Agent Orange: A toxic herbicide and defoliant which was used in the Vietnam conflict. It contains 2, 4, 5-trichlorophenoxyacetic acid (2, 4, 5-T) and 2-A dichlorophonoxyacetic acid (2, 4-D) with trace amounts of dioxin.

Agglomeration: The process by which precipitation particiles grow larger by collision or contract with cloud particles or other precipitation particles.

Agglutination: The process of uniting solid particles coated with a thin layer of adhesive material or of arresting solid particles by impact on a surface coated with an adhesive.

Agricultural Pollution: The liquid and solid wastes from farming, including: runoff and leaching of

pesticides and fertilizers, erosion and dust from plowing, animal manure and carcasses, crop residues, and debris.

Airborne Particulates: Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Airborne particulates include: wind blown dust, emissions from industrial processes, smoke from the burning of wood and coal, and the exhaust of motor vehicles.

Airborne Release: Release of any chemical into the air.

Air Changes Per Hour (ACH): The movement of a volume of air in a given period of time; if a house has one air change per hour, it means that all of the air in the house will be placed in a one-hour period.

Air Contaminant: Any particulate matter, gas or combination thereof, other than water vapour of natural air. (See air pollutant).

Air Curtain: A method of containing oil spills. Air bubbling through a perforated pipe causes an upward water flow that slows the spread of oil. It can also be used to stop fish from entering polluted water.

Air Mass: A widespread body of air that gains certain meteorological or polluted characteristics - e.g., a heat inversion or smogginess while set in one location. The characteristics can change as it moves away.

Air Monitoring: (See monitoring)

Air Pollutant: Any substance in air which could, if in high enough concentration, harm man, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of matter capable of being airborne. They may be in the form of solid particles, liquid droplets, gases, or airborne. They may be in the form of solid particles, liquid droplets, gases, or in combinations of these forms. Generally, they fall into two main groups: (1) those emitted directly from identifiable sources and (2) those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents, with or without photoactivation. Exclusive of pollen, fog, and dust, which are of natural origin, about 100 contaminants have been identified and fall into the following categories: solids, sulfur compounds, volatile organic chemicals, nitrogen compounds, oxygen compounds halogen compounds, radioactive compounds, and odors.

Air Pollution: The presence of contaminant or pollutant substances in the air that do not disperse properly and interfere with human health or welfare, or produce other harmful environmental effects.

Air Pollution Episode: A period of abnormally high concentration of air pollutants, often due to low winds and temperature inversion, that can cause illness and death. (See: episode, pollution).

Air Quality Control Region: An area-designated by the federal government - in which communities share a common air pollution problem. Sometimes several states are involved.

Air Quality Criteria: The levels of pollution and lengths of exposure above which adverse health and welfare effects may occur.

Air Quality Standards: The level of pollutants prescribed by regulations that may not be exceeded during a specified time in a defined area.

Alachlor: A herbicide, marketed under the trade name Lasso, used mainly to control weeds in corn

and soybean fields.

Alar: Trade name for daminozide, a pesticide that makes apples redder, firmer, and less likely to drop off trees before growers are ready to pick them. It is made from ethyl isocyanate.

Algae: Simple rootless plants that grow sunlit waters in relative proportion to the amounts of nutrients available. They can affect water quality adversely by lowering the dissolved oxygen in water, they are food for fish and small aquatic animals.

Algal Blooms: Sudden spurts of algal growth, which can affect water quality adversely and indicate potentially hazardous changes in local water chemistry.

Alpha Particle: A positively charged particle composed of 2 neutrons and 2 protons released by some atoms undergoing radioactive decay. The particle is identical to the nucleus of a helium atom.

Alternate Method: Any method of sampling and analyzing for an air pollutant which is not a reference or equivalent method but which has been demonstrated in specific cases to FEPA's satisfaction to produce results adequate for compliance.

Ambient Air: Any unconfined portion of the atmosphere: open air, surrounding air.

Ambient Air Quality Standards: (See: Criteria Pollutants and National Ambient Air Quality Standards).

Anadromous: Fish that spend their adult life in the sea but swim upriver to fresh-water spawning grounds to reproduce.

Anaerobic: A life or process that occurs in, or is not destroyed by, the absence of oxygen.

Antagonism: The interaction of two chemicals having opposing, or neutralizing effect on each other, or - given some specific biological effect - a chemical interaction that appears to have an opposing or neutralizing effect over what might otherwise be expected.

Antibodies: Proteins produced in the body by immune system cells in response to antigens, and capable of combining with antigens.

Anti-Degradation Clause: Part of FEPA air quality and water quality requirements prohibiting deterioration where pollution levels are above the legal limit.

Antigen: A substance that causes production of antibodies when introduced into animal or human tissue.

APHA: American Public Health Association.

Aquatic LC50: (same as TL 96). A concentration in my/l (ppm) which kills in 96 hours half of a group of ten or more of a medium sensitivity warm water species fo fish such as Lepomis macrochirus (bluegill) or Pimephales promelas (flathead minnow), or cold water species such as salmonidae, when using the testing method described in subsection 1.8.1.

API: American Petroleum Institute.

Aquifer: An underground geological formation, or group of formations containing usable amounts of groundwater that can supply wells and springs.

Arbitration: A process for the resolution of disputes. Decisions are made by an impartial arbitrator selected by the parties. These decisions are usually legally binding. (See: mediation).

Area Source: Any small source of non-natural air pollution that is released over a relatively small area but which cannot be classified as a point source. Such sources may include vehicles and other small fuel combustion engines.

Asbestos: A mineral fiber that can pollute air or water and cause cancer or asbestosis when inhaled. FEPA has banned or severely restricted its use in manufacturing and construction.

Asbestos containing waste material: Any waste that contains more than one per cent asbestos by weight and that can be crumbled, pulverized, or reduced to powder when dry, by hand pressure.

Asbestosis: A disease associated with chronic exposure to an inhalation of asbestos fibers. The disease makes breathing progressively more difficult and can lead to death.

A-Scale Sound Level: A measurement of sound approximating the sensitivity of the human ear, used to note the intensity or annoyance of sounds.

Assimilation: The ability of a body of water to purify itself of pollutants.

ASTM: American Society of Testing and Materials.

Atmosphere (atm): A standard unit of pressure representing the pressure exerted by a 29.92-inch column of mercury at sea level at 45' latitude and equal to 1,000 grams per square centimeter. (the) The whole mass of air surrounding the earth, composed largely of oxygen and nitrogen.

Atomize: To divide a liquid into extremely minute particles, either by impact with a jet of steam or compressed air, or by passage through some mechanical device.

Attainment Area: An area considered to have air quality as good as or better than the national ambient air quality standard as defined in the Clean Air Act. An area may be an attainment area for one pollutant and a non-attainment area for others.

Attenuation: The process by which a compound is reduced in concentration over time, through adsorption, degradation, dilution, and/or transformation.

Attractant: A chemical or agent that lures insects or other pests by stimulating their sense of smell.

Attrition: Wearing or grinding down of a substance by friction. A contributing factor in air pollution, as with dust.

Autotropic: An organism that produces food from inorganic substances.

AWWA: American Water Works Association.

B

Background Level: In air pollution control, the concentration of air pollutants in a definite area during a fixed period of time prior to the starting up or on the stoppage of a source of emission under control. In toxic substances monitoring, the average presence in the environment, originally referring to naturally occuring phenomena.

BACTA - Best Available Control Technology: An emission limitation based on the maximum degree of emission reduction which (considering energy, environmental, and economic impacts and other costs) is achievable through application of production processes and available methods, systems, and techniques.

Bacteria: (Singular, bacterium) Microscopic living organisms which can aid in pollution control by consuming or breaking down organic matter in sewage, or by similarly acting on oil spills or other water pollutants. Bacteria in soil, water or air can also cause human, animal and plant health problems.

Baffle Chamber: In incinerator design, a chamber designed to promote the settling of fly ash and coarse particulate matter by changing the direction and/or reducing the velocity of the gases produced by the combustion of the refuse or sludge.

Baghouse Filter: Large fabric bag, usually made of glass fibres, used to eliminate intermediate and large (greater than 20 microns in diameter) particles. This device operates in a way similar to the bag of an electric vacuum cleaner, passing the air and smaller particulate matter, while entrapping the larger particulates.

Baling: Compacting solid waste into blocks to reduce volume and simplify handling.

Ballistic separator: A machine that sorts organic from inorganic matter for composting.

Band Application: In pesticides, the spreading of chemicals over, or next to, each row of plants in a field.

Banking: A system for recording qualified air emission reductions for later use in bubble, offset, or netting transactions. (See: emissions trading).

Bar Screen: In wastewater treatment, a device used to remove large solids.

Barrier Coating(s): A layer of a material that acts to obstruct or prevent passage of something through a surface that is to be protected, e.g. grout, caulk or various sealing compounds; somethimes used with polyurethane membrances to prevent corrosion or oxidation of metal surfaces, chemical impacts on various materials, or, for example, to prevent soil-gas-borne radon from moving from walls, cracks, or joints in a house.

Basal Application: In pesticides, the application of a chemical on plant stems or tree trunks just above the soil line.

Batch: Any waste which is generated less frequently than once a month.

Benthic Organism (Benthos): A form of aquatic plant or animal life that is found on or near the bottom of a stream, lake or ocean.

Benthic Region: The bottom layer of a body of water.

Beryllium: An airborne metal that can be hazardous to human health when inhaled. It is discharged by machine shops, ceramic and propellant plants, and foundries.

Beta Particle: An elementary particle emitted by radioactive decay, that may cause skin burns. It is halted by a thin sheet of paper.

Bioassay: Using living organisms to measure the effect of a substance, factor, or condition by

comparing before-and-after data. Term is often used to mean cancer bioassays.

Biochemical Oxygen Demand (BOD): A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. The greater the BOD, the greater the degree of pollution.

Biodegradable: The ability to break down or decompose rapidly under natural conditions and processes.

Biological Control: In pest control, the use of animals and organisms that eat or otherwise kill or out-compete pests.

Biological Magnification: Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into a river or lake and are eaten by aquatic organisms such as fish which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the chain. (See: bioaccumulative).

Biological Oxidation: The way bacteria and micro-organisms feed on and decompose complex organic materials. Used in self-purification of water bodies and in activated sludge wastewater treatment.

Biological Treatment: A treatment technology that uses bacteria to consume waste. This treatment breaks down organic materials.

Biomass: All of the living material in a given area; ofen refers to vegetation. Also called "biota".

Biomonitoring: 1. The use of living organisms to test the suitability of effluents for discharge into receiving waters and to test the quality of such waters down stream from the discharge. 2. Analysis of blood, urine, tissues, etc., to measure chemical exposure in humans.

Biosphere: The portion of earth and its atmosphere that can support life.

Biostabilizer: A machine that converts solid waste into compost by grinding and aeration.

Biota: (See: biomass).

Biotechnology: Techniques that use living organisms or parts of organisms to produce a variety of products (from medicines to industrial enzymes) to improve plants or animals or to develop micro-organisms for specific uses such as removing toxics from bodies of water, or as pesticides.

Biotic Community: A naturally occurring assemblage of plants and animals that live in the same environment and are mutually sustaining and interdependent.

Black Lung: A disease of the lungs caused by habitual inhalation of coal dust.

Blackwater: Water that contains animal, human or food wastes.

Bloom: A proliferation of algae and/or higher aquatic plants in a body of water; often related to pollution, especially when pollutants accelerate growth.

Bod_5: The amount of dissolved oxygen consumed in five days by biological processes breaking down organic matter.

Bog: A type of wetland that accumulates appreciable peat deposits. Bogs depend primarily on

precipitation for their water source, are usually acidic and rich in plant residue with a conspicuous mat of living green moss.

Boom: 1. A floating device used to contain oil on a body of water. 2. A piece of equipment used to apply pesticides from ground equipment such as a tractor or truck (See: sonic broom).

Botanical Pesticide: A pesticide whose active ingredient is a plant produced chemical such as nicotine or strychnine.

Brackish Water: A mixture of fresh and salt water.

Broadcast Application: In pesticides, the spreading of chemicals over an entire area.

Bubble: A system under which existing emissions sources can propose alternate means to comply with a set of emissions limitations; under the bubble concept, sources can control more than required at one emission point where control costs are relatively low in return for a comparable relaxation of controls at a second emission point where costs are higher.

Bubble Policy: (See emissions trading).

Buffer Strips: Strips of grass or other erosion-resisting vegetation between or below cultivated strips or fields.

Buffer Zone Standard: This specifies the distance between a source of environmental nuisance or hazard and areas inhibited or frequented by the general public.

Burial Ground (Graveyard): A disposal site for radioctive waste materials that uses earth or water as a shield.

By-product: Material, other than the principal product, that is generated as a consequence of an industrial process.

C

Cadmium (Cd): A heavy metal element that accumulates in the environment.

Cap: A layer of clay, or other highly impermeable material installed over the top of a closed landfill to prevent entry of rainwater and minimize production of leachate.

Capture Efficiency: The fraction of all organic vapours generated by a process that are directed to an abatement or recovery device.

Carbon Adsorber: An add-on control device which uses activated carbon to absorb volatile organic compounds from a gas stream. The VOCs are later recovered from the carbon.

Carbon Dioxide (CO_2): A colorless, non-poisonous gas, which results from fossil fuel combustion and is normally a part of the ambient air.

Carbon Monoxide (CO): A colorless, odorless, non-poisonous gas, produced by incomplete fossil fuel combustion.

Carboxyhemoglobin: Hemoglobin in which the iron is associated with carbon monoxide (CO). The affinity of hemoglobin for CO is about 300 times greater than for oxygen.

Carcinogen: Any substances that can cause or contribute to the production of cancer.

Carcinogenic: Cancer-producing.

Carrying Capacity: 1. In recreation management, the amount of use a recreation area can sustain without deterioration of its quality. 2. In wildlife management, the maximum number of animals an area can support during a given period of the year.

Cask: A thick-walled container (usually lead) used to transpot radioactive material. Also called a coffin.

Catalytic Converter: An air pollution abatement device that removes pollutants from motor vehicle exhaust, either by oxidizing them into carbon dioxide and water or reducing them to nitrogen and oxygen.

Catalytic Incinerator: A control device with oxidizes volatile organic compounds (VOCs) by using a catalyst to promote the combustion process. Catalytic incinerators require lower temperatures than conventional thermal incinerators, with resultant fuel and cost savings.

Categorical Pretreatment Standard: A technology-based effluent limitation for an industrial facility which discharges into a municipal sewer system. Analogous in strigency to Best Availability Technology (BAT) for direct dischargers.

Cathodic Protection: A technique to prevent corrosion of a metal surface by making that surface the cathode of an electrochemical cell.

Caustic Soda: Sodium hydroxide, a strong alkaline substance used as the cleaning agent in some detergents.

$CBOD_5$: The amount of dissolved oxygen consumed in 5 days from the carbonaceous portion of biological processes breaking down in an effluent. The test methodology is the same as for BOD_5, except that nitrogen demand is suppressed.

Cells: 1. In solid waste disposal, holes where waste is dumped, compacted, and covered with layers of dirt on a daily basis. 2. The smallest structural part of living matter capable of functioning as an independent unit.

Centrifugal Collection: A mechanical system using centrifugal force to remove aerosols from a gas stream or to de-water sludge.

Cesium (Cs): A silver-white, soft ductile element of the alkali metal group that is the most electropositive element known. Used especially in photoelectric cells.

Channelization: Straightening and deepening streams so water will move faster, a flood-reduction or marsh-drainage tactic that can interfere with waste assimilation capacity and disturb fish and wildlife habitats.

Characteristic: Any one of the four categories used in defining hazardous waste: ingitability, corrosivity, reactivity, and toxicity.

Chemical Oxygen Demand (COD): A measure of the oxygen required to oxidize all compounds in water, both organic and inorganic.

Chemical Treatment: Any one of a variety of technologies that use chemicals or a variety of

chemical processes to treat waste.

Chemosterilant: A chemical that controls pests by preventing reproduction.

Chilling Effect: The lowering of the Earth's temperature because of increased particles in the air blocking the sun's rays. (See: greenhouse effect).

Chlorinated Hydrocarbons: These include a class of persistent, broad-spectrum insecticides, that linger in the environment and accumulate in the food chain. Among them are DDT, aldrin, dieldrin, heptachlor, chlordane, lindane, endrin, mirex, hexachloride, and toxaphene. Other examples include TCE, used as an industrial solvent.

Chlorinated Solvent: An organic solvent containing chlorine to drinking water, sewage, or industrial waste to disinfect or to oxidize undesirable compounds.

Chlorinator: A device that adds chlorine, in gas or liquid form, to water or sewage to kill infectious bacteria.

Chlorine-Contact Chamber: That part of a water treatment plant where effluent is disinfected by chlorine.

Chlorofluorocarbons (CFC's): A family of inert, non-toxic, and easily liquified chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere they drift into the upper atmosphere where their chlorine components destroy ozone.

Chlorosis: Discoloration of normally green plant parts, that can be used by diseases, lack of nutrients, or various air pollutants.

Chronic Toxicity: The capacity of a substance to cause long-term poisonous human health effects. (See acute toxicity).

Clarification: Clearing action that occurs during waste water treatment when solids settle out. This is often aided by centrifugal action and chemically induced coagulation in waste water.

Clarifier: A tank in which solids are settled to the bottom and are subsequently removed as sludge.

Cleanup: Actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and/or the environment. The term "cleanup" is sometimes used interchangeably with the terms remedial action, removal action, response action, or corrective action.

Cloning: In biotechnology, obtaining a group of genetically identical cells from a single cell. This term has assumed a more general meaning that includes making copies of a gene.

Closed-Loop Recycling: Reclaiming or reusing waste water for non-potable purposes in an enclosed process.

Closure: The requirements placed upon all TSD facilities to ensure that all such facilities are closed in an acceptable manner (See also "post-closure").

Coagulation: A clumping of particles in waste water to settle out impurities. It is often induced by chemicals such as lime, alum and iron salts.

Coastal Zone: Lands and waters adjacent to the coast that exert an influence on the uses of the

sea and its ecology, or, inversely, whose uses and ecology are affected by the sea.

Coefficient of Haze (COH): A measurement of visibility interference in the atmosphere.

Coliform Organism: Microorganisms found in the intestinal tract of humans and animals. Their presence in water indicates fecal pollution and potentially dangerous bacterial contamination by disease-causing microorganisms.

Combined Sewers: A sewer system that carries both sewage and storm-water runoff. Normally, its entire flow goes to a waste treatment plant, but during a heavy storm, the storm water volume may be so great as to cause overflows. When this happens untreated mixtures of storm water and sewage may flow into receiving waters. Storm-water runoff may also carry toxic chemicals from industrial areas or streets into the sewer sytem.

Combustion: Burning, or rapid oxidation, accompanied by release of energy in the form of heat and light. A basic cause of air pollution.

Combustion Product: Substance produced during the burning or oxidation of a material.

Command Post: Facility located at a safe distance upwind from an accident site, where the on-scene coordinator, responders, and technical representatives can make response decisions, deploy manpower and equipment, maintain liaison with news media, and handle communications.

Comment Period: Time provided for the public to review and comment on a proposed FEPA action or rulemaking after it is published.

Communication: mechanical shredding or pulverizing of waste. Used in both solid waste management and wastewater treatment.

Comminuter: A machine that shreds or pulverizes solids to make waste treatment easier.

Community Relations: The FEPA effort to establish two-way communication with the public to create understanding of FEPA programs and related actions, to assure public input into decisionmaking processes related to affected communities, and to make certain that the Agency is aware of and responsive to public concerns.

Community Water System: A public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25-year-round residents.

Compaction: Reduction of the bulk of solid waste by rolling and tamping.

Compliance Coating: A coating whose volatile organic compound content does not exceed that allowed by regulation.

Compliance Schedule: A negotiated agreement between a pollution source and a government agency that specifies dates and procedures by which a source will reduce emissions and, thereby, comply with a regulation.

Compost: A mixture of garbage and degradable trash with soil in which certain bacteria in the soil break down the garbage and trash into organic fertilizer.

Composting: The natural biological decomposition of organic material in the presence of air to form a humus-like material controlled methods of composting include mechanical mixing and aerating, ventilating the materials by dropping them through a vertical series of aerated chambers, or placing the

compost in the piles out in the open air and mixing it or turning it periodically.

Confined Aquifer: An aquifer in which ground water is confined under pressure which is significantly greater than atmospheric pressure.

Conservation: Avoiding waste of, and renewing when possible, human and natural resources. The protection, improvement, and use of natural resources according to principles that will assure their highest economic or social benefits.

Constituent or Dangerous Waste Constituent: A chemically distinct component of a dangerous waste stream or mixture.

Contact Pesticide: A chemical that kills pests when it touches them, rather than by being eaten (stomach poison). Also, soil that contains the minute skeletons of certain algae that scratches and dehydrates waxy-coated insects.

Container: Any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled.

Contaminant: Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil.

Contigency Plan: A document setting out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or other accident that releases toxic chemicals, hazardous wastes, or radioactive materials which threaten human health or the environment.

Contract Labs: laboratories under contract to FEPA, which analyze samples taken from wastes, soil, air, and water or carry out research projects.

Contrails: Long, narrow clouds caused when high-flying jet aircraft disturb the atmosphere.

Contour Plowing: Farming methods that breakground following the shape of the land in a way that discourages erosion.

Conventional Pollutants: Statutorily listed pollutants which are understood well by scientists. These may be in the form of organic waste, sediment, acid, bacteria and viruses, nutrients, oil and grease, or heat.

Conventional Systems: Systems that have been traditionally used to collect municipal waste water in gravity sewers and convey it to a central primary or secondary treatment plant prior to discharge to surface waters.

Coolant: A liquid or gas used to reduce the heat generated by power production in nuclear reactors, electric generators, various industrial and mechanical processes, and automobile engines.

Cooling Tower: A structure that helps remove heat from water used as a coolant; e.g., in electric power generating plants.

Core: The uranium-containing heart of a nuclear reactor, where energy is released.

Corrosion: The dissolving and wearing away of metal caused by a chemical reaction such as between water and the pipes that the water contracts, chemicals touching a metal surface, or contact between two metals.

Corrosive: A chemical agent that reacts with the surface of a material causing it to deteriorate or wear away.

Cost-Effective Alternative: An alternative control or corrective method identified after analysis as being the best available in terms of reliability, permanence, and economic considerations.

Cover: Vegetation or other material providing protection as ground cover.

Cover Material: Soil used to cover compacted solid waste in a sanitary landfill.

Crawl Space: In some types of houses, which are constructed so that the floor is raised slightly above the ground, an area beneath the floor which allows access to utilities and other services. This is in contrast to slab-on-grade or basement construction houses.

Criteria: Descriptive factors taken into account by FEPA in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year when issued by FEPA, the criteria provide guidance to the States on how to establish their standards.

Cubic Feet Per Minute (CFM): A measure of the volume of a substance flowing through air within a fixed period of time. With regard to indoor air, refers to the amount of air, in cubic feet, that is exchanged with indoor air in a minute's time, or an air exchange rate.

Cultural Eutrophication: Increasing rate at which water bodies "die" by pollution from human activities.

Cumulative Working Level Months (CWLM): The sum of lifetime exposure to radon working levels expressed in total working level months.

Curie: A quantitative measure of radioactivity equal to 3.7 x 1010 disintegrations per second.

Cutie-Pie: An instrument used to measure radiation levels.

Cyclone Collector: A device that uses centrifugal force to pull large particles from polluted air.

D

DDT: The first chlorinated hydrocarbon insecticide (chemical name: Dichloro-phenyl-Trichloromethane). It has a half-life of 15 years and can collect in fatty tissues of certain animals. EPA banned registration and interstate sale of DDT for virtually all but emergency uses in the United States in 1972 because of its persistence in the environment and accumulation in the food chain.

Dechlorination: Removal of chlorine for a substance by chemically replacing it with hydrogen or hydroxide ions in order to detoxify the substances involved.

Decibel (dB): A unit of sound measurement. In general, a sound doubles in loudness for every increase of ten decibels.

Decomposition: The breakdown of matter by bacteria and fungi. It changes the chemical makeup and physical appearance of materials.

Degradation: The process by which a chemical is reduced to a else complex form.

Delegated State: A state (or other governmental entity) which has applied for, and received

authority to administer, within its territory, its state regulatory program as the federal program required under Decrees 42 and 58 of 1988. The term does not connote any transfer of FEPA authority to a State.

Defoliant: A herbicide that removes leaves from trees and growing plants.

Denitrification: The anaerobic biological reduction of nitrate nitrogen to nitrogen gas.

Depletion Curve: In hydraulics, a graphical representation of water depletion from storage-stream channels, surface soil, and ground water. A depletion curve can be drawn for base flow, direct runoff, or total flow.

Depressurization: A condition that occurs when the air pressure inside a structure is lower than the air pressure outside. Depressurization can occur when household appliances that consume or exhaust house air, such as fireplaces or furnaces, are not supplied with enough makeup air. Radon-containing soil gas may be drawn into a house more rapidly under depressurized conditions.

Dennal LD50: The single dosage in milligrams per kilogram (mg/kg) body weight which, when dermally (skin) applied for 24 hours, within 14 days kills half of a group of ten rabbits each weighing between 2.0 and 3.0 kilograms.

Dermal Toxicity: The ability of a pesticide or toxic chemical to poison people or animals by contact with the skin. (See: contact pesticide).

DES: A synthetic estrogen, diethylstibestrol, is used as a growth stimulant in food animals. Residues in meat are though to be carcinogenic.

Desalinization: Removing salt from ocean or brackish water.

Desiccant: A chemical agent that absorbs moisture; some desiccant are capable of drying out plants or insects, causing death.

Designated Bugs: Popular term for microbes developed through biotechnology that can degrade specific toxic chemicals at their source in toxic waste dumps or in ground water.

Designated facility: The facility designated by the generator on the manifest to receive a dangerous waste shipment.

Desulfurization: Removal of sulfur from fossil fuels to reduce pollution.

Designated Uses: Those water uses identified in state water quality standards which must be achieved and maintained. uses can include cold water fisheries, public water supply, agriculture, etc.

Detergent: Synthetic washing agent that helps to remove dirt and oil. Some contain compounds which kill useful bacteria and encourage algae growth when they are in wastewater that reaches receiving waters.

Developer: A person, government unit, or company that proposes to build a hazardous waste treatment, storage, or disposal facility.

Diatomaceous Earth (Diatomite): A chalk-like material (fossilized diatoms) used to filter out solid waste in waste-water treatment plants, also used as an active ingredient in some powdered pesticides.

Diazinon: An insecticide, not to be used on open areas such as sod farms and golf courses because

it posed a danger to migratory birds who gathered on them in large numbers. It could be used in agriculture, or on lawns of homes and commercial establishments.

Dicofol: A pesticide used on citrus fruits.

Differentiation: The process by which single cells grow into particular forms of specialized tissue, e.g., root, stem, leaf.

Diffused Air: A type of aeration that forces oxygen into sewage by pumping air through perforated pipes inside a holding tank and bubbling it through the sewage.

Digester: In wastewater treatment, a closed tank; in solid waste conversion, a unit inwhich bacterial action is induced and accelerated in order to break down organic matter and establish the proper carbon to nitrogen ratio.

Digestion: The biochemical decomposition of organic matter, resulting in partial gasification, liquefaction, and mineralization of pollutants.

Dike: A low wall that can act as a barrier to prevent a spill from spreading.

Dilution Ratio: The relationship between the volume of water in a stream and the volume of incoming water. It affects the ability of the stream to assimilate waste.

Dinocap: A fungicide used primarily by apple growers to control summer diseases. laboratory tests found it caused birth defects in rabbits.

Dinoseb: A herbicide that is also used as a fungicide and insecticide. It poses the risk of birth defects and sterility.

Dioxin: Any of a family of compounds known chemically as dibenzo-p-dioxins. Concern about them arises from their potential toxicity and contaminants in commercial products. Tests on laboratory animals indicate that it is one of the more toxic man-made chemicals known.

Direct Discharger: A municipal or industrial facility which introduces pollution through a defined conveyance or system; a point source.

Discharge or Dangerous Waste Discharge: The accidental or intentional release of hazardous substances, dangerous waste or waste constituent may enter or be emitted into the environment. Release includes, but is not limited to, the actions of: Spilling, leaking, pumping, pouring, emitting, dumping, emptying, depositing, placing, or injecting.

Disinfectant: A chemical or physical process that kills pathogenic organisms in water. Chlorine is often used to disinfect sewage treatment effluent, water supplies, wells, and swimming pools.

Dispersant: A chemical agent used to break up concentrations of organic material such as spilled oil.

Disposal: Final placement or destruction of toxic radioactive, or other wastes, surplus or banned pesticides or other chemicals, polluted soils, and drums containing hazardous materials from removal actions or accidental releases. Disposal may be accomplished through use of approved secure landfills, surface impoundments, land farming, deep well injection, ocean dumping; or incineration.

Dissolved Oxygen (DO): The oxygen freely available in water. Dissolved oxygen is vital to fish and other aquatic life and for the prevention of odours. Traditionally the level of dissolved oxygen has

been accepted as the single most important indicator of a water body's ability to support desirable aquatic life. Secondary and advanced waste treatment are generally designed to protect DO in waste-receiving waters.

Dissolved Solids: Disintegrated organic and inorganic material contained in water. Excessive amounts make water unfit to drink or use in industrial processes.

Distillation: The act of purifying liquids through boiling, so that the steam condenses to a pure liquid and the pollutants remain in a concentrated residue.

DNA: Deoxyribonucleic acid, the molecule in which the genetic information for most living cells is encoded. Viruses, too, can contain RNA.

DNA Hybridization: Use of a segment of DNA, called a DNA probe, to identify its complementary DNA; used to detect specific genes. This process takes advantage of the ability of a single strand of DNA to combine with a complimentary strand.

DOE: Department of Environment (United Kingdom).

Dose: In radiology, the quantity of energy or radiation absorbed.

Dosimeter: An instrument that measures exposure to radiation.

Drain: An open or closed conduit which conduct stormwater, run-offs, domestic waste waters etc.

Dredging: Removal of mud from the bottom of water bodies using a scooping machine. This disturbs the ecosystem and causes silting that can kill aquatic life. Dredging of contaminated muds can expose aquatic life to heavy metals and other toxics.

Dump: A site used to dispose of solid wastes without environmental controls.

Dust: Particles light enough to be suspended in air.

Dustfall Jar: An open container used to collect large particles from the air for measurement and analysis.

DW: Dangerous waste.

Dystrophic Lakes: Shallow bodies of water that contain much humus and/or organic matter, that contain many plants but few fish and are highly acidic.

E

Ecological Impact: The effect that a man-made or natural activity has on living organisms and their non-living (abiotic) environment.

Ecology: The relationship of living things to one another and their environment, or the study of such relationships.

Economic Poisons: Chemicals used to control pest and to defoliate cash crops such as cotton.

Ecosphere: The "bio-bubble" that contains life on earth, in surface waters, and in the air. (See: biosphere).

Ecosystem: The interacting system of a biological community and its non-living environmental surroundings.

EDW: Extremely Dangerous Waste.

Effluent: Waste water-treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Effluent Limitation: Restrictions established by a State of FEPA on quantities, rates and concentrations in waste water discharges.

EHW: Extremely Hazardous Waste.

Electrodialysis: A process that uses electrical current applied to permeable membranes to remove minerals from water. Often used to desalinize salty or brackish water.

Electrostatic Precipitator (ESP): An air pollution control device that removes particles from a gas stream (smoke) after combustion occurs. The ESP imparts an electrical charge to the particles, causing them to adhere to metal plates inside the precipitator. Rapping on the plates causes the particles to fall into a hopper for disposal.

Emergency (Chemicals): A situation created by an accidental release or spill of hazardous chemicals which poses a threat to the safety of workers, residents, the environment, or property.

Emergency Episode: (See: air pollution episode).

Emission: Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities, from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts.

Emission Factor: The relationship between the amount of pollution produced and the amount of raw material processed. For example, an emission factor for a blast furnace making iron would be the number of kilograms of particulates per ton of raw materials.

Emission Standard: The maximum amount of air polluting discharge legally allowed from a single source, mobile or stationary.

Endangered Species: Animals, birds, fish, plants, or other living organisms threatened with extinction by man-made or natural changes in their environment.

Endangerment Assessment: A study conducted to determine the nature and extent of contamination at a site and the risk posed to public health or the environment. FEPA or the state conducts the study.

Enforcement: FEPA: actions to obtain compliance with environmental laws, rules, regulations, or agreements and/or obtain penalties or criminal sanctions for violations.

Enrichment: The addition of nutrients (e.g., nitrogen, phosphorus, carbon compounds) from sewage effluent or agricultural runoff to surface water. This process greatly increases the growth potential for algae and aquatic plants.

Environment: The sum of all external conditions affecting the life, development and survival of an organism.

Environmental Assessment: A written environmental analysis to determine whether a development would significantly affect the environment and thus require preparation of a more detailed environmental impact statement.

Environmental Audit: 1. An independent assessment of the current status of a party's compliance with applicable environmental requirements. 2. An independent evaluation of a party's environmental compliance policies, practices, and controls.

Environmental Impact Statement: A document required of development agencies by the FEPA for major projects or legislative proposals significantly affecting the environment. A tool for decision making, it describes the positive and negative effects of the undertaking and lists alternative actions.

Environmental Response Team: FEPA experts located in FEPA's Zonal Offices all over Nigeria, who can provide around-the-clock technical assistance to FEPA State offices and State Governments during all types of emergencies involving hazardous wastes sites and spills of hazardous substances.

Epidemic: Widespread outbreak of a disease, or a large number of cases of a disease in a single community or relatively small area.

Epidemiology: The study of diseases as they affect population, including the distribution of disease, or other health-related states and events in human populations, the factors (e.g. age, sex, occupation, economic status) that influence this distribution, and the application of this study to control health problems.

Episode (Pollution): An air pollution incident in a given area caused by a concentration of atmospheric pollution reacting with meteorological conditions that may result in a significant increase in illnesses or deaths. Although most commonly used in relation to air pollution, the term may also be used in connection with other kinds of environmental events such as a massive water pollution situation.

Equivalent Method: Any method of sampling and analyzing for air pollution which has been demonstrated to the FEPA Director/Chief Executive's satisfaction to be, under specific conditions, an acceptable alternative to the normally used reference methods.

Equilibrium: In relation to radiation, the state at which the radioactivity of consecutive elements within a radioactive series is neither increasing nor decreasing.

Erosion: The wearing away of land surface by wind or water. Erosion occurs naturally from weather or run-off but can be intensified by land-clearing practices related to farming, residential or industrial development, road building, or timber-cutting.

Estuary: Regions of interaction between rivers and nearshore ocean waters, where tidal action and river flow create a mixing of fresh and salt water. These areas may include bays, mouths of rivers, salt marshes, and lagoons. These brackish water ecosystems shelter and feed marine life, birds, and wildlife (See: wetlands).

Ethylene Dibromide (EDB): A chemical used as an agricultural fumigant and in certain industrial processes. Extremely toxic and found to be a carcinogen in laboratory animals.

Eutrophication: The slow aging process during which a lake, estuary, or bay evolves into a bog or marsh and eventually disappears. During the later stages of eutrophication the water body is choked by abundant plant life as the result of increased amounts of nutritive compounds such as nitrogen and phosphorus. Human activities can accelerate the process.

Eutrophic Lakes: Shallow, murky bodies of water that have excessive concentrations of plant nutrients causing excessive algal production. (See: dystrophic lakes).

Evaporation Ponds: Areas where sewage sludge is dumped and allowed to dry out.

Evapotranspiration: The loss of water from the soil both by evaporation and by transpiration from the plants growing in the soil.

Exceedance: Vialation of environmental protection standards by exceeding allowable limits or concentration levels.

Exclusionary: Any form of zoning ordinance that tends to exclude specific classes of persons or businesses from a particular district or area.

Exempt Solvent: Specific organic compounds that are not subject to requirements of regulation because they have been deemed by FEPA to be of negligible photochemical reactivity.

Exempted Aquifer: Underground bodies of water defined in the Underground Injection Control programme as aquifers that are sources of drinking water (although they are not being used as such) and that are exempted from regulations barring underground injection activities.

Exposure: The amount of radiation or pollutant present in an environment which represents a potential health threat to the living organisms in that environment.

Extremely Hazardous Substances: Any of the chemicals identified by FEPA on the basis of toxicity, and listed under FAC 000-000-9903. The list is subject to revision.

F

Fabric Filter: A cloth device that catches dust particles from industrial emissions.

Facility: All contiguous land, and structures, other appurtenances, and improvements on the land used for recycling, reusing, reclaiming, transfening, storing, treating, or disposing of dangerous waste. Unless otherwise specified, the terms "facility" "treatment", "storage", "disposal facility", "TSD facility", "dangerous waste facility" or "waste management facility", shall be used interchangeably.

Feasibility Study: 1. Analysis of the practicability of a proposal; e.g. a description and analysis of the potential clean-up alternatives for a site or alternatives for a site. The feasibility study usually recommends selection of a cost-effective alternative. It usually starts as soon as the remedial in estimation is underway; together, they are commonly referred to as the "R1/FS". The term can apply to a variety of proposed corrective or regulatory actions. 2. In research, a small-scale investigation of a problem to ascertain whether or not a proposed research approach is likely to provide useful data.

Fecal Coliform Bacteria: Bacteria found in the intestinal tracts of mammals. Their presence in water or sludge is an indicator of pollution and possible contamination by pathogens.

Feedlot: A relatively small, confined area for the controlled feeding of animals that tends to concentrate large amounts of animal wastes that cannot be absorbed by the solid and, hence, may be carried to nearby streams or lakes by rainfall runoff.

Fen: A type of wetland that accumulates peat deposits. Fens are less acidic than bogs, deriving most of their water from groundwater rich in calcium and magnesium. (See: wetlands).

FEPA: Federal Environmental Protection Agency established by Decree No. 58 of November,

1988.

Fermentation: Chemical reactions accompanied by living microbes that are supplied with nutrients and other critical conditions such as heat, pressure, and light that are specific to the reaction at hand.

Fertilizer: Materials such as nitrogen and phosphorus that provide nutrients for plants. Commercially sold fertilizers may contain other chemicals or may be in the form of processed sewage sludge.

Filling: Depositing dirt and mud or other materials into aquatic areas to create more dry land, usually for agricultural or commercial development purposes. Such activities often damage the ecology of the area.

Filtration: A treatment process, under the control of qualified operators, for removing solid (particulate) matter from water by passing the water through porous media such as sand or a manmade filter. The process is often used to remove particles that contain pathogenic organisms.

Final Closure: The closure of all dangerous waste management units at a facility in accordance with all applicable closure requirements so that dangerous waste maanagement activities are no longer conducted at the facility.

Finding of No Significant Impact (FNSI): A document prepared by FEPA that presents the reasons impact: why a proposed action would not have a significant impact on the environment and thus would not require preparation of an Environmental Impact Statement. An FNSI is based on the results of an environmental assessment.

First Draw: The water that immediately comes out when a tap is first opened. This water is likely to have the highest level of lead contamination from plumbing materials.

Floc: A clump of solids formed in sewage by biological or chemical action.

Flocculation: The process by which clumps of solids in water or sewage are made to increase in size by biological or chemical action so that they can be separated from the water.

Floor Sweep: A vapour collection designed to capture vapours which are heavier than air and which collect along the floor.

Flowmeter: A gauge that shows the speed fo wastewater moving through a treatment plant. Also used to measure the speed of liquids moving through various industrial processes.

Flue Gas: The air coming out of a chimney after combustion in the burner it is venting. It can include nitrogen oxides, carbon oxides, water vapour, sulfur oxides, particles and many chemical pollutants.

Flue Gas Desulfurization: A technology which uses a sorbent, usually lime or limestone, to remove sulfur dioxide from the gases produced by burning fossil fuels. Flue gas desulferization is currently the state-of-the art technology in use by major SO2 emitter, e.g., power plants.

Fluorides: Gaseous, solid, or dissolved compounds containing fluorine that result from industrial processes. Excessive amounts in food can lead to fluorosis.

Fluorocarbon (FCs): Any of a number of organic compounds analogous to hydrocarbons in which one or more hydrogen atoms are replaced by fluorine. Once used as a propellant in aerosols, they are now primarily used in coolants and some industrial processes. FCs containing chlorine are called

chlorofluorocarbons (CFCs). They are believed to be modifying the ozone layer in the stratosphere, thereby allowing more harmful solar radiation to reach the Earth's surface.

Fluorosis: An abnormal condition caused by excessive intake of fluorine, characterized chiefly by mottling of the teeth.

Flume: A natural or man-made channel that diverts water.

Flush: 1. To open a cold-water tap to clear out all the water which may have been sitting for a long time in the pipes. In new homes, to flush a system means to send large volumes of water gushing through the unused pipes to remove loose particles or solder and flux. 2. To force large amounts of water through liquid to clean out piping or tubing, storage or process tanks.

Fly Ash: Non-combustible residual particles from the combustion process carried by flue gas.

Fogging: Applying a pesticide by rapidly heating the liquid chemical so that it forms very fine droplets that resemble smoke or fog. It may be used to destroy mosquitoes, black flies and similar pests.

Food Chain: A sequence of organisms, each of which uses the next, lower member of the sequence as a food source.

Food Chain Crops: Tobacco, crops grown for human consumption, and crops grown to feed animals whose products are consumed by humans.

Formaldehyde: A colourless, pungent, irritating gas CH_2O, used chiefly as a disinfectant and preservative and in synthesizing other compounds and resins.

Formulation: The substances or mixture of substances which is comprised of all active and inert ingredients in a pesticide.

Fresh Water: Water that generally contains less than 1,000 milligrams per litre of dissolved solids.

Fuel Standard: This specifies the levels of sulphur lead and other toxic substances in a fuel. The levels of these toxic substances in the fuel will determine their respective levels during combustion.

Fugitive Emissions: Emissions not caught by a capture system.

Fume: Tiny particles trapped in vapour in a gas stream.

Fumigant: A pesticide that is vapourized to kill pests. Used in buildings and greenhouses.

Fungi: (Singular, Fungus) Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms that lack chlorophyll(i.e., are not photosynthetic) and which are usually non-mobile, filamentous, and multicellular. Some grow in the ground, others attach themselves to decaying trees and other plants, getting their nutrition from decomposing organic matter. Some cause disease, others stabilize sewage and break down solid wastes in composting.

Fungicide: Pesticides which are used to control, prevent, or destroy fungi.

G

Gamma Radiation: Gamma rays are true rays of energy in contrast to alpha and beta radiation. The properties are similar to x-rays and other electromagnetic waves. They are the most penetrating

waves of radiant nuclear energy but can be blocked by dense materials such as lead.

Gasification: Conversion of solid material such as coal into a gas for use as a fuel.

Geiger Counter: An electrical device that detects the presence of certain types of radioactivity.

Gene: A length of DNA that directs the synthesis of a protein.

General Permit: A permit applicable to a class or category of dischargers.

Generator: A facility or mobile source that emits pollutants into the air or releases hazardous wastes into water or soil.

Genetic Engineering: A process of inserting new genetic information into existing cells in order to modify any organism for the purpose of changing one of its characteristics.

Genetic Properties: Those substances which cause or significantly contribute to nitrogen teratogenic or carcinogenic effects in man or wildlife.

Germicide: Any compound that kills disease-causing micro-organisms.

Granular Activated Carbon Treatment: A filtering system often used in small water systems and individual homes to remove organics. GAC can be highly effective in removing elevating levels of radon from water.

Gray Water: The term given to domestic wastewater composed of washwater from sinks, kitchen sinks, bathroom sinks and tubs, and laundry tubs.

Greenhouse Effect: The warming of the Earth's atmosphere caused by a build-up of carbon dioxide or other trace gases; it is believed by many scientists that this build-up allows light from the sun's rays to heat the Earth but prevents a counterbalancing loss of heat.

Grinder Pump: A mechanical device which shreds solids and raises the fluid to a higher elevation through pressure sewers.

Gross Alpha Particle Activity: Total activity due to emission of alpha particles. Used as the screening measurement for radioactivity generally due to naturally-occurring radionuclides. Activity is commonly measured in picocuries.

Gross Beta Particle Activity: Total activity due to emission of beta particles used as the screening measurement of radioactivity from man-made radionuclides since the decay products of fission are beta particle and gamma ray emitters. Activity is commonly measured in picocuries.

Ground Cover: Plants grown to keep soil from eroding.

Grounding water: The supply of fresh water found beneath the Earth's surface, usually in aquifers, which is often used for supplying wells and springs. Because ground water is a major source of drinking water there is growing concern over areas where leaching agricultural or industrial pollutants or substances from leaking underground storage tanks are contaminating ground water.

H

Habitat: The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

Half-Life: 1. The time required for a pollutant to lose half its effect on the environment, for example, the half-life of DDT in the environment is 15 years, of radium, 1,580 years. 2. The time required for half of the atoms of a radioactive element to undergo decay. 3. The time required for the elimination of one half a total dose from the body.

Halogen: Any of a group of 5 chemically-related nonmetallic elements that includes bromine, fluorine, chlorine, iodine, and astatine.

Halogenated hydrocarbons (HH): Organic compounds which, as part of their composition, include one or more atoms of fluorine, chlorine, bromine, iodine, or astatine. The requirements of this document apply to only those halogenated hydrocarbons which can be obtained using the testing method described in subsection 1.8.1, and which are persistent dangerous wastes.

Halon: bromine-containing compounds with long atmospheric lifetimes whose breakdown in the stratosphere cause depletion of ozone. Halons are used in fire-fighting.

Hammermill: A high-speed machine that hammers and cutters to crush, grind, chip or shred solid wastes.

Hard Water: Alkaline water containing dissolved salts that interfere with some industrial processes and prevent soap from lathering.

Hazardous Air Pollutants: Air pollutants which are not covered by ambient air quality standards but which may reasonably be expected to cause or contribute to irreversible illness or death. Such pollutants include asbestos, beryllium, mercury, benzene, coke oven emissions, radionuclides, and vinyl chloride.

Hazardous Ranking System: The principle screening tool used by FEPA to evaluate risks to public health and the environment associated with abandoned or uncontrolled hazardous waste sites.

Hazardous Substance: 1. Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. 2. Any substance designated by FEPA to be reported if a designated quantity of the substance is spilled in the waters of Nigeria or if otherwise emitted to the environment.

Hazardous Waste: By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appears on special FEPA lists.

Hazards Analysis: The procedures involved in (1) identifying potential sources of release of hazardous materials from fixed facilities or transportation accidents: (2) determining the vulnerability of a geographical area to a release of hazardous materials; and (3) comparing hazards to determine which present greater or lesser risks to a community.

Hazards Identification: Providing information on which facilities have extremely hazardous substances, what those chemicals are, and how much there is at each facility. The process also provides information on how the chemicals are stored and whether they are used at high temperatures.

Heat Island Effects: A "dome" of elevated temperatures over an urban area caused by structural and pavement heat fluxes, and pollutant emissions from the area below the dome.

Heavy Metals: Metallic elements with high atomic weights, e.g. mercury, chromium, cadmium,

arsenic, and lead. They can damage living things at low concentration and tend to accumulate in the food chain.

Heptachlor: An insecticide allowed only for use in seed treatment.

Herbicide: A chemical pesticide designed to control or destroy plants, weeds, or grasses.

Herbivore: An animal that feeds on plants.

Heterotrophic Organisms: Consumers such as humans and animals and decomposers-chiefly bacteria and fungi - that are dependent on organic matter for food.

High-Density Polyethylene: A material that produces toxic fumes when burned. Used to make plastic bottles and other products.

High-Level Radioactive Waste (HLW): Waste generated in the fuel of a nuclear reactor, found at nuclear reactors or nuclear fuel reprocessing plants. It is a serious threat to anyone who comes near the wastes without shielding (See : Low-Level Radiactive Waste).

Holding Pond: A pond or reservoir, usually made of earth, built to store polluted runoff.

Hood Capture Efficiency: The emissions from a process which are captured by hood and directed into the control device, expressed as a per cent of all emissions.

Host: 1. In genetics, the organism, typically a bacterium, into which a gene from another organism is transplanted. 2. In medicine, an animal infected by or parasitized by another organism.

Humus: Decomposed organic material.

Hybrid: A cell organism resulting from a cross between two unlike plant or animal cells or organisms.

Hybridoma: A hybrid cell that produces monoclonal antibodies in large quantities.

Hydrocarbons (HC): Chemical compounds that consist entirely of carbon and hydrogen.

Hydrogen Sulphide (HS): Gas emitted during organic decomposition. Also a by product of oil refining and burning. It smells like rotten eggs and, in heavy concentration, can cause illness.

Hydrogeology: The geology of ground water, with particular emphasis on the chemistry and movement of water.

Hydrology: The science dealing with the properties, distribution, and circulation of water.

I

Ignitable: Capable of burning or causing a fire.

Impoundment: A body of water or sludge confined by a dam, dike, floodgate, or other barrier.

Immediately Dangerous to Life and Health (IDLH): The maximum level to which a healthy individual can be exposed to a chemical for 30 minutes and escape without suffering irreversible health effects or impairing symptoms. used as "level of concern". (See: level of concern).

In vitro: 1. "In glass", a test-tube culture. 2. Any laboratory test using living cells taken from an organism.

In vivo: In the living body of a plant or animal. In vivo tests are those laboratory experiments carried out on whole animals or human volunteers.

Incineration: Burning of certain types of solid, liquid or gaseous materials. 2. A treatment technology involving destruction of waste by controlled burning at high temperatures, e.g., burning sludge to remove the water and reduce the remaining residues to a safe, non-burnable ash which can be disposed of safely on land, in some waters or in underground locations.

Incineration at Sea: Disposal of waste by burning at sea on specially-designed incinerator ships.

Incinerator: A furnace for burning wastes under controlled conditions.

Incompatible waste: A dangerous waste which is unsuitable for placement in a particular device or facility because it may corrode or decay the containment materials, or is unsuitable for mixing with another waste or material because the mixture might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, fumes, mists, or gases, or flammable fumes.

Indicator: In biology, an organism, species, or community whose characteristics show the presence of specific environmental conditions.

Indirect Discharge: Introduction of pollutants from a non-domestic source into a publicly owned waste treatment system. Indirect discharges can be commercial or industrial facilities whose wastes go into the local sewers.

Indoor Air: The breathing air inside a habitable structure or conveyance.

Indoor Air Pollution: Chemical, physical, or biological contaminants in indoor air.

Indoor Climate: Temperature, humidity, lighting and noise levels in a habitable structure or conveyance. Indoor climate can affect indoor air pollution.

Inert Ingredient: Pesticide components such as solvents, carriers, and surfactants that are not active against target pests. Not all inert ingredients are innocuous.

Inert Separator: A device that uses entrifugal force to separate waste particles.

Infiltration: 1. The penetration of water through the ground surface into sub-surface solid or the penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls, 2. A land application technique where large volumes of waste water are applied to land, allowed to penetrate the surface and percolate through the underlying soil. (See percolation).

Inflow: Entry of extraneous rain water into a sewer system from sources other than infiltration, such as basement drains, manholes, storm drains, and street washing.

Influent: Water, wastewater, or other liquid flowing into a reservoir, basin, or treatment plant.

Inhalation LC_{50}: A concentration in milligrams of substance per litre of air which, when administered to the respiratory tract for 4 hours, kills within 14 days half of a group of ten rats each weighing between 200 and 300 grams.

Injection Well: A well into which fluids are injected for purposes such as waste disposal, improving

the recovery of crude oil, or solution mining.

Injection Zone: A geological formation, group of formations, or part of a formation receiving fluids through a well.

Island Water: Water not subject to tidal influence.

Inner Liner: A continuous layer of material placed inside a tank or container which protects the construction materials of the tank or container from the wastes or reagents used to treat the waste.

Inoculum: 1. Bacterium placed in compost to start biological action. 2. A medium containing organisms which is introduced into cultures or living organisms.

Inorganic Chemicals: Chemical substances of mineral origin, not of basically carbon structure.

Insecticide: A pesticide compound specifically used to kill or control the growth of insects.

Inspection and Maintenance (I/M): 1. Activities to assure proper emissions-related operation of mobile sources of air pollutants, particularly automobile emissions controls. 2. Also applies to wastewater treatment plants and other anti-pollution facilities and processes.

Instream Use: Water use taking place within a stream channel, e.g., hydro-electric power generation, navigation, water-quality improvement, fish propagation, recreation.

Integrated Pest Management (IPM): A mixture of pesticide and non-pesticide methods to control pests.

Interceptor Sewers: Large sewer lines that, in a combined system, control the flow of the sewage to the treatment plant. In a storm, they allow some of the sewage to flow directly into a receiving stream, thus preventing an overload by a sudden surge of water into the sewers. They are also used in separate systems to collect the flows from main and trunk sewers and carry them to treatment points.

Interstate Waters: Waters that flow across or form part of state or international boundaries.

Interstitial Monitoring: The continuous surveillance of the space between the walls of an underground storage tank.

Inversion: An atmospheric condition caused by a layer of warm air preventing the rise of cooling air trapped beneath it. This prevents the rise of pollutants that might otherwise be dispersed and can cause an air pollution episode.

Ion: An electrically charged atom or group of atoms which can be drawn from waste water during the electrodialysis process.

Ion Exchange Treatment: A common water softening method often found on a large scale at water purification plants that rem some organics and radium by adding calcium oxide or calcium hydroxide to increase the p to a level where the metals will precipitate out.

Ionization Chamber: A device that measures the intensity of ionizing radiation.

Ionizing Radiation: Radiation that can remove electrons from atoms, i.e., alpha, beta, and gamma radiation.

Irradiated Food: Food that has been subject to brief radioactivity, usually by gamma rays, to kill

insects, bacteria, and mold, and preserve it without refrigeration or freezing.

Irradiation: Exposure to radiation of wavelengths shorter than those of visible light (gamma, x-ray, or ultraviolet), for medical purposes, the destruction of bacteria in milk or other food stuffs, or for inducing polymerization of monomers or vulcanization of rubber.

Irrigation: Technique for applying water or wastewater to land areas to supply the water and nutrient needs of plants.

Isotope: A variation of an element that has the same atomic number but a different weight because of its neutrons, various isotopes of the same element may have different radioactive behaviour.

K

Kinetic Rate Coefficient: A number that describes the rate at which a water constitute such as a biochemical oxygen demand or dissolved oxygen increases or decreases.

L

Lagoon: (1) A shallow pond where sunlight, bacterial action, and oxygen work to purify wastewater, also used for storage of wastewaters or spent nuclear fuel rods (2) Shallow body of water, often separated from the sea by coral reefs or sandbars.

Land Application: Discharge of wastewater onto the ground for treatment or reuse. (See: irrigation).

Land Farming (of waste): A disposal process in which hazardous waste deposited on or in the soil is naturally degraded by microbes.

Landfills: 1. Sanitary landfills are land disposal sites for non-hazardous solid wastes at which the waste is spread in layers, compacted to the smallest practical volume, and cover material applied at the end of each operating day. 2. secure chemical landfills are disposal sites for hazardous wastes. They are selected and designed to minimize the chance of release of hazardous substances into the environment.

Land treatment: The practice of allowing dangerous waste onto or incorporating dangerous waste into the soil surface so that it will degrade or decompose. if the waste will remain after the facility is closed, this practice is disposal.

Lateral Sewers: Pipes that run under city streets and receive the sewage from home and businesses.

LC 50/Lethal Concentration: Median level concentration, a standard measure of toxicity. It tells how much of a substance is needed to kill half of agroup of experimental organisms at a specific time of observation. (See: LD 50).

Leachate: A liquid that results from water collecting contaminants as it trickles through wastes, agricultural pesticides or fertilizers. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, ground water, or soil.

Leachate Collection System: A system that gathers leachate and pumps it to the surface for treatment.

Leaching: The process by which soluble constituents are dissolved and carried down through the soil

by a percolating fluid. (See: Leachate).

Lead (Pb): A heavy metal that is hazardous to health if breathed or swallowed. Its use in gasoline, paints, and plumbing compounds has been sharply restricted or eliminated by federel laws and regulations. (See: heavy metals).

Leaded Gasoline: Gasoline to which lead has been added to raise the octane level.

LD50/Lethal Dose: The dose of a toxicant that will kill 50 per cent of the test organisms within a designated period of time. The lower the LD 50, the more toxic the compound.

LDO: The highest concentration of a toxic substance at which none of the organisms die.

LD L0: The lowest concentration and dosage of a toxic substance which kills test organisms.

Level of Concern (LOC): The concentration in air of an extremely hazardous substance above which there may be serious immediate health effects to anyone exposed to it for short periods of time.

Lift: In a sacitary landfill, a compacted layer of solid waste and the top layer of cover material.

Lifting Station: (See: Pumping station).

Limestone Scrubbing: Process in which sulfur gases moving towards a smokestack are passed through a limestone and water solution to remove sulfur before it reaches the atmosphere.

Limiting Factor: A condition, whose absence, or excessive concentration, is incompatible with the needs or tolerance of a species or population and which may have a negative influence on their ability to grow or even survive.

Limnology: The study of the physical, chemical, meteorological, and biological aspects of fresh water.

Liner: 1. A relatively impermeable barrier designed to prevent leachate from leaking from a landfill. Liner materials include plastic and dense clay. 2. An insert or sleeve for sewer pipes to prevent leakage or infiltration.

Lipid Solubility: The maximum concentration of a chemical that will dissolve in fatty substances; lipid soluble substances are insoluble in water. If a substance is lipid soluble it will very selectively disperse through the environment via living tissue.

Liquefaction: Changing a solid into a liquid.

Lower Explosive Limit (LEL): The concentration of a compound in air below which a flame will not propagate if the mixture is ignited.

Lowest Achievable Emission Rate: This is the rate of emissions which reflects (a) the most stringent emission limitation which is contained in the implementation plan of any state for such source unless the owner or operator of the proposed source demonstrates such limitations are not achievable; or (b) the most stringent emissions limitation achieved in practice, which ever is more stringent. Application of this term does not permit a proposed new or modified source or emit pollutants in excess of existing new source standards.

Low-Level Radioactive Waste (LLRW): Wastes less hazardous than most of those generated by a

nuclear reactor. Usually generated by hospitals research laboratories, and certain industries. The Energy Commission and FEPA share responsibilities for managing them. (See: high-level radioactive wastes).

M

Marine Sanitation Devices: Any equipment installed on board a vessel to receive, retain, treat, or discharge sewage and any process to treat such sewage.

Major Modification: This term is used to define modifications with respect to Prevention of Significant Deterioration and New Source Review, and refers to modifications to major stationary sources of emissions and provides significant pollutant increase levels below which a modification is not considered major.

Major Stationary Sources: Term used to determine to applicability of Prevention of Significant Deterioration and new source regulations. In a non-attainment area, any stationary pollutant source that has a potential to emit more than 100 tons per year is considered a major stationary source. In PSD areas the cutoff level may be either 100 or 250 tons, depending upon the type of source.

Manufacturers Formulation: A list of substances or component parts as described by the maker of a coating, pesticide or other product containing chemicals or other substances.

Marsh: A type of a wetland that does not accumulate appreciable peat deposits and is dominated by herbaceous vegetation. Marshes may be either fresh or saltwater and tidal or non-tidal. (See: wetlands).

Matabolite: Any substance produced in or by biological processes and derived from a pesticide.

Maximum Contaminant Level: The maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards.

Mechanical Aeration: Use of mechanical energy to inject air into water to cause a waste stream to absorb oxygen.

Mechanical Turbulence: Random irregularities of fluid motion in air caused by buildings or mechanical, non-thermal processes.

Media: Specific environmentas- air, water, soil - which are the subject or regulatory concern and activities.

Mercury: A heavy metal that can accumulate in the environment and is highly toxic if breathed or swallowed. (See: heavy metals).

Methane: A colourless, non-poisonous, flammable gas created by anaerobic decomposition of organic compounds.

Microbes: Microscopic organisms such as algae, animals, viruses, bacteria, fungus, and protozoa, some of which causes diseases. (See: micro-organism).

Mist: Liquid particles measuring 500 to 40 microns, that are formed by condensation of vapour. By comparison, "fog" particles are smaller than 40 microns.

Mitigation: Measures taken to reduce adverse impacts on the environment.

Mixed Liquor: A mixture of activated sludge and water containing organic matter undergoing activated sludge treatment in an aeration tank.

Mobile Source: A moving producer of air pollution, mainly forms of transportation such as cars, trucks, motorcycles, airplanes.

Modelling: An investigative technique using a mathematical or physical representation of a system or theory that accounts for all or some of its known properties. Models are often used to test the effect of changes of system components on the overall performance of the system.

Model Plant: A description of a typical but theoretical plant used for developing economic, environmental impact and energy impact analyses as support for regulations or regulatory guidelines. It is an imaginary plant with features of existing or future plants used to estimate the cost of incorporating air pollution control technology as the first step in exploring the economic impact of a potential NSPS.

Monitoring: Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals and other living things.

Monitoring Wells: Wells drilled at a hazardous waste management facility or Superfund site to collect ground-water samples for the purpose of physical, chemical, or biological analysis to determine the amounts, types and distribution of contaminants in the ground water beneath the site.

Monoclonal Antibodies: (Also called MABs and MCAs) Molecules of living organisms that selectively find and attach to other molecules to which their structure conforms exactly. This could also apply to equivalent activity by chemical molecules.

Muck Soils: Earth made from decaying plant materials.

Mulch: A layer of material (wood chips, straw, leaves, etc.) placed around plants to hold moisture, prevent weed growth, protect the plants and enrich the soil.

Multiple Use: Use of land for more than one purpose, i.e., grazing of livestock, wildlife production, recreation, watershed, and timber production. Could also apply to use of bodies of water for recreational purposes,. fishing, and water supply.

Mutagen: Any substance that can cause a change in genetic material.

Mutate: To bring about a change in the genetic constitution of a cell by altering its DNA. In turn, "mutagenesis" is any process by which cells are mutated.

N

National Ambient Air Quality Standards (NAAQS): Air quality standards established by FEPA that apply to outside air throughout the country.

National Response Centre: The FEPA operations centre that receives notifications of all releases of oil and hazardous substances into the environment.

National Response Team (NRT): Representatives of relevant federal agencies that, as a team, co-ordinate federal responses to nationally significant incidents of pollution and provide advice and technical assistance to the responding agency(ies) before and during a response action.

Natural Gas: A natural fuel containing primarily methane and ethane that occurs in certain geologic

formations.

Natural Selection: The process of survival of the fittest by which organisms that adapt to their environment survive and those that do not disappear.

Navigable Waters: Traditionally, waters sufficiently deep and wide for navigation by all, or specified sizes of vessel.

Necrosis: Death of plant or animal cells. In plants, necrosis can discolour areas on the plant or kill it entirely.

Nematocide: A chemical agent which is destructive to nematodes (round worms or threadworms).

Neutralization: Decreasing the acidity or alkalinity of a substance by adding to it alkaline or acidic materials respectively.

New Source: Any stationary source which is built or modified after publication of final or proposed regulations that prescribe a standard of performance which is intended to apply to that type of emission source.

New Source Performance Standards (NSPS:) Uniform national FEPA air emission and water effluent standards which limit the amount of pollution allowed from new sources or from existing sources that have been modified.

Nitrate: A compound containing nitrogen which can exist in the atmosphere or as a dissolved gas in water and which can have harmful effects on humans and animals. Nitrates in water can cause severe illness in infants and cows.

Nitric Oxide (NO): A gas formed by combustion under high temperature and high pressure in an internal combustion engine. It changes into nitrogen dioxide in the ambient air and contributes to photochemical smog.

Nitrification: The process whereby ammonia in wastewater is oxidized to nitrite and then to nitrate by bacterial or chemical reactions.

Nitrilotriacetic Acid (NTA): A compound being used to replace phosphates in detergents.

Nitrite: 1. An intermediate in the process of nitrification. 2. Nitrous oxide salts used in food preservation.

Nitrogen Dioxide (NO2): The result of nitric oxide combining with oxygen in the atmosphere. a major component of photochemical smog.

Nitrogenous wastes: Animal or vegetable residues that contain significant amounts of nitrogen.

Nitrogen Oxides (NO_x): Products of combustion from transportation and stationary sources and major contributors to the formation of ozone in the troposphere and acid deposition.

Non-Conventional Pollutant: Any pollutant which is not a statutorily listed or which is poorly understood by the scientific community.

Non-ionizing Electromagnetic Radiation: 1. Radiation that does not change the structure of atoms but does heat tissue and may cause harmful biological effects. 2. Microwaves, radio waves, and low-frequency electromagnetic fields from high-voltage transmission lines.

Non-Point Source: Pollution sources which are diffuse and do not have single point of origin or are not introduced into a receiving stream from a specific outlet. The pollutants are generally carried off the land by stormwater runoff. The commonly used categories for non-point sources are agriculture, forestry, urban, mining, construction, dams and channels, land disposal and saltwater intrusion.

Nuclear Power Plant: A facility that converts atomic energy into usable power, heat produced by a reactor makes steam to drive turbines which produce electricity.

Nuclear Winter: Prediction by some scientists that smoke and debris rising from massive fires resulting from a nuclear war could enter the atmosphere and block out sunlight for weeks or months. The scientists making this prediction project a cooling of the earth's surface, and changes in climate which could, for example, negatively effect world agricultural and weather patterns.

Nutrient: Any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

O

Ocean: A bigger body of water with a higher rate of dispersion and dilusion.

Off-Site Facility: A hazardous waste treatment, storage or disposal area that is located at a place away from the generating site.

Oil Spill: An accidental or intentional discharge of oil which reaches bodies of water. Can be controlled by chemical dispersion, combustion, mechanical containment, and/or adsorption.

Oil Fingerprinting: A method that identifies sources of oil and allows spills to be traced back to their source.

Oligotrophic Lakes: Deep clear lakes with low nutrient supplies. They contain little organic matter and have a high dissolved-oxygen level.

Oncogenic: A substance that causes tumors, whether benighn or malignant.

On Scene Co-ordinator (OSC): An official of a government Agency/Department predestinated by FEPA to co-ordinate and direct spill or dump removal action or oil or hazardous spill corrective action.

On-Site Facility: A hazardous waste treatment, storage or disposal area that is located on the generating site.

Opacity: The amount of light obscured by particulate pollution in the air; clear window glass has a zero opacity, a brick wall has 100 per cent opacity. Opacity is used as an indicator of changes in performances of particulate matter pollution control systems.

Open Burning: Uncontrolled fires in an open dump.

Open Dump: An uncovered site used for disposal of waste without environmental control. (See: dump).

Operable Unit: Term of each of a number of separate activities undertaken as part of a spill or dump site cleanup. A typical operable unit would be removing drums and tanks from the surface of a

site.

Operation and Maintenance: 1. Activities conducted at a site after a spill or dump site action is completed to ensure that the action is effective and operating properly. 2. Actions taken after construction to assure that facilities constructed to treat waste water will be properly operated, maintained, and managed to achieve efficiency levels and prescribed effluent limitations in an optimum manner.

Operator: A person responsible for the overall operation of a facility.

Oral LD50: The single dosage in milligrams per kilogram (mg/kg) body weight, when orally administered, which, within 14 days, kills half a group of ten or more white rats each weighing between 200 and 300 grams.

Organic: Referring to or derived from living organisms. 2. In chemistry, any compound containing carbon.

Organic Chemicals/Compounds: Animal or plant-produced substances containing mainly carbon, hydrogen, and oxygen.

Organic Matter: Carbonaceous waste contained in plant or animal matter and originating from domestic or industrial sources.

Organism: Any living thing.

Organophosphates: Pesticide chemicals that contain phosphorus; used to control insects. They are short-lived, but some can be toxic first applied.

Organotins: Chemical compounds used in anti-foulant paints to protect the hulls of boats and ships, buoys, and dock pilings from marine organisms such as barnacles.

Osmosis: The tendency of a fluid to pass through a permeable membrane such as the wall of a living cell into a less concentrated solution so as to equalize the concentrations on both sides of the membrane.

Outfall: The place where an effluent is discharged into receiving waters.

Overburden: The rock and soil cleared away before mining.

Overfire Air: Air forced into the top of an incinerator or boiler to fan the flames.

Overland Flow: A land application technique that cleanses waste water by allowing it to flow over a sloped surface. As the water flows over the surface, the contaminants are removed and the water is collected at the bottom of the slope for re-use.

Overturn: The period of mixing (turnover), by top to bottom circulation, of previously stratified water masses. This phenomenon may occur in spring and/or fall, or after storms. It results in a uniformity of chemical and physical properties of the water at all depths.

Oxidant: A substance containing oxygen that reacts chemically in air to produce a new substance. The primary ingredient of photochemical smog.

Oxidation Pond: A man-made lake or body of water in which waste is consumed by bacteria. It is used most frequently with other waste-treatment processes. An oxidation pond is basically the same

as a sewage lagoon.

Oxygenerated Solvent: An organic solvent containing oxygen as part of the molecular structure. Alcohols and ketones are oxygenated compounds often used as paint solvents.

Ozonator: A device that adds ozone to water.

Ozone: Found in two layers of the atmosphere, the stratosphere and the troposphere. In the stratosphere (the atmospheric layer beginning 12 to 17 kilometers above the earth's surface) ozone is a form of oxygen found naturally which provides a protective layer shielding the earth from ultraviolet radiation's harmful health effects on humans and the environment. In the troposphere (the layer extending up 12 to 17 kilometers from the earth's surface), ozone is a chemical oxidant and major component of photochemical smog. Ozone can seriously affect the human respiratory system and is one of the most prevalent and widespread urban pollutants. Ozone in the troposphere is produced through complex chemical reactions of nitrogen oxides, which are among the primary pollutants emitted by combustion sources; hydrocarbons, released into the atmosphere through the combustion, handling and processing of petroleum products; and sunlight.

Ozone Depletion: Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to biological life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (Chlorofluorcarbons or halons) which break down when they reach the stratosphere and catalytically destroy ozone molecules.

P

Packed Tower: A pollution control device that forces dirty air through a tower packed with crushed rock or wood chips while liquid is sprayed over the packing material. the pollutants in the air stream either dissolve or chemically react with the liquid.

Pandemic: Widespread throughout an area, nation or the world.

Paraquat: A standard herbicide used to kill various types of crops, including marijuana.

Particulates: Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions.

Particulate Loading: The mass of particulates per unit volume of air or water.

Pathogenic: Capable of causing disease.

Pathogens: Micro-organism that can cause disease in other organisms or in humans, animals and plants. They may be bacteria, viruses, or parasites and are found in sewage, in runoff from animal farms or rural areas populated with domestic and/or wild animals, and in water used for swimming. Fish and shellfish contaminated by pathogens, or the contaminated water itself, can cause serious illnesses.

PCBs: A group of toxic, persistent chemicals (polychlorinated biphenyls) used in transformers and capacitators for insulating purposes and in gas pipeline systems as a lubricant.

Percolation: The movement of water downward and radially through the sub-surface soil layers, usually continuing downward to the ground water.

Permeability: The rate at which liquids pass through soil or other materials in a specified direction.

Permit: An authorization, license, or equivalent control document issued by FEPA or an approved state agency to implement the requirements of an environmental regulation; e.g., a permit to operate a wastewater treatment plant or to operate a facility that may generate harmful emissions.

Persistence: Refers to the length of time a compound, once introduced into the environment, stays there. A compound may persist for less than a second or indefinitely.

Persistent Pesticides: Pesticides that do not break down chemically or breakdown very slowly and that remain in the environment after a growing season.

Pest: An insect, rodent, nematode, fungus, weed or other form of terrestrial or aquatic plant or animal life or virus, bacterial or micro-organism that is injurious to health or the environment.

Pesticide: Substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. Pesticides can accumulate in the food chain and/or contaminate the environment if mis-used.

Pesticide Tolerance: The amount of pesticide residue allowed by law to remain in or on a harvested crop. By using various safety factors, FEPA sets these levels well below the point where the chemicals might be harmful to consumers.

Ph: A measure of the acidity or alkalinity of a liquid or solid material.

Phenols: Organic compounds that are by products of petroleum refining, tanning, and textile, dye, and resin manufacturing. Low concentrations cause taste and odour problems in water; higher concentrations can kill aquatic life and humans.

Pheromone: Hormonal chemical produced by female of a species to attract a mate.

Phosphates: Certain chemical compounds containing phosphorus.

Phosphorus: An essential chemical food element that can contribut to the eutrophication of lakes and other water bodies. Increased phosphorus levels result from discharge of phosphorus containing materials into surface waters.

Photochemical Oxidants: Air pollutants formed by the action of sunlight on oxides of nitrogen and hydrocarbones.

Photochemical Smog: Air pollution caused by chemical reactions of various pollutants emitted from different sources.

Physical and Chemical Treatment: Processes generally used in large-scale waste-water treatment facilities. Physical processes may involve air-stripping or filtration. Chemical treatment includes coagulation, chlorination, or ozone addition. The term can also refer to treatment processes, treatment of toxic materials in surface waters and ground waters, oil spills, and some methods of dealing with hazardous materials on or in the ground.

Phytoplankton: That portion of the plankton community comprised of tiny plants, e.g., algae, diatoms.

Phytotoxic: Something that harms plants.

Picocurie: Measurement of radioactivity. A picocurie is one million millionth, or a trillionth, of a

curie, and represents about 2.2 radioactive particle disintegrations per minute.

Picocuries Per Litre (pCi/l): A unit of measure used for expressing levels of radon gas. (See: picocurie).

Pig: A container, usually lead, used to ship or store radioactive materials.

Pile: 1. The fuel element in a nuclear reactor. 2. A heap of waste.

Placard: proper display and of identification on vehicles transporting dangerous waste.

Plankton: Tiny plants and animals that live and float in water.

Plasmid: A circular piece of DNA that exists apart from the chromosome and replicates independently of it. bacterial plasmids carry information that renders the bacterial resistant to antibiotics. Plasmids are often used in genetic engineering to carry desired genes into organisms.

Plastics: Non-metallic compounds that result from a chemical reaction, and are moulded or formed into rigid or pliable construction materials or fabrics.

Plugging: 1. The act or process of stopping the flow of water, oil, or gas into or out of a formation through a borehole or well penetrating that formation. 2. Stopping a leak or sealing off a pipe or hose.

Plume: 1. A visible or measureable discharge of a contaminant from a given point of origin. Can be visible or thermal in water, or visible in the air, for example, a plume of smoke. 2. The area of measurable and potentially harmful radiation leaking from a damaged reactor. 3. The distance from a toxic release considered dangerous for those exposed to the leaking fumes.

Plutonium: A radioactive metallic element similar chemically to uranium.

Point Source: A stationery location or fixed facility from which pollutants are discharged or emitted. Also, any single identifiable source of pollution, e.g., a pipe, ditch, ship, ore pit, factory smokestack.

Pollen: 1. A fine dust produced by plants. 2. The fertilizing element of flowering plants. 3. A natural or background air pollutant.

Pollutant: Generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

Pollutant Standard Index (PSI). Measure of adverse health effects of air pollution levels in major cities.

Pollution: Generally, the presence of matter or energy whose nature, location or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, and radiological integrity of water.

Polycyclic Aromatic Hydrocarbons (PAH): Hydrocarbon molecules composed of two or more benzene rings. For the purpose of this document, the PAH of concern for designation are only those PAH with more than three rings and less than seven rings.

Polyelectrolytes: Synthetic chemicals that help solids to clump during sewage treatment.

Polymer: Basic molecular ingredients in plastic.

Polyvinyl Chloride (PVC): A tough, environmentally indestructible plastic that releases hydrochloric acid when burned.

Population: A group of interbreeding organisms of the same kind occupying a particular space. Generically, the number of humans or other living creatures is designated to be 30 years.

Post-Closure: The time period following the shutdown of a waste management or manufacturing facility. For monitoring purposes, this is often considered to be 30 years.

Potable Water: Water that is safe for drinking and cooling.

Potentially Responsible Party (PRP): Any individual or company including owners, operators, transporters or generators potentially responsible for, or contributing to, the contamination problems at a spill or dump site whenever possible. FEPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated.

PPM/PPB: Parts per million/parts per billion, a way of expressing tiny concentrations of pollutants in air, water, soil, human tissue, food, or other products.

Precipitate: A solid that separates from a solution because of some chemical or physical change.

Precipitation: Removal of solids from liquid waste so that the hazardous solid portion can be disposed of safely; removal or particles from airborne emissions.

Precipitators: Air pollution control devices that collect particles from an emission.

Precursor: In photochemical terminology, a compound such as volatile organic compound (VOC) that "precedes" an oxidant. Precursors react in sunlight to form ozone or other photochemical oxidants.

Preliminary Assessment: The process of collecting and reviewing available information about a known or suspected waste site or release.

Pressure Sewers: A system of pipes in which water, waste water, or other liquid is transported to a higher elevation by use of pumping force.

Pretreatment: Processes used to reduce, eliminate, or alter the nature of waste water pollutants from non-domestic sources before they are discharged into publicly owned treatment works.

Prevention: Measures taken to minimize the release of wastes to the environment.

Prevention of Significant Deterioration (PSD): FEPA programme in which State and/or Federal permits are required that are intended to restrict emissions for new or modified sources in places where air quality is already better than required to meet primary and secondary ambient air quality standards.

Primary Waste Treatment: First steps in waste water treatment; screens and sedimentation tanks are used to remove most materials that floats or will settle. Primary treatment results in the removal of about 30 per cent of carbonaceous biochemical oxygen demand from domestic sewage.

Process Weight: Total weight of all materials, including fuel, used in a manufacturing process. It is used to calculate the allowable particulate emission rate from the process.

Proteins: Complex nitrogenous organic compounds of high molecular weight that contain amino-acids as their basic unit and are essential for growth and repair of animal tissue. Many proteins are

enzymes.

Protoplast: A membrane-bound cell from which the outer cell wall has been partially or completely removed. The term often is applied to plant cells.

Public Water System: A system that provides piped water for human consumption to at least 15 service connections or regularly serves 25 individuals.

Publicity Owned Treatment Works (POTW): A waste treatment works owned by a State, Unit of Local government, usually designed to treat domestic waste waters.

Pumping Station: Mechanical devices installed in sewer or water systems or other liquid carrying pipelines that move the liquids to a higher level.

Putrescible: Able to rot quickly enough to cause odours and attract flies.

Pyrolysis: Decomposition of a chemical by extreme heat.

Q

Quality Assurance/Quality Control: A system of procedures, checks, audits and corrective actions to ensure that all FEPA research design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.

Quench Tank: A water-filled tank used to cool incinerator residues or hot materials during industrial processes.

R

Radiation Absorbed Dose (RAD): A unit of absorbed dose of radiation. One RAD of absorbed dose is equal to .01 joules per kilogram.

Radiation: Any form of energy propagated as rays, waves, or streams of energetic particles. The term is frequently used in relation to the emission of rays from the nucleus of an atom.

Radiation Standards: Regulations that set maximum exposure limits for protection of the public from radioactive materials.

Radioactive Substances: Substances that emit radiatation.

Radiobiology: The study of radiation effects on living things.

Radio Frequency Radiation: (See Non-ionizing Radiation)

Radionuclide: Radioactive element characterized according to its atomic mass and atomic number which can be man-made or naturally occurring. Radioisotopes can have a long life as soil or water pollutants, and are believed to have potentially mutagenic effects on the human body.

Radius of Vulnerable Zone: The maximum distance from the point of release of a hazardous substance in which the airborne concentration could reach the level of concern under specified weather conditions.

Radon: A colourless naturally occurring, radioactive, inert gaseous element formed by radioactive decay of radium atoms in soil or rocks.

Radon Decay Products: A term used to refer collectively to the immediate products of the radon decay chain. These include Po-218, PB-214, Bi-214, and Po-214, which have an average combined half-life of about 30 minutes.

Rasp: A machine that grinds waste into a manageable material and helps prevent odour.

Raw Sewage: Untreated waste water.

Reasonably Available Control Technology (RACT): The lowest emissions limit that a particular source is capable of meeting by the application of control technology that is both reasonably available, as well as technologically and economically feasible. RACT is usually applied to existing sources in non-attainment areas and most cases is less stringent than new source performance standards.

Receiving Waters: A river, lake, ocean, stream or other water-course into which waste water or treated effluent is discharged.

Recharge: The process by which water is added to a zone of saturation, usually by percolation from the soil surface, e.g., the recharge of an aquifer.

Recharge Area: A land area in which water reaches to the zone of saturation from surface infiltration, e.g., an area where rainwater soaks through the earth to reach an aquifer.

Reclaim: To process a material in order to recover useable products, or to regenerate the material. Reclamation is the process of reclaiming.

Recombinant Bacteria: A type of micro-organism whose genetic makeup has been altered by deliberate introduction of new genetic elements. The offspring of these altered bacteria also contain these new genetic elements.

Recombinant DNA (rDNA): The new DNA that is formed by combining pieces of DNA from different organisms or cells.

Recommended Maximum Contaminant Level (RMCL): The maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on human health would occur, and which includes an adequate margin of safety. Recommended levels are non-enforceable health goals. (See maximum contaminant level).

Record of Decision (ROD): A public document that explains which cleanup alternative(s) will be used for a spill or dump cleanup.

Recover: Extract a useable material from a solid or dangerous waste through a physical, chemical, biological, or thermal process. Recovery is the process of recovering.

Re-cycle/Re-use: The process of minimizing the generation of waste by recovering useable products that might otherwise become waste. Examples are the recycling of aluminium cans, waste paper, and bottles.

Red Tide: A proliferation of a marine plankton that is toxic and often fatal to fish. This natural phenomenon may be stimulated by the addition of nutrients. A tide can be called red, green or brown, depending on the coloration of the plankton.

Re-entry Interval: The period of time immediately following the application of a pesticide during which unprotected workers should not enter a field.

Refuse: (See solid waste).

Refuse Reclamation: Conversion of solid waste into useful products, e.g., composting organic wastes to make the soil conditioners or separating aluminium and other metals for melting any recycling.

Regeneration: Manipulation of individual cells or masses of cells to cause them to develop into whole plants.

Regional Response Team (RRT): Representatives of FEPA, local and State agencies who may assist in co-ordination of activities at the request of the On-Scene Co-ordinator before and during an environmental accident such as oil spill, cleaning up of highly polluted water.

Registrant: Any manufacturer or formulator who obtains registration for a pesticide active ingredient or product.

Registration: Formal listing with FEPA and Ministry of Health of a new pesticide before it can be sold or distributed in intra- or inter-state commerce. The product must be registered with the Federal Ministry of Health. Ministry of Health is responsible for registration (pre-market licensing) of pesticides on the basis of data demonstrating that they will not cause unreasonable adverse effects on human health or the environment when used according to approved label directions.

Registration Standards: Published reviews of all the data available on pesticide active ingredients.

Roantgen Equivalent Man (REM): The unit of dose equivalent from ionizing radiation to the human body, used to measure the amount of radiation to which a person or a part of a human has been exposed.

Remedial Action (RA): The actual construction or implementation phase of a spill or dumps site cleanup that follows remedial design.

Remedial design (RD): A phase of remedial action that follows the remedial investigation/feasibility study and includes development of engineering drawing and specifications for a site cleanup.

Remedial Investigation: An in-depth study designed to gather the data necessary to determine the nature and extent of contamination at a spill or dump site; establish criteria for cleaning up the site; identify preliminary alternatives for remedial actions; and support the technical and cost analyses of the alternatives. The remedial investigation is usually done with the feasibility study. Together they are usually referred to as the "RI/RS".

Remedial Project Manager (RPM): The FEPA or State official responsible for overseeing remedial action at a site.

Remedial Response: A long-term action that stops or substantially reduces a release or threat of a release of hazardous substances that is serious but not an immediate threat to public health.

Removal Action: Short-term immediate action taken to address releases of hazardous substances that require expedited response. (See: cleanup).

Reportable Quantity (RQ): The quantity of a hazardous substance that triggers reports. If a substance is released in amounts exceeding its RQ, the release must be reported to the National Response Center, the State, and community emergency co-ordinators for areas likely to be affected.

Representative Sample: A sample which can be expected to exhibit the average properties of the sample sources.

Requirement: This is used to describe an administrative decision by a regulatory body to fulfill a given mission. It does not necessarily have a scientific justification.

Re-registration: The re-evaluation and re-licensing of existing pesticides originally registered prior to current scientific and regulatory standards. Ministry of Health re-registers pesticides through its Registration Program.

Reservoir: Any natural or artificial holding area used to store, regulate, or control water.

Residual: Amount of a pollutant remaining in the environment after a natural or technological process has taken place, e.g., the sludge remaining after initial wastewater treatment, or particulates remaining in air after the air passes through a scrubbing or process.

Resistance: For plants and animals, the ability to withstand poor-environmental conditions and/or attacks by chemicals or disease. The ability may be inborne or developed.

Resource: A person, thing, or action needed for living or to improve the quality of life.

Response Action: A FEPA authorized action involving either a short-term removal action or a long-term removal response that may include but is not limited to: removing hazardous materials from a site to a FEPA-approved hazardous waste facility for treatment, containment, or destruction; containing the waste safely on-site, destroying or treating the waste on-site; and identifying and removing the source of ground-water contamination and halting further migration of contaminants. (See: cleanup).

Resource Recovery: The process of obtaining matter or energy from materials formerly discarded.

Restoration: Measures taken to return a site to pre-violation conditions.

Restricted Use: When a pesticide is registered, some or all of its uses may be classified for restricted use if the pesticide requires special handling because of its toxicity. Restricted use pesticides may be applied only by trained, certified applicators or those under their direct supervision.

Restriction Enzymes: Enzymes that recognize certain specific regions of a long DNA molecule and then cut the DNA into smaller pieces.

Reverse Osmosis: A water treatment process used in small water systems by adding pressure to force water through a semi-permeable membrane. Rverse osmosis removes most drinking water contaminants. Also used in wastewater treatment. Large-scale reverse osmosis plants are now being developed.

Ribonucleic Acid (RNA): A molecule that carries the genetic message from DNA to a cell's protein-producing mechanisms; similar to, but chemically different from, DNA.

Riparian Habitat: Areas adjacent to rivers and streams that have a high density, diversity, and productivity of plant and animal species relative to nearby uplands.

Riparian Rights: Entitlement of a land owner to the water on or bordering his property, including the right to prevent diversion or misuse of upstream waters. Generally, a matter of state law.

Risk Assessment: The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of

specific pollutants.

Risk Communication: The exchange of information about health or environmental risks between risk assessors, risk managers, the general public, news media, interest groups, etc.

Run-Off: Any rainwater, leachate, or other liquid which drains over land from any part of a facility.

Run-On: Any rainwater, leachate, or other liquid which drains over land onto any part of a facility.

S

Salinity: The degree of salt in water.

Salts: Minerals that water picks up as it passes through the air, over and under the ground, and as it is used by households and industry.

Salt Water Intrusion: The invation of fresh surface or ground water by salt water. If the salt water comes from the ocean it may be called sea water intrusion.

Salvage: The utilization of waste materials.

Sanitation: Control of physical factors in the human environment that could harm development, health, or survival.

Sand Filters: Devices that remove some suspended solids from sewage. Air and bacteria decompose additional wastes filtering through the sand so that cleaner water drains from the bed.

Sanitary Survey: An on-site review of the water sources, facilities, equipment, operation and maintenance of a public water system to evaluate the adequacy of these elements for producing and distributing safe drinking water.

Saturated Zone: A subsurface area in which all pores and cracks are filled with water under pressure equal to or greater than that of the atmosphere.

Scrap: Materials discarded from manufacturing operations that may be suitable for reprocessing.

Scrap Metal: Bits and pieces of metal parts (e.g., bars, turnings, rods, sheets, wire) or metal pieces that may be combined together with bolts or soldering (e.g. radiators, scrap automobiles, railroad box cars), which when worn or superfluous can be recycled.

Screening: Use of screens to remove coarse floating and suspended solids from sewage.

Scrubber: An air pollution device that uses a spray of wate or reactant or a dry process to trap pollutants in emissions.

Secondary Drinking Water Regulations: Unenforceable regulations which apply to public water systems and which specify the maximum contamination levels which, in the judgement of FEPA, are required to protect the public welfare. These regulations apply to any contaminants, that may adversely affect the odour or appearance of such water and consequently may cause people served by the system to discontinue its use.

Secondary Treatment: The second step in most publicly owned waste treatment systems in which bacteria consume the organic parts of the waste. It is accomplished by bringing together waste,

bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 per cent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment. (See: primary, tertiary treatment).

Secure Chemical (See: landfills).

Secure Maximum Contaminant Level: Maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a water supply, the consumer, or of contamination resulting from corrosion of piping and plumbing caused by water quality.

Sediments: Soil, sand, and minerals washed from land into water usually after rain. They pile up in reservoirs, rivers and harbours, destroying fish-nesting areas and holes of water animals, and clouding the water so that needed sunlight might not reach aquatic plants. Careless farming, mining, and building activities will expose sediment materials, allowing them to be washed off the land after rainfalls.

Sedimentation: Letting solids settle out of wastewater by gravity during wastewater treatment.

Sedimentation Tanks: Holding areas for wastewater where floating wastes are skimmed off and settled solids are removed for disposal.

Selective Pesticide: A chemical designed to affect only certain types of pests leaving other plants and animals unharmed.

Semi-Confined Aquifer: An aquifer that is partially confined by a soil layer (or layers) of low permeability through which recharge and discharge can occur.

Senescence: Term for the aging process. Sometimes used to describe lakes or other bodies of water in advanced stages of eutrophication.

Septic Tank: An underground storage tank for wastes from homes having no sewer line to a treatment plant. The waste goes directly from the home to the tank, where the organic waste is decomposed by bacteria and the sludge settles to the bottom. The effluent flows out of the tank into the ground through drains; the sludge is pumped out periodically.

Service Connector: The pipe that carries tap water from the public water main to a building.

Settleable Solids: Materials heavy enough to sink to the bottom of a wastewater treatment tank.

Settling Chamber: A series of screens placed in the way of the gases to slow thestream of air, thus helping gravity to pull particles out of the emission into a collection area.

Settling Tank: A holding area for wastewater, where heavier particles sink to the bottom for removal and disposal.

Sewage: The waste and wastewater produced by residential and commercial establishments and discharged into sewers.

Sewage Lagoon: (See: Lagoon).

Sewage Sludge: Sludge produced at a Publicly Owned Treatment Workds.

Sewage Works: A wastewater trreatment plant.

Sewer: A channel or conduit that carries wastewater and stormwater runoff from the source to a

treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers are used for both purposes.

Sewerage: The entire system of sewage collection, treatment, and disposal.

Shotgun: Non-scientific term for the process of breaking up the DNA derived from an organism and then moving each separate and unidentified DNA fragment into a bacterium.

Signal Words: The words used on a pesticide label - Danger, Warning, Caution - to indicate the level of toxicity of the chemicals.

Significant Deterioration: Pollution resulting from a new source in previously "clean" areas. (See: prevention of significant deterioration).

Significant Municipal Facilities: These publicly owned sewage treatment plants that discharge 4 million litres per day or more and are therefore considered by States to have the potential for substantial effect on the quality of receiving waters.

Significant Violations: Violations by point source discharges of sufficient magnitude and/or duration to be a regulatory priority.

Silt: Fine particles of sand or rock that can be picked up by the air or water and deposited as sediment.

Silviculture: Management of forest land for timber. Sometimes contributes to water pollution, as in clear-cutting.

Sinking: Controlling oil spills by using an agent to trap the oil and sink it to the bottom of the body of water where the agent and the oil are biodegraded.

Site Inspection: The collection of information from a site to detemine the extent and severity of hazards posed by the site. It follows and is more extensive that a preliminary assessment. The purpose is to gather information necessary to score the site, using the Hazard Ranking System and to determine if the site presents an immediate threat requires prompt removal action.

Siting: The process of choosing a location for a facility.

Skimming: Using a machine to remove oil or scum from the surface of the water.

Slow Sand Filtration: Treatment process involving passage of raw water through a bed of sand at low velocity which results in the substantial removal of chemical and biological contaminants.

Sludge: A semi-solid residue from any of a number of air or water treatment processes. Sludge can be a hazardous waste.

Slurry: A watery mixture of insoluble matter that results from some pollution control techniques.

Smelter: A facility that melts or fuses ore, often with an accompanying chemical change, to separate the metal. Emissions are known to cause pollution. Smelting is the process involved.

Smog: Air pollution associated with oxidants. (See: photochemical smog).

Smoke: Particles suspended in air after incomplete combustion of materials.

Soft Detergents: Clearing agents that break down in nature.

Soft Water: Any water that is not "hard" i.e., does not contain a significant amount of dissolved minerals such as salts containing calcium or magnesium.

Solid Adsorption Field: A sub-surface area containing a trench or bed with clean stones and a system of distribution piping through which treated sewage may seep into the surrounding soil for further treatment and disposal.

Soil Conditioner: A organic material like humus or compost that helps soil absorb water, build a bacterial community, and distribute nutrients and minerals.

Soil Gas: Gaseous elements and compounds that occur in the small spaces between particles of the earth and soil. Such gases can move through or leave the soil or rock, depending on changes in pressure.

Solder: A metallic compound used to seat the joints between pipes. Until recently, most solder contained 50 per cent lead.

Sole Source Aquifer: An aquifer that supplies 50 per cent or more of the drinking water of an area.

Solid Waste: Non-liquid, non-soluble materials ranging from municipal garbage to industrial wastes that contain complex, and sometimes, hazardous substances. Solid wastes also include sewage sludge, agricultural refuse, demolition wastes, and mining residues. Technically, solid waste also refers to liquids and gases in containers.

Solid Waste Disposal: The final placement of refuse that is not salvaged or recycled.

Solid Waste Management: Supervised handling of waste materials from their source through recovery processes to disposal.

Solidification and Stabilization: Removal of wastewater from a waste or changing it chemically to make the waste less permeable and susceptible to transport by water.

Solvent: Substance (usually liquid) capable of dissolving of dispersing one or more other substances.

Soot: Carbon dust formed by incomplete combustion.

Sorption: The Action of soaking up or attracting substances. A process used in may pollution control systems.

Source: Any building, structure, facility, or installation from which there is or may be the discharge of pollutants.

Special Review: Formally known as Rebuttable Presumption Against Registration (RPAR), this is the regulatory process through which existing pesticides suspected of posing unreasonable risks to human health, non-target organisms, or the environment are referred to review by FEPA. The review requires an intensive risk/benefit analysis with opportunity for public comment. If the risk of any use of a pesticide is found to outweigh social and economic benefits, regulatory actions - ranging from label revisions and use-restriction to cancellation or suspended registration - can be initiated.

Species: A reproductively isolated aggregate of interbreeding populations of organisms.

Spent Material: Any material that has been used and as a result of contamination can no longer

serve the purpose for which it was produced without processing.

Spill Prevention Control and Countermeasures Plan (SPCC): Plan covering the release of hazardous substance as defined in Decrees 42 and 58 of 1988.

Sprawl: Unplanned development of open land.

Spoil: Dirt or rock that has been removed from its original location, destroying the composition of the soil in the process, as with strip-mining or dredging.

Stabilization: Conversion of the active organic matter in sludge into inert, harmless material.

Stabilization Ponds: (See Lagoon).

Stable Air: A mass of air that is not moving normally, so that it holds rather than disperses pollutants.

Stock Effect: Used air, as in a chimney, that moves upward because it is warmer than the surrounding atmosphere.

Stack Gas: (See: flue gas).

Stagnation: Lack of motion in a mass of air or water, which tends to hold pollutants.

Standards: Prescriptive norms which govern action and actual limits on the amount of pollutants or emissions produced. FEPA, under most of its responsibilities, establishes minimum standards.

State Emergency Response Commission (SERC): Commission appointed by each State governor according to the requirements of the State. The SERC's designate emergency planning districts, appoint local emergency planning committees, and supervise and co-ordinate their activities.

State Implementation Plans (SIP): FEPA-approved State plans for the establishment, regulation, and enforcement or air pollution standards.

Stationary Source: A fixed, non-moving producer of pollution, mainly power plants and other facilities using industrial combustion processes.

Sterilization: 1. In pest control, the use of radiation and chemicals to damage body cells needed for reproduction. 2. The destruction of all living organisms in water or on the surface of various materials. In contrast, disinfection by the destruction of most living organisms in water or on surfaces.

Storage: Temporary holding of waste pending treatment or disposal. Storage methods include containers, tanks, wastes piles, and surface impoundments.

Storm Sewer: A system of pipes (separate from sanitary sewers) that carry only water runoff from building and land surfaces.

Stratification: Separating into layers.

Stratosphere: The portion of the atmosphere that is 10-to-25 miles above the earth's surface

Strip-Cropping: Growing crops in a systematic arrangement of strips or bands which serve as barriers to wind and water erosion.

Strip-Mining: A process that uses machines to scrape soil or rock away from mineral deposits just under the earth's surface.

Suden Accident: An unforeseen and unexpected occurrence which is not continuous or repeated in nature.

Sulfur Dioxide (SO2): A heavy, pungent, colourless, gaseous air pollutant formed primarily by the combustion of fossil plants.

Sump: A pit or tank that catches liquid runoff for drainage or disposal.

Sump Pump: A mechanism for removing water or wastewater from a sump or wet well.

Surface Impoundment: Treatment, storage, or disposal of liquid hazardous wastes in ponds.

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.

Surfactant: A surface-active agent used in detergents to cause lathering.

Surveillance system: A series of monitoring devices designed to determine environmental quality.

Suspended Solids: Small particles of solid pollutants that float on the surface of, or are suspended in sewage or other liquids. They resist removal by conventional means. (See: Total Suspended Solids).

Suspension: The act of suspending the use of pesticide when FEPA deems it necessary to do so in order to prevent an imminent hazard resulting from continued use of the pesticide. An emergency suspension takes effect immediately; under an ordinary suspension goes into effect. Such a hearing process might take six months.

Suspension Culture: Individual cells or small clumps of cells growing in a liquid nutrient medium.

Swamp: A type of wetland that is dominated by woody vegetation and does not accumulate appreciable peat deposits. Swamps may be fresh or salt water and tidal or non-tidal. (See: Wetlands)

Synergism: The co-operative interaction of two or more chemicals or other phenomena producing a greater total effect than the sum of their individual effects.

Synthetic Organic Chemicals (SOCs): Man-made organic chemicals. Some SOCs are volatile, others tend to stay dissolved in water rather than evaporate out of it.

Systemic Pesticide: A chemical that is taken up from the ground or absorbed through the surface and carried through the system of the organism being protected, making the organism toxic to pests.

T

Tailings: Residue of raw materials or waste separated out during the processing of crops or mineral ores.

Tank: A stationary device designed to contain an accumulation of dangerous waste, and which is constructed primarily of non earthen materials to provide structural support.

TBT Paints (Trybutilin) (See: organotins)

Technology-Based Standards: Effluent limitations applicable to direct and indirect sources which are developed on a category-by category basis using statutory factors, not including water quality effects.

Teratogen: Substance that causes malformation or serious deviation from normal development of embryos and fetuses.

Terracing: Diking, built along the contour of sloping agricultural land, that holds runoff and sediment to reduce erosion.

Tertiary Treatment: Advanced cleaning of wastewater that goes beyond the secondary or biological state. It removes nutrients such as phosphorus and nitrogen and most BOD and suspended solids.

Thermal Pollution: Discharge of heated water from industrial processes that can affect the life processes of aquatic organisms.

Thermal treatment: The use of a device which uses primarily elevated temperatures to treat a dangerous waste.

Threshold Limit Value (TLV): Represents the air concentrations of chemical substances to which it is believed that workers may be daily exposed without adverse effect.

Threshold Planning Quantity: A quantity designated for each chemical on the list of extremely hazardous substances that triggers notification by facilities to the State emergency response commission that such facilities are subject to emergency planning under FEPA.

Tidal Marsh: Low, flat marshlands traversed by channels and tidal hollows and subject to tidal inundation; normally, the only vegetation present are salt-tolerant bushes and grasses. (See: Wetlands).

TLM 96: Same as "Aquatic LC50".

Tolerances: The permissible residue levels for pesticides in raw agricultural produce and processed foods. Whenever a pesticide is registered for use on a food or a feed crop, a tolerance (or exemption from the tolerance requirement must be established. Federal Ministry of Health establishes the tolerance levels which are enforced by the Food and Drug Administration and the Ministry of Agriculture.

Topography: The physical features of a surface area including relative elevations and the position of natural and man-made features.

Totally enclosed treatment facility: A facility for treating dangerous waste which is directly connected to a production process and which prevents the release of dangerous waste or dangerous waste constituents into the environment during treatment.

Total Suspended Solids (TSS): A measure of the suspended solids in wastewater, effluent, or water bodies, determined by using tests for "total suspended non-filterable solids." (See: suspended solids).

Toxic: Harmful to living organisms.

Toxic Pollutants: Materials contaminating the environment that cause death, disease, birth defects in organisms that ingest or absorb them. The quantities and length of exposure necessary to cause these effects can vary widely.

Toxic Cloud: Airborne mass of gases, vapours, fumes, or aerosols containing toxic materials.

Toxic Substance: A chemical or mixture that may present an unreasonable risk of injury to health or the environment.

Toxicant: A poisonous agent that kills or injures animal or plant life.

Toxicity: The degree of danger posed by a substance to animal or plant life. (See: acute, chronic toxicity).

Toxicology: The science and study of poisons control

Transfer facility or collection facility: A facility at which dangerous waste shipments are collected, consolidated, and stored for more than ten days before transfer to a storage, treatment, or disposal facility.

Transformation: The process of placing new genes into a host cell, thereby inducing the host cell to exhibit functions encoded by the DNA.

Transpiration: The process by which water vapour is lost to the atmosphere from living plants. The term can also be applied to the quantity of water thus dissipated.

Transportation: The movement of dangerous waste by air, rail, highway (land), or water.

Transporter: A person engaged in the off-site transportation of dangerous waste.

Trash-to-Energy Plan: A plan for putting waste back to work by burning trash to produce energy.

Treatment: The physical, chemical, or biological processing of dangerous waste to make such wastes non-dangerous or less dangerous, safer for transport, amenable for energy or material resource recovery, amenable for storage, or reduced in volume.

Treatment, Storage, and Disposal Facility: Site where a hazardous substance is treated, stored, or disposed. TSD facilities are regulated by FEPA and States.

Treatment Zone: A soil areas of the unsaturated zone of a land treatment unit within which dangerous wastes are degraded, transformed or immobilized.

Trichloroethylene (TCE): A stable, low-boiling colorless liquid, toxic by inhalation. TCE is used as a solvent, metal degreasing agent, and in other industrial applications.

Trickling Filter: A coarse, biological treatment system in which waste water is trickled over a bed of stones or other material covered with bacterial growth, leading to bacterial break down of the waste.

Trihalomethane (THM): One of a family of organic compounds, named as derivatives of methane. THM's are generally the by-products from chlorination of drinking water that contains organic material.

Triple rinsing: The cleansing of containers in accordance with the requirements of subsection 2.4.2.

Troposphere: The lower atmosphere the portion of the atmosphere between seven and ten miles from the Earth's surface where clouds are formed.

Tundra: A type of ecosystem dominated by lichens, mosses, grasses, and weedy plants. Tundra is found at high latitudes (arctic tundra) and high altitudes (alpine tundra). Arctic tundra is underlain by

permafrost and is usually very wet. (See: wetlands).

Turbidimeter: A device that measures the amount of suspended solids in a liquid.

Turbidity: 1. Haziness in air caused by the presence of particles and pollutants. 2. A similar cloudy condition in water due to suspended silt or organic matter.

U

Ultra Clean Coal (UCC): Coal that has been washed, ground into fine particles, then chemically treated to remove sulfur, ash, silicone, and other substances; usually briguetted and coated with a sealant made from coal.

Ultraviolet Rays: Radiation from the sun that can be useful or potentially harmful. UV rays from one part of the spectrum enhance plant life and are useful in some medical and dental procedures; UV rays from other parts of the spectrum to which humans are exposed (e.g. while getting a sun-tan) can cause skin cancer or other tissue damage. The ozone layer in the stratosphere provides a protective shield that limit the amount of ultraviolet rays that reach the Earth's surface.

Underground injection: The subsurface emplacement of fluids through a bored, drilled, or driven well, or through a dug well, where the depth of the dug well is greater than the largest surface dimension.

Underground Injection Control (UIC): The programme under the Safe Drinking Water Act that regulates the use of wells to pump fluids into the ground.

Underground Sources of Drinking Water: As defined in the UIC programme this term refers to aquifers that are currently being used as a source of drinking water, and those that are capable of supplying a public water system. They have a total dissolved solids content of 10,000 milligrams per litre or less, and are not "exempted aquifers". (See: exempted aquifer).

Underground Storage Tank: A tank located all or partially underground that is designed to hold gasoline or other petroleum products or chemical solutions.

Unsaturated Zone: The area above the water table where the soil pores are not fully saturated, although some water may be present.

Uranium: A radioactive heavy metal element used in nuclear reactors and the production of nuclear weapons. Term refers usually to U-238, the most abundant radium isotope, although a small percentage of naturally-occurring uranium is U-235.

Urban Runoff: Stormwater from city streets and adjacent domestic or commercial properties that may carry pollutants of various kinds into the sewer systems and/or receiving waters.

USEPA: United States Environmental Protection Agency.

V

Vaccine: Dead or partial or modified antigen used to induce immunity to certain infectious diseases.

Vapour: The gaseous phase of substances that are liquid or solid at atmospheric temperature and pressure, e.g., steam.

Vapour Capture System: Any combination of hoods and ventilation system that captures or contains

organic vapours in order that they may be directed to an abatement or recovery device.

Vapour Dispersion: The movement of vapour clouds in air due to wind, gravity spreading, and mixing.

Vapour Plumes: Flue gases that are visible because they contain water droplets.

Vaporisation: The change of a substance from a liquid to a gas.

Variance: Government permission for a delay or exception in the application of a given law, ordinance, or regulation.

Vector: 1. An organism, often an insect or rodent, that carries disease. 2. An object that is used to transport genes into a host cell(vectors can be plasmids, viruses, or other bacteria). A gene is placed in the vector; the vector then "infects" the bacterium.

Ventilation/Suction: The act of admitting fresh air into a space in order to replace stale or contaminated air; achieved by blowing air into the space. Similarly, suction represents the admission of fresh air into an interior space by lowering the pressure outside of the space, thereby drawing the contaminated air outward.

Vinyl Chloride: A chemical compound, used in producing some plastics, that is believed to be carcinogenic.

Virus: The smallest form of micro-organisms capable of causing disease.

Visible Emission Standard: This controls the emission of black smoke from stacks or vehicle exhausts.

Volatile: Description of any substance that evaporates readily.

Volatile Organic Compound (VOC): Any organic compound which participates in atmospheric photochemical reactions except for those designated by FEPA's Director/Chief Executive as having negligible photochemical reactivity.

Volatile Synthetic Organic Chemicals: Chemicals that tend to volatilize or evaporate from water.

Vulnerability Analysis: Assessment of elements in the community that are susceptible to damage should a release of hazardous materials occur.

Vulnerable Zone: An area over which the airborne concentration of a chemical involved in an accidental release could reach the level of concern.

W

Waste: 1. Unwanted materials left over from a manufacturing process. 2. Refuse from places of human or animal habitation.

Waste Load Allocation: The maximum load of pollutants each discharger of waste is allowed to release into a particular waterway. Discharge limits are usually required for each specific water quality criterion being or expected to be, violated.

Waste Treatment Stream: The continuous movement of waste from generator to treater and disposer.

Waste Treatment Plant: A facility containing a series of tanks, screens, filters and other processes by which pollutants are removed from water.

Wastewater: The spent or used water from individual homes, a community, a farm or an industry that contains dissolved or suspended matter.

Wastewater Operations and Maintenance: Actions taken after construction to assure that facilities constructed to treat wastewater will be properly operated, maintained, and managed to achieve efficiency levels and prescribed effluent levels in an optimum manner.

Water Courses: This includes water bodies such as streams, rivers, lagoons, etc.

Water Pollution: The presence in water of enough harmful or objectionable material to damage the water's quality.

Water Quality Criteria: Specific levels of water quality which, if reached, are expected to render a body of water suitable for its designated use. The criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water Quality Guideline: A numerical concentration or narrative statement recommended to support and maintain a designated water use.

Water Quality Objective: A numerical concentration or narrative statement which has been established to support and protect the designated uses of water at a specified site. An "Objective" is an aim or goal towards which to strive. It is not as rigid and authoritative as a standard and does not have enforcement element.

Water Quality Standards: State-adopted and FEPA-approved ambient standards for water bodies. The standards cover the use of the water body and the water quality criteria which must be met to protect the designated use or uses.

Watershed: The land area that drains into a stream.

Water Supplier: A person who owns or operates a public water system.

Water Supply System: The collection treatment, storage and distribution of potable water from source to consumer.

Water Solubility: The maximum concentration of a chemical compound, which can result when it is dissolved in water. If a substance is water soluble it can very readily disperse through the environment.

Water Table: The level of ground water.

Well: A bored, drilled, or driven shaft, or a dug hole, whose depth is greater than the largest surface dimension and whose purpose is to reach underground water supplies or oil, or to store or bury fluids below ground.

Well Injection: The subsurface emplacement of fluids in a well.

Well Monitoring: The measurement, by on-site instruments or laboratory methods, of the quality of

water in a well.

Well Plug: A watertight and gastight seal installed in a borehole or well to prevent movement of fluids.

Wetlands: An area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include: swamps, bogs, fens, marshes and estuaries.

Wildlife Refuge: An area designated for the protection of wild animals, within which hunting and fishing are either prohibited or strictly controlled.

Wood-Burning Stove Pollution: Air pollution caused by emission of particulate matter, carbon monoxide, total suspended particulates, and polycyclic organic matter from wood-burning stoves.

Working Level (WL): A unit of measure for documenting exposure to radon decay products. One working level is equal to approximately 200 pioccuries per litre.

Working Level Month (WLM): A unit of measure used to determine cumulative exposure to radon.

Workroom Air Standard: This specifies threshold limit values which represent the concentration in air below which a contaminant is normally harmless for occupational exposure. This standard is set to protect workers in factories.

WPC: Water Pollution Control.

X, Y, Z

Xenobiotic: Term for non-naturally occurring man-made substances found in the environment (i.e.., synthetic material solvents, plastics).

Zooplankton: Tiny aquatic animals eaten by fish.

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