

ABU DHABI NATIONAL OIL COMPANY

HEALTH SAFETY AND ENVIRONMENTAL MANAGEMENT MANUAL OF CODES OF PRACTICE

VOLUME 2 : ENVIRONMENTAL PROTECTION

CODE OF PRACTICE ON POLLUTION PREVENTION AND CONTROL

ADNOC-COPV2-02

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I. PURPOSE

Pollution Prevention and Control (PPC) is a regulatory approach to controlling the environmental impacts of certain industrial sources, based on the prevention of pollution or, where this is not possible or practicable, the minimisation of pollution using the Best Available Techniques (BAT). PPC takes an integrated approach to management of environmental impacts. This means that emissions to air, water and land, together with a number of other environmental effects, must be considered together, so that a high level of environmental protection is achieved overall.

The concept of Pollution Prevention and Control (PPC) is now firmly based in modern environmental regulatory processes in other parts of the world. It provides the primary mechanism through which industrial operations are permitted to operate and the environmental controls that are required. The purpose of this Code of Practice is to assist Group Companies to operate their existing facilities and to plan for new projects, taking into account the requirements of PPC. It draws on the PPC regulatory system which applies in Europe [Refs. 1 and 2], and US-EPA PPC regulations [Ref. 3].

This Code of Practice establishes the requirements for PPC for certain existing and future planned Group Company industrial facilities. These requirements are complementary to those detailed in ADNOC Codes of Practice on Environmental Impact Assessment, Waste Management and Control of Major Accident Hazards.

II. DEFINITIONS

Activity

General term referring to industrial operations on a site covered by PPC.

Available techniques

In the context of BAT, those techniques developed on a scale which allows implementation in an industrial sector, under economically and technically viable conditions, taking into consideration the cost and advantages.

BAT

Best Available Techniques. The most effective and advanced stage in development of Activities and their methods of Operation which indicates the practical suitability of particular Techniques for providing in principle the basis for ELVs designed to prevent and where this is not practicable, generally to reduce Emissions and the impact on the environment as a whole.

BATNEEC

Best Available Techniques Not Entailing Excessive Cost. Former term used in Integrated Pollution Control (IPC), the forerunner to IPPC. Now superseded by BAT



Bequerel (Symbol Bq)

The SI unit of activity. One bequerel equals one nuclear transformation per second. 1 Bq = $2.7'10^{-11}$ Ci.

BOD

Biological Oxygen Demand

BREF Notes

Guidance documents on BAT produced by the European Commission.

BS

British Standards

CFR

Code of Federal Regulations (USA)

COD

Chemical Oxygen Demand

COMAH

Control of Major Accident Hazards

СОР

Code(s) of Practice

dB(A)

The decibel measured on the A weighted scale. On this scale the noise level is adjusted to reflect the sensitivity of the human ear to different frequencies.

DDT

Dichlorodiphenyltrichloroethane (colourless chemical used as an insecticide)

EA

UK Environment Agency

EIA

Environmental Impact Assessment

ELV

Emission Limit Value. The mass, concentration or level of an emission which must not be exceeded over a given time period

Emission

The direct or indirect release of substances, vibration, heat, or noise from an installation into air, water or land.

EQS

Environmental Quality Standard. A requirement or objective which must be fulfilled as set out in UAE legislation and may be relevant in the determination of BAT.



EU

European Union

FEA

Federal Environment Authority (UAE)

GHG

Green House Gas

HSEIA

Health, Safety and Environmental Impact Assessment. Systematic process of identifying HSE impacts of existing, new or substantially altered projects, and establishing mitigation requirements.

Installation (Facility)

That part of an industrial operation falling within the scope of PPC requirements.

ISO

International Standards Organisation

LDAR

Leak Detection and Repair

LSA (scale)

Low Specific Activity scale (see NORM).

NORM

Naturally Occurring Radioactive Material. See LSA.

OAQPS

Office of Air Quality Planning and Standards (USA)

OHRM

Occupational Health Risk Management

Operator

Person who has control over the operation of an installation. Can refer to an individual or organization.

Pollution

Any emission as a result of human activity which may be harmful to human health or the quality of the environment, cause offence to any human senses, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment.

PPC

Integrated Pollution Prevention and Control. Term used to describe the regulatory regime applying to certain types of industrial process, under the PPC Regulations [Refs. 1, 2 and 3].

European Community Directive 96//61/EC on Integrated Pollution Prevention and Control, 1996.
 Pollution Prevention and Control Regulations, SI200/1973. HMSO, 2000.
 U.S. EPA Pollution Prevention Act (P2), Title III - SARA 313.

Significant Environmental Impact

Adverse environmental impact that exceeds pre-defined criteria. ADNOC distinguishes between planned and accidental significant impacts, with different criteria for both. The criteria are defined in ADNOC document '*Code of Practice on Environmental Impact Assessment*' [Ref. 5].

Specified Waste Management Activity

Within the context of PPC, means the disposal of waste to landfill, the disposal of hazardous waste other than by incineration or landfill, in a facility with a capacity exceeding 10 tonnes per day, the disposal of waste oils, other than by incineration or landfill, in a facility with a capacity exceeding 10 tonnes per day or the disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day. Also covers recovering by distillation any waste oil or solvent, cleaning or regenerating ion exchange resins, solvent , reclamation/ regeneration, recovery of components from catalysts and oil rerefining or other reuses of oil.

Substance

Any chemical element and its compounds and any biological entity or microorganism, except radioactive substances or genetically modified organisms.

Substantial Change

A change in an operation which may have significant negative effects on human beings or the environment.

TOC

Total Organic Compounds

USEPA

United States Environmental Protection Agency

WHO

World Health Organization

Further detail on definitions is provided in the document ADNOC COP 'Guideline on HSE Definitions & Abbreviations' [Ref. 4].

III. EXISTING LAWS

There is currently no UAE Federal legislation, as prepared by the Federal Environmental Agency (FEA), which deals strictly with PPC. The FEA supports and encourages 'Cleaner Production' initiatives and environmental protection and the controls to achieve these via emissions, discharges, waste streams, transportation, etc. are covered in various items of UAE legislation including:

[4] ADNOC Manual of Codes of Practice: 'Guidelines on HSE Definitions & Abbreviations', ADNOC-COPV1-05.
 [5] ADNOC Manual of Codes of Practice: 'Code of Practice on Environmental Impact Assessment, ADNOC-COPV2-01.



- Federal Law No (24) of 1999 for the Protection and Development of the Environment.
- Regulations for the Assessment of Environmental Effects of Installations
- Regulations for the Protection of the Marine Environment
- Regulation for the Protection of Air from Pollution
- Regulation for Handling Hazardous Materials, Hazardous Wastes and Medical Wastes
- Regulation for Insecticides and Agricultural Additives And Fertilizers
- Regulation for the Protection of Natural Reservations
- Federal Law No(1) of 2002 Regarding Organisation and Monitoring the Use of Radiation and Protection.

Applicable details of these are provided in Appendix 2 of ADNOC Codes of Practice '*Environmental Impact Assessment*' [Ref. 5]. All Group Company operational facilities must, as a minimum, achieve compliance with these national environmental standards.

In addition to national standards, Group Companies must consider other relevant standards where appropriate. Environmental standards have been developed by various international bodies and in particular:

- World Health Organization (WHO)
- United States Environmental Protection Agency (USEPA)
- European Union (EU)
- UK Environment Agency (EA)

Detailed references to these standards are provided in Appendix 3. In addition, the United Nations Environmental Programme (UNEP) provides useful information and protocols on how to implement these.

These standards are regularly subject to change, as scientific knowledge on possible effects of pollutants on the environment increases, and as new technologies become available to control pollution. For these reasons, specific standards are not given in this report, but the sources of information for the standards are provided. Group Companies must ensure that the latest version of the relevant standards is used.

[5] ADNOC Manual of Codes of Practice: 'Code of Practice on Environmental Impact Assessment', ADNOC-COPV2-01.



1. INTRODUCTION

Pollution Prevention and Control (PPC) is a term used to describe a regulatory system for control of pollution from certain industrial processes, which is based on an operator demonstrating that:

- The Best Available Techniques (BAT) are being, or will be, used to prevent and minimise pollution from the installation.
- No pollution takes place that causes significant adverse impact on the receiving environment. Significant impact is defined in Section 2.7 of the ADNOC document 'Code of Practice on Environmental Impact Assessment' [Ref. 5].

The processes to which PPC is applicable and which fall within the scope of this Code of Practice are listed in Appendix 1.

The application of this system covers pollution into all environmental media, together with other aspects such as energy use and accident scenarios.

ADNOC Group Companies will have to demonstrate their conformance with this Code of Practice through a preparation of a PPC Compliance Report (see Section 3).

This document establishes the framework for the introduction of PPC into the ADNOC Group. It draws on the current regulatory regime in Europe, but has been adapted to the particular circumstances of ADNOC Group Companies. Other international regulatory regimes can be referred to, i.e. USEPA. This Code of Practice is applicable to all existing and future planned Group Company operations listed in Appendix 1. New and existing projects falling within the scope of Appendix 1 will be required to demonstrate use of BAT and minimum environmental impact through the HSEIA process [Ref. 6].



2. OVERVIEW OF PPC PROCESS REQUIREMENTS

2.1 Basic Principles

The basic approach to PPC involves identifying options, assessing the environmental effects and considering economics. It differs from other regulatory approaches in that the environmental requirements are defined at the facility level, rather than on a general basis.

PPC requires an operator to demonstrate that the Best Available Techniques (BAT) have been used to control discharges of pollutants to all environmental media and that there are no significant environmental impacts. BAT is defined as:

'the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole' [Ref. 2].

The terms Best, Available and Techniques have the following defined meanings:

- **Best::** Means in relation to techniques, the most effective in achieving a high general level of protection of the environment as a whole.
- Available: Means those techniques which have been developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the cost and advantages, providing they are reasonably accessible to the operator.
- **Techniques:** Includes both the technology used and the way in which the installation is designed, built, operated and decommissioned.

BAT covers both the plant and how it is operated. In particular, operation is taken to include:

- Management.
- Management systems.
- Staff numbers.
- Training.
- Personnel competencies.
- Working methods.
- Maintenance.
- Records.
- Monitoring of releases.

[2] Pollution Prevention and Control Regulations, SI200/1973. HMSO, 2000.



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In determining what is BAT for a particular process, special consideration must be given to the following, taking into account the likely costs and benefits of a measure and the principles of precaution and prevention:

- The use of low-waste technology.
- The use of less hazardous substances.
- The recovery and recycling of substances generated and used in the process and of waste, where appropriate.
- Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale.
- Technological advances and changes in scientific knowledge and understanding.
- The nature, effects and volume of emissions concerned.
- The commissioning dates for new or existing installations or mobile plant.
- The length of time needed to introduce the best available technique.
- The consumption and nature of raw materials (including water) used in the process and the energy efficiency of the process.
- The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it.
- The need to prevent accidents and to minimise their consequences on the receiving environment.

Specific guidance on BAT for the oil, gas and petrochemical industries has been produced by the UK Environment Agency and US EPA [Refs. 7, 8, 9 and 2]. General guidance on BAT is given in Section 4 of this Code of Practice.

2.2 Consideration of Options

PPC requires the operator to choose the best pollution prevention and control option available to achieve a high level of protection of the environment, taken as a whole. This is achieved through application of BAT and the setting of emission limit values (ELVs). ELVs are normally set at the facility level, rather than on a more general basis. In establishing ELVs for specific Group Company installations, consideration must be given to national emission limits and any other applicable Guidelines e.g. WHO, USEPA, EU (see Appendix 3).

[Regulations established under Federal Law No. (24) of 1999 [Ref. 10], specify ELVs for various discharges. In addition, guidance on applicable ELV's for the oil and gas industry and on BAT is available in the form of BAT reference (BREF) Notes (EU) and the USEPA (see Appendix 3).

[7] HMIP Chief Inspectors Guidance Note, Processes Subject to Integrated Pollution Control S2 1.10 Petroleum Processes: Oil Refining and Associated Processes, HMSO, London 1995.

^[2] Pollution Prevention and Control Regulations, SI200/1973. HMSO, 2000.

 ^[8] HMIP Chief Inspectors Guidance Note. Processes Subject to Integrated Pollution Control S2 1.11 Petroleum Processes: Onshore Oil Production. HMSO, London 1995ADNOC Guideline on Environmental Risk Assessment, 2003.
 [9] Environment Agency, Technical Guidance IPC S3 1.02, Oil and Gas Processes, Supplementary Guidance Note. UK Environment Agency, 2000

^[10] UAE Federal Law No (24) of 1999 for the Protection and Development of the Environment

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In considering the most applicable ELVs for Group Company operations, the strictest limit must generally be used. However, it is not sufficient to design or operate a facility up to the prescribed regulatory limit. The principle of BAT requires that operators prevent or, where this is not practicable, to reduce emissions. This means that if emissions can be prevented or reduced further at reasonable cost, irrespective of whether the ELV is compliant with prescribed limits, then this would be done.

ELVs lower than FEA Regulatory limits may also need to be applied to a particular operation for other reasons. This would be the case, for example, where environmental assessment demonstrates that the operation of the facility could breach an environmental quality standard (EQS)/Guideline limit, or that significant environmental impacts could arise.

2.3 Emissions Inventory

A list of all emissions to the environment for each option must be compiled, together with release points. The emissions inventory should also be integrated with the HSEIA process and submitted. The following emissions must be included:

- Point source emissions to surface water, groundwater and sewer.
- Point source emissions to air.
- Fugitive emissions.
- Abnormal emissions from emergency relief vents, flares etc.
- Emissions from waste (eg waste treatment, waste waster treatment operations), consumption of raw materials, water and energy.
- Sources, type and level of noise.
- Sources, type and emission of odorous compounds.

2.4 Environmental Assessment

Once the various options for pollution prevention/control have been identified, the next stage in the process is comparison of the environmental impacts of the options. This assessment must focus on significant effects only (direct and indirect), please refer to the EIA Code of Practice [5].

The main focus of the assessment must be on the effects of releases to the environment into all media, in particular large-scale releases and releases of hazardous substances. Small-scale releases, other than those which are toxic or may be discharged in an environmentally sensitive area, generally do not need to be considered.

An indicative list of pollutants which will normally require to be assessed is provided in Section 4. Other pollutants may also have to be included, depending on the particular operation and potential environmental impact.

Consideration must also be given to emissions of heat, vibrations and noise, where these may have significant impacts.

^[5] ADNOC Manual of Codes of Practice: 'Code of Practice on Environmental Impact Assessment, ADNOC-COPV2-01.



Other issues which must also be taken into account in evaluating options are:

- Consumption and nature of raw materials.
- Energy demands and efficiency.
- Waste production.
- Accidents and their consequential environmental risks.
- The restoration of the site and risks of pollution.

The environmental assessment of options requires specialist skills and must be carried out by a suitably qualified person.

Once the environmental assessment of the different options has been completed, it will then be possible to rank the options, according to the likely scale of environmental impact.

2.5 Economic Assessment

Once the various options have been ranked, those with the lowest environmental impact overall must normally be considered as BAT, unless economic considerations means the particular technique is not practicable. Costs must be inclusive of capital and operating costs. Guidance on these aspects of BAT is available through European BREF Notes and the USEPA (See Appendix 3). The basic process of determining BAT is illustrated in Figure 1.



Figure 1: The BAT Assessment Process

2.6 BAT Implementation

For new installations, BAT must be incorporated from the outset and must be part of basic design standards for new projects. For existing installations,

operators will need to establish proposals for upgrading plant to achieve BAT, within a reasonable timescale agreed with ADNOC. Such agreed time scale would consider the extent, complexity and cost of required plant alterations.

Where a particular installation is scheduled for closure within a relatively short period of time, upgrading to BAT may not be economically justifiable. In such cases, operators will need to prepare an assessment of the situation with justifications for reduced pollution control.

2.7 Site Assessment and Restoration

An important element in PPC is the restoration of operational sites to their original condition, following cessation of the industrial activity.

In order to establish a baseline against which any future pollution of the site can be assessed, it is necessary to carry out a site assessment and prepare a Site Report.

The Site Report must cover all of the land on which the particular activities of the installation covered by PPC take place, including land which is integral to the operation, such as areas where materials are stored.

Site Reports must include a risk assessment which includes the identification and assessment of:

- **Sources.** Substances that are already in, on or under the land with potential to cause pollution to water courses.
- **Receptors.** Whatever is vulnerable to the adverse effects of the substances that are or will be used or produced at the site (e.g. people, animals, ground water, vegetation, buildings or services).
- **Pathways.** The means by which a polluting substance may come into contact with a receptor.

The environmental risk assessment must be based on the potential significant impact of a contaminant based on the combined source-receptor-pathway linkage.

On closure of the site, Group Companies must ensure that the site is restored, as far as practicable to its original condition and taking into consideration the intended future use of the site. This must include:

- Removing (as far as practicable), treating or immobilising any pollutants.
- Remedying or mitigating any harm the pollutants may have caused.

Removal and treatment of any pollution must be based on assessment of environmental risks and the presence of source-receptor-pathway analysis. Further information on the risk based assessment methodology is given in the document ADNOC '*Guidelines on Environmental Risk Assessment*' [11].

[11] ADNOC Manual of Codes of Practice: 'Guidelines on Environmental Risk Assessment, ADNOC-COPV2-07.



3. PREPARATION OF PPC COMPLIANCE REPORT

The operators of any of the processes listed in Appendix 1 must prepare an PPC Compliance Report which demonstrates compliance with BAT and the objectives of PPC. For existing operations, PPC Compliance Reports must be completed and submitted to ADNOC EH&S Division through the HSEIA process and integrated with it. For new facilities, compliance with BAT must be demonstrated as part of the HSEIA process [Ref. 6] and integrated with it. As all HSEIA reports are subject to periodic review and resubmission for ADNOC approval, the PPC Compliance Report will be a dynamic report which, at the time of HSEIA resubmission, must provide an up-to-date compliance overview.

The PPC Compliance Report must be prepared by a competent person with sufficient knowledge and experience in the process(es) under consideration and environmental matters. Where appropriate specialist skills are not available within Group Companies, external support will be required.

The PPC Compliance Report must contain the following key information:

- Details of the operator and the installation, including a site plan, grid reference etc.
- Report on the present condition of the operating (active) site with reference to any substances in, on or under the site which may pose a pollution risk. This information will serve as a baseline condition report to be used in the future, during decommissioning and restoration of the site.
- Detailed description of the installation and activities on the site.
- Details of all raw materials used, energy required and substances produced on the site.
- The nature, quantities and sources of all emissions/releases, discharges, and wastes to the environment from the site and possible significant effects. Emissions include all direct and indirect release of substances, vibrations, heat or noise into air water or land.
- The technology being used (or proposed to be used) for preventing or, where this is not practicable, to reduce emissions. Details of BAT assessment.
- Proposals for monitoring emissions.
- Measures to be taken for the prevention, minimization, and recovery of emissions, releases, and waste generated by the operation of the installation. These measures would need to be technically acceptable, achievable, and cost effective.
- Results of an environmental impact assessment.
- Executive Summary.

[6] ADNOC Manual of Codes of Practice: 'Code of Practice on HSEIA Requirements', ADNOC-COPV1-02.

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Some of the information required for the PPC Compliance Report will be available from documents already prepared for other purposes (e.g. EIA Reports [Ref. 5], COMAH Reports [Ref. 12]). Where such information already exists, operators must submit this as part of the Compliance Report.

For existing operations which are not yet able to demonstrate full compliance with BAT, or where the assessment indicates significant pollution, the Compliance Report must contain a statement on the improvement objectives, together with a clearly defined timetable for improvements, leading to ultimate demonstration of BAT and fulfilment of PPC requirements. The general principal to be adopted by Group Companies is one of continuous improvement.

In some circumstances, full achievement of BAT may not be possible, for practical or operational reasons. In such cases, site Compliance Reports must contain a detailed analysis of the situation and operators must be able to demonstrate in rigorous engineering, scientific and economic terms, why achievement of BAT is not possible.

[5] ADNOC Manual of Codes of Practice: '*Code of Practice on Environmental Impact Assessment*, ADNOC-COPV2-01. [12] ADNOC Manual of Codes of Practice: '*Code of Practice on Control of Major Accident Hazards (COMAH*', ADNOC-COPV5-01.

4. ENVIRONMENTAL RELEASES AND CONTROLS

This section identifies the main environmental releases to air, land and water which need to be considered for those sites falling within the scope of this Code of Practice. It also provides indicative information on typical BAT requirements. More detailed information on BAT is provided in Sectoral Guidance produced by the European Union, UK Environment Agency, and USEPA [Refs. 9, 13, 14, 15 and 3].

For the purposes of PPC, the main environmental releases which need to be considered are:

- Atmospheric emissions.
- Liquid effluents.
- Physical emissions (noise, vibration, heat)
- Waste substances

The basis of control of polluting releases is through the establishment of ELVs and the application of BAT. In considering an appropriate ELV for a particular installation, consideration must be given to the following:

- Federal emission limits.
- Other relevant emission limits (e.g. EU, USEPA).
- Any relevant Environmental Quality Standard (EQS).
- Existing environmental quality conditions.

For new installations, all emission criteria must be met and the operation of the facility must not compromise any EQS. Where there is a risk of compromising an EQS, stricter emission limits must be applied.

For existing installations, where there is a breach of any EQS due solely or mainly to the installation, the application of BAT will apply.

In a multi-use industrial site, it will not be appropriate to consider single emission sources in isolation. In such cases, it is recommended that a combined approach to emission control is taken and that any improvement requirements are proportionate to the degree of pollution caused by individual operators. This will necessitate close cooperation of different operators on the site, so that the best overall environmental control solutions are implemented.

Appendix 2 gives a list of Proscribed Substances whose release must be controlled using BAT, which is being emitted before add-on controls from any point source at a set threshold.

[3] U.S. EPA Pollution Prevention Act (P2), Title III - SARA 313.

^[9] Environment Agency, Technical Guidance IPC S3 1.02, Oil and Gas Processes, Supplementary Guidance Note. UK Environment Agency, 2000

^[13] Environment Agency, Integrated Pollution Prevention and Control (IPPC), Environmental Assessment and Appraisal of BAT. Horizontal Guidance Note IPPC H1, UK Environment Agency, 2002

^[14] Environment Agency. Integrated Pollution Prevention and Control (IPPC), General Sector Guidance. IPPC Sector Guidance Note S0.01, 2001

^[15] DEFRA, Integrated Pollution Prevention and Control: A Practical Guide. UK Department of Environment, Food and Rural Affairs, 2002.



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4.1 Atmospheric Emissions

The main atmospheric releases which must be considered in determining BAT in compliance with PPC are:

- Sulphur dioxide and other sulphur compounds.
- Oxides of nitrogen and other nitrogen compounds.
- Carbon Monoxide.
- Volatile Organic Compounds.
- Metals and their compounds.
- Dust.
- Asbestos.
- Chlorine and its compounds.
- Fluorine and its compounds.
- Arsenic and its compounds.
- Cyanides.
- Substances with carcinogenic or mutagenic properties.
- Dioxins and Furans.
- Fugitive releases.
- Carbon Dioxide and green house gases (GHGs).

Indicative BAT requirements include:

- Operators must review options for emission abatement for the prevention or control of release of the above substances.
- There must be no visible persistent plumes (except for water vapour) during normal process operating conditions.
- Operators must identify and where possible quantify all sources of fugitive releases. A leak detection and repair programme must be established for installations such a refineries, gas processing plant and chemical plants.

4.2 Discharges to Water

The main discharges to water that must be considered are:

- Organohalogen compounds and substances that may form such compounds in the aquatic environment.
- Organophosphorous compounds.
- Substances which have proven carcinogenic or mutagenic properties.
- Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances.



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- Produced oily water (oil/gas producing wells)
- Drill cuttings and fluids
- Cyanides.
- Metals and their compounds.
- Arsenic and its compounds.
- Biocides and plant health products.
- Materials in suspension.
- Substances which contribute to eutrophication (e.g. nitrates and phosphates).
- Substances which affect oxygen balance.
- Chemicals contained in hydrotest waters.
- Ballast water.
- Slop oils.

Indicative BAT requirements include:

- Water use must be minimized and wastewater reused/recycled wherever practicable.
- Risks of contamination of surface or ground waters must be minimised.
- Appropriate treatment plant to be provided to ensure contaminated effluent streams do not pollute the environment.
- All discharges to be in compliance with any relevant ADNOC/FEA water discharge criteria. Discharges must not cause a breach of any water EQS.
- Appropriate engineering controls to be in place to prevent leakages from pipes and vessels, including regular maintenance and inspection to detect leaks.
- Provide impervious surfaces and containment kerbs for all liquid surface storage facilities, including sealed drainage systems.
- All environmentally harmful liquids must be stored on a hard-surfaced bunded area to act as barrier to prevent pollution.

4.3 Groundwater

All discharges to ground water must be controlled and no discharge is permitted unless it is in compliance with relevant guidelines for the protection of useable groundwater. Information on relevant guidelines is provided in Appendix 3.

Discharges of any substances included in List 1 of Appendix 2 are prohibited.



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Discharges of any substance included in List 2 of Appendix 2 may be permitted, providing an operator can demonstrate that there are no risks to groundwater and a prior investigation of the area has been carried out. The investigation must include assessment of underlying geology, hydrology, soil type, depth to saturation zone and existing groundwater quality. An independent assessment is advisable for operations in particularly sensitive areas.

4.4 Physical Emissions

4.4.1 <u>Noise</u>

PPC requires that installations be operated in such a way as to prevent emissions that may be harmful to human health, affect the quality of the environment, cause offence to human senses or interfere with amenity. The control of noise needs to be consistent with these requirements, with the overall aim of minimising nuisance to sensitive receptors.

Noise should be taken to include vibration and, in the context of PPC, refers exclusively to impacts beyond the boundary of the installation (Fence line). Noise effects within the site boundary are the subject of documents ADNOC 'Code of Practice on OHRM - Physical Agents' [Ref. 16] and 'Guidelines on Noise Control and Hearing Conservation' [Ref. 17].

Noise nuisance is normally assessed by reference to the likelihood of complaints, which can be either a function of the absolute level of noise (including frequency components), and/or the magnitude of change in noise levels over an existing background. Assessment of the likelihood of complaints must be carried out using the British Standard method BS 4142 [Ref. 18]. Assessments must be carried out at the most noise sensitive time of day (generally nighttimes).

For each major noise source identified on the site, operators must compile the following information:

- The sources and locations, marked on scaled plan of the site.
- The type of noise (continuous, intermittent, fixed or mobile).
- Duration of noise source.
- Contribution of individual source to overall site noise emission (qualitative description such as high, medium or low, unless data are available).

Operators must review all major sources from their installation and identify all nearby noise sensitive receptors (residential areas, schools, hospitals, recreational areas etc). Noise levels at the nearest receptor must be monitored to check compliance with allowable noise limits (see Appendix 2 of Ref. 17).

^[17] ADNOC Manual of Codes of Practice: '*Guidelines on Noise Control and Hearing Conservation*', ADNOC-COPV3-10. [18] BS4142:1997 Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas. BSI, London



For new facilities, the change in noise level at the nearest noise sensitive receptor must not exceed 5 dB(A) L_{eq} above the existing level, prior to the new plant becoming operational.

Indicative BAT requirements include:

- Operators must employ basic good practice measures to limit noise emissions, including adequate maintenance of plant whose deterioration may give rise to increases in noise.
- Noise control measures must be employed to ensure noise nuisance does not arise at noise sensitive receptors.
- Where there is the potential for noise nuisance to arise with new or existing installations, detailed measurements and noise modelling must be carried out.

4.5 Waste Management

General environmental requirements for management of waste in Group Companies are given in the document ADNOC '*Codes of Practice on Waste Management*' [Ref. 19]. PPC places additional requirements with respect to the management of wastes from PPC sites.

The principal objective for all installations is to prevent the creation of waste which could cause harm to people or the environment. Where this is not possible, releases must be minimised through use of less raw materials, processes changes or recycling/reuse.

Key operational requirements include:

- Ongoing identification and implementation of waste-prevention opportunities.
- Active participation and commitment of staff at all levels.
- Monitoring of raw materials usage and reporting against key performance indicators.

Operators must carry out regular waste minimisation audits and identify areas for improvements, including development of action plans. The audits must include but are not necessarily limited to:

- Identification of waste production sources, including location to be marked on a plot plan.
- Mapping of process flows on a Process Flow Diagram.
- Mass balance of raw materials.
- Development of an action plan and improvement timetable.

[19] ADNOC Manual of Codes of Practice: 'Code of Practice on Waste Management', ADNOC-COPV2-05.

Indicative BAT requirements include:

- Operators must have a system in place to record the quantity, nature, origin and, where relevant, the destination, collection frequency, mode of transport and treatment of any waste that is disposed of or recovered.
- Waste must be segregated and final disposal routes identified for all wastes. Wherever practicable, this must be as near as possible to the point of production.
- Records must be maintained of all wastes disposed of in accordance with the Duty of Care (see document ADNOC 'Code of Practice on Waste Management' [Ref. 19]).
- All waste storage areas to be located away from watercourses or sensitive land uses and be clearly signed.
- Storage areas must have a defined capacity which must not be exceeded.
- Special, separate storage areas to be provided for special wastes such as flammable materials. Incompatible wastes must be kept separate i.e. oxidisers, acids, alkalis, reactive wastes. Details of the main groups of mutually incompatible waste streams are provided in Appendix 4.
- Storage containers must be secured with lids and regularly inspected for leaks.
- Hard-surfaced bunded storage for all environmentally harmful fluids and/or dry wastes that may produce harmful fluids when in contact with liquids (e.g. washdown or rainwater).
- Shaded, ventilated storage for volatile waste organic substances, and those of low flashpoint.
- Procedures must be in place for dealing with leaking containers.
- All appropriate steps must be taken to prevent emissions from storage or handling of waste.
- Operators must prepare a waste management plan identifying the Best Practical Environmental Option (BPEO) for the final disposal of waste (see ADNOC 'Code of Practice on Waste Management' [Ref. 19]).

4.5.1 <u>Hazardous Wastes</u>

Typical hazardous wastes produced by Group Companies include waste oils, sludge, LSA scale (NORM), radioactive substances, drilling waste/chemicals, biocides, solvents etc. These wastes must be managed and controlled in such a manner as to prevent, or where this is not possible, to minimise pollution of the environment. Operators must set up procedures for hazardous waste management that are consistent with PPC objectives, BAT, legal requirements and the requirements of ADNOC '*Code of Practice on Waste Management*' [Refs. 19, 20 and 21].

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LSA Scale (NORM)

Deposits of Naturally Occurring Radioactive Materials (NORM), in the form of Low Specific Activity (LSA) scale, can be formed in certain circumstances inside oil production equipment. It arises from the process of seawater injection into the formation, which results the co-precipitation of ²²⁶ Radium and ²²⁸ Radium, derived from natural radioactive decay of uranium and thorium present in the formation. LSA can also contain radioactive isotopes of lead in the form of ²¹⁰Pb. Where it is necessary to remove this scale or dispose of components which have LSA scale inside them, the management of this waste steam must be properly monitored and controlled.

Because of the potential occupational and environmental risks presented by this type of waste, special procedures for disposal are considered necessary. At present, there is no universally accepted isotope concentration level which can be taken as a cut-off to classify this particular waste stream. The classification of NORM waste varies from country to country and depends on local regulations. In Abu Dhabi, radioactive materials are controlled under Law No3 of 1979, Ministerial Order No 154 of 199, and Federal Law No. (1) of 2002. However, local regulations do not define a cut-off level for classification of NORM waste.

Typical action levels used by the international oil industry for discharge of NORM waste into the environment, without special requirements for disposal, are given in Table 4.1.

Radionuclide	Solids (Bq/g)	Aqueous (Bq/I)	Air (Bq/m³)
²³² Th	5	0.05	0.005
²²⁸ Ra	10	0.1	0.5
228Th	5	0.5	0.01
²²⁸ Ac	10	20	20
²²⁴ Ra	2	0.5	1
²¹² Pb	5	2	20
²¹² Bi	5	50	50
²³⁸ U	10	5	0.02
234Th	10	5	50
²³⁴ U	20	5	0.05
230Th	10	0.5	0.02
²²⁶ Ra	2	0.1	0.5
²¹⁰ Pb	10	0.05	0.5
²¹⁰ Bi	20	10	20
²¹⁰ Po	10	0.1	0.5

TABLE 4.1 ACTION LEVELS FOR UNLICENSED DISPOSAL OF NORM WASTE (Bq/g)

Source: International oil company



Note: The values given in Table 4.1 represent limits, above which disposal will normally require authorisation from local regulatory authorities. Group Companies must check actual requirements with ADNOC.

Group Companies must develop appropriate procedures for the proper management and disposal of NORM waste, in accordance with relevant UAE and international requirements for the handling/disposal of radioactive contaminated material. In developing these procedures, Group Companies (and Contractors) must ensure they use the latest best practice international guidance on NORM waste and comply fully with local Abu Dhabi regulations. Monitoring of LSA scale must be carried out by a suitably accredited laboratory so that the material can be properly classified and handled accordingly. (Note: Guidance on the occupational health aspects of NORM is included in the ADNOC Guideline on Ionising Radiation [Ref. 22]).

For example, all European Union countries have adopted the limit of 10Bq/g for classification of NORM waste containing ²²⁶Radium [Ref. 23]. Above this level, the waste is considered as radioactive and can only be disposed of to a recognised radioactive waste disposal facility. Below 10 Bq/g, LSA could be disposed of as non-radioactive (although hazardous) waste. The International Atomic Energy Agency has defined 'Exempt Activity Levels' ie limits of radioactivity above which restrictions on transport and disposal should be applied . These limits are 10 Bq/g for diffuse NORM sources , 10,000 Bq/g for discrete sources of ²²⁶Radium and ²¹⁰Lead, and 100,000 Bq/g for discrete sources of ²²⁸Radium [Ref. 24].

^[22] ADNOC Manual of Codes of Practice: 'Guidelines on Ionising Radiation', ADNOC-COPV3-09.

^[23] EURATOM, Directive No.96/29 of 96/5/13, 1996

^[24] International Atomic Energy Agency. Regulations for the Safe Transport of Radioactive Material, Safety Series No 6, Vienna, 1985/1990.



5 CONTAMINATED LAND AND REMEDIATION

Group companies must ensure that all sources of ground contamination are prevented or, where this is not practical, minimised, in accordance with PPC objectives.

All PPC installations will require a Site Report to be prepared to establish the baseline conditions prior to operations (see Section 2). The Site Report must identify any substance in, on or under the land which may be a pollution risk. It must also record any pollution incidents, such as spillages, that may have occurred at the site and details of measures put in place to mitigate their effects.

On closure of the facility, a closure Site Report must be prepared for comparison with the pre-operational/baseline report. Operators must address any changes in pollution that have occurred as a result of operations on the site and any pollution risks.

The overall objective is to restore operational sites to their original condition as practicably possible and to ensure there are no unacceptable pollution risks. Guidance on the assessment of pollution risks for use in site closure assessments is provided in the document ADNOC '*Guidelines on Environmental Risk Assessment*' [11].

In carrying out site remediation/restoration, operators must consider the following approaches:

- Removing, treating or immobilizing any pollutants.
- Remedying any harm the pollutants have caused.
- Mitigating the effects of any harm.



6 RESOURCE AND ENERGY CONSERVATION

Operators must take all practical measures to conserve the use of natural resources and reduce energy consumption.

A statement on energy use must be prepared, based on the quantity of energy delivered and used at the site, or exported (e.g. power generation plants) (in mWh), broken down into energy supply categories. Emissions of carbon dioxide must be calculated for each category of energy use using the emission factors given in Table 6.1.

Fuel	Emission Factor : Carbon		Emission Factor : Carbon Dioxide	
	Kg /mWh	Kg/GJ	Kg /mWh	Kg/GJ
Electricity*	45.3	12.6	166	46.2
Coal	81.7	22.7	300	83.2
Heavy Fuel Oil	70.9	19.7	260	72.2
Petrol	65.5	18.2	240	66.7
Liquid Petroleum Gas	62.7	17.4	230	63.8
Jet Kerosene	65.5	18.2	240	66.7
Ethane	54.5	15.2	200	55.7
Naphtha	70.9	19.7	260	72.2
Refinery Gas	54.5	15.2	200	19.1
Natural Gas	51.8	14.4	190	52.8

TABLE 6.1: CO2 EMISSION FACTORS

1 tonne carbon = 3.66 tonnes of CO₂,1 mWh = 3.6 GJ

* Emissions factor for public supply, based on primary energy consumption.

Operators must describe the current (or for new installations, the proposed) measures in place for energy conservation at the installation. In particular, operators must have regard to minimizing energy use through:

- Energy efficient operating, maintenance and housekeeping measures in relation to air conditioning, operation of motors, compressed gas systems, steam distribution, hot water systems, lubrication and boiler operation/maintenance.
- Use of physical techniques to avoid energy losses such as insulation, containment methods, avoidance of unnecessary heated water discharges.
- Building services energy uses.
- Heat recovery from different parts of the process.
- High –efficiency dewatering techniques.



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- Good insulation.
- Plant layout to minimise pumping distances.
- Phase optimisation of electronic control motors.
- Use of waste cooling water to recover heat.
- Optimisation of combustion efficiency in combustion plant.
- Use of continuous processing rather than batch processing.

In addition to the above, operators must prepare an Energy Efficiency Plan which:

- Identifies all techniques relevant to the installation.
- Identifies to what extent these have been used.
- Establishes priorities.
- Highlights any techniques which could have other adverse effects on the environment.

The Energy Efficiency Plan should be submitted to ADNOC EH&S Division as part of the HSEIA process.



7 ACCIDENTS AND THEIR CONSEQUENCES

As a general principle, PPC requires that necessary measures must be taken to prevent accidents that may have environmental consequences, and to limit those consequences. Accident in this context includes any abnormal operation which may increase emissions.

Some installations falling within the scope of this Code of Practice will also be subject to control under the COMAH regime [Ref. 12]). In such cases, the site COMAH Report may provide the necessary documentation to satisfy the accident provisions of PPC. However, it is possible that potential accident scenarios may be too small to fall within the scope of COMAH, but may still have significant environmental consequences. Small-scale accidents must therefore also be considered.

To control/minimise the risks to the environment from accidents, operators shall:

- Identify the hazards posed by the installation/activity.
- Assess the risks (consequences x probability) of accidents occurring due to hazards associated with the installation / activity.
- Implement measures to reduce the risks of accidents, and prepare contingency plans to deal with any accidents that may occur.
- Prepare an accident management plan. This may be integrated with the site emergency response plan but must cover the environmental consequences of an accident.

Indicative BAT requirements include:

- Identification of all hazards to the environment.
- Assessment of risks:
 - estimate the probability of occurrence
 - establish what could be discharged and what quantity
 - identify pathways and receptors
 - identify consequences for receptors
 - assess the significance of consequences for the environment
 - identify risk management methods
- Identification of the techniques necessary to reduce the risks:
 - prepare an inventory of substances which are used on the site and could have environmental consequences if released.
 - prepare procedures for ensuring incompatible raw materials or wastes do not come into contact with each other
 - provision of adequate storage for raw materials and waste
 - provision of process design alarms, trips and other controls

[12] ADNOC Manual of Codes of Practice: 'Code of Practice on Control of Major Accident Hazards (COMAH)', ADNOC-COPV5-01.



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- provision of containment barriers such as bunds
- installation of techniques to prevent overfilling of storage vessels such as high level alarms/cut-offs
- provision of an installation log to record all incidents, near misses, procedural changes, abnormal events and findings of maintenance inspections
- provision of procedures to identify, respond and learn from incidents/near misses
- define roles and responsibilities of all personnel involved in accident management
- identify communication routes with local authorities and other relevant agencies
- provision of clear guidance on how each accident scenario is to be managed
- prepare procedures to ensure poor communications do not result in incidents during shift changes, maintenance or other engineering work
- provision of appropriate control techniques to limit the consequences of an accident, such as oil spill containment equipment, isolation of drains etc
- identification and provision of personnel training
- provision of procedures to check the composition of the contents of any collection sump, before emptying
- provision of high level alarms to drainage sumps
- process waters, drainage, emergency firewater, chemically contaminated water and spillages must be routed to the effluent control system.



8 MONITORING

Group Company operational sites falling within the scope of this Code of Practice must put in place a suitable environmental monitoring programme for emissions to all media. Monitoring must normally be carried out during commissioning, start up, normal operations and shut down.

Where monitoring shows that substances are not emitted in significant quantities, consideration can be given to reduced monitoring frequencies.

8.1 Emission Monitoring

8.1.1 Emissions to Water or Sewer

Typical monitoring requirements for discharge to surface waters, marine environment or to public works for sewer treatment are shown in Table 8.1.

PARAMETER*	MONITORING FREQUENCY**
Flow rate	Continuous and integrated daily flow rate
PH	Continuous
Temperature	Continuous
COD/BOD	Flow-weighted sample or composite, weekly or monthly average
TOC	Continuous
Turbidity	Continuous
Dissolved oxygen	Continuous

TABLE 8.1: MONITORING OF LIQUID DISCHARGES

* Other parameters must be included as identified in the inventory of releases and as per the Federal Environmental Agency – Maritime Environment Protection Guideline.

** Periodic sampling may be acceptable as an alternative to continuous monitoring, subject to agreement with ADNOC EH&S Division

8.1.2 Emissions to Air

Continuous monitoring of significant releases must be carried out where appropriate. Where continuous monitoring is not appropriate or available, non–continuous monitoring must be used.

Gas flow must be determined to relate concentrations of pollutants to mass releases. In addition, in order to relate emissions to reference conditions, temperature, oxygen and water vapour content must be measured.

Visual and olfactory assessment of releases from incinerators, flares, furnaces and other sources which could cause nuisance must be made at least once per shift and the results recorded on a daily log. All final releases must be essentially colourless, free from persistent trailing mist or fume and free from droplets.



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Complex sites (eg Refineries, Petrochemicals, Gas Process Plants, Polyolefins) must establish an ongoing Leak Detection and Repair (LDAR) programme to cover fugitive emissions. Monitoring of total hydrocarbon emissions from the site must be carried out at quarterly intervals using portable hydrocarbon monitors. Results must be used to establish targets for reduction in fugitive releases over time, see USEPA 40 CFR 60, Subpart VV for guidance.

8.1.3 <u>Waste</u>

For waste emissions, the following must be monitored/analyzed and recorded:

- Physical and chemical composition.
- Whether hazardous or non hazardous.
- Handling precautions and substances with which it cannot be mixed.
- Where waste is disposed of directly onto land (land fills), monitoring of the spread of contamination (leachate and migration of contaminates) may be necessary, subject to a risk assessment and the presence of a source-receptor pathway (see document ADNOC 'Guideline on Environmental Risk Assessment' [Ref. 11]).

8.1.4 Environmental Monitoring Beyond the Site Boundary

Environmental monitoring beyond the site boundary may be required in any of the following circumstances:

- There are sensitive receptors which could be affected by releases from the installation.
- Emissions from the installation contribute a significant amount to the Environmental Quality Standard.
- There is a need to validate dispersion modelling studies used in the BAT assessment.
- There is a history of complaints by members of the public or others.

The need for external environmental monitoring must be assessed individually and in consultation with ADNOC EH&S Division.

8.2 Reference Methods

Where monitoring is carried out, operators must ensure that equipment used is fit for purpose and certified to an appropriate international standard (e.g. UK MCERTS, USEPA). Analytical methods must be certified to an appropriate international standard such as ISO, BS or equivalent.



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- 5. ADNOC Manual of Codes of Practice: '*Code of Practice on Environmental Impact Assessment*', ADNOC-COPV2-01.
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- 22. ADNOC Manual of Codes of Practice: '*Guidelines on Ionising Radiation*', ADNOC-COPV3-09.
- 23. EURATOM, Directive No.96/29 of 96/5/13, 1996
- 24. International Atomic Energy Agency. Regulations for the Safe Transport of Radioactive Material, Safety Series No 6, Vienna, 1985/1990.

Other references (not specifically referenced in the document)

- Environment Agency, Integrated Pollution Prevention and Control (IPPC), Energy Efficiency. Horizontal Guidance Note IPPC H2, UK Environment Agency, 2002.
- Norwegian Radiation Protection Authority (<u>www.gr.is/nsfs/lysebo.htm</u>)

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APPENDIX 1 ACTIVITIES INCLUDED WITHIN THE SCOPE OF PPC REQUIREMENTS



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ACTIVITIES INCLUDED WITHIN THE SCOPE OF PPC REQUIREMENTS

The following activities fall within the scope of PPC and the requirements of this Code of Practice.

- Burning any fuel in an appliance with a rated thermal input of 50 mW or more.
- Burning any of the following fuels in an appliance with a rated thermal input of 3 mW or more but less than 50 mW.
 - waste oil
 - recovered oil
 - fuel derived from waste
- Refining of gas where the use of gas in any 12 month period exceeds 1000 tonnes.
- Reforming natural gas.
- Production of gas from oil.
- Oil production.
- Refining of crude oil, condensate, and mineral oils.
- Loading, unloading or other handling of, or storage of, or the physical, chemical or thermal treatment of:
 - crude oil
 - stabilized crude petroleum
 - crude shale oil
 - associated gas or condensate
 - emulsified hydrocarbons intended for use as fuel
- Activities involving the pyrolysis, carbonisation, distillation, liquefaction, gasification, partial oxidation or other heat treatment of oil, other carbonaceous material or mixtures thereof.
- Production of organic chemicals.
- Polymerisation or co-polymerisation of any unsaturated hydrocarbon or vinyl chloride which involves use of 50 tonnes or more of any of these materials in any 12 month period.
- Any activity involving the use in any 12 month period of one tonne or more of toluene di-isocyanate or other di-isocyanate of comparable volatility.
- Production of inorganic chemicals.
- Any activity which uses or is likely to result in the release to air or water of any halogen, hydrogen halide, other than the treatment of water by chlorine.



- Any activity which may result in the release into air, water or ground resources of Mercury, Arsenic or Cadmium or any compound of these elements.
- Production of fertilizers, including the conversion of chemical fertilizers into granules.
- Any activity which involves the use of ammonia.
- The incineration of any waste chemical or plastic.
- The incineration of hazardous waste
- The disposal of waste to landfill receiving more than 10 tonnes of waste per day or with a capacity in excess of 25000 tonnes.
- The disposal of waste oil (other than by incineration or landfill) in a facility with a capacity exceeding 10 tonnes per day.
- The disposal of hazardous waste, other than by incineration or landfill.
- The recovery of oil or any organic solvent by distillation.
- Re-refining of oil or other reuses of oil.
- Ships Ballast water management.
- Crude oil ships slop oil management.



APPENDIX 2 PROSCRIBED SUBSTANCES



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PROSCRIBED SUBSTANCES WHOSE RELEASE TO THE ENVIRONMENT MUST BE PREVENTED AND CONTROLLED

a) Discharges to water (surface water, groundwater and marine waters)

- Mercury and its compounds
- Cadmium and its compounds
- All isomers of hexachlorocylohexane
- All isomers of DDT
- Pentachlorophenol and its compounds
- Hexachlorobenzene
- Hexachlorobutadiene
- Aldrin
- Dieldrin
- Endrin
- Polychlorinated Biphenyls
- Dichlorvos
- 1,2-Dichloroethane
- All isomers of trichlorobenzene
- Atrazine
- Simazine
- Tributyltin compounds
- Triphenyltin compounds
- Trifluralin
- Fenitrothion
- Azinphos-methyl
- Malathion

b) Releases to Land

- POL wastes (Petroleum, Oils, Lubricants)
- Organic solvents
- Azides
- Halogens
- Metal carbonyls
- Organometallic compounds



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- Oxidising agents
- Dioxins (polychlorinated dibenzo-p-dioxin and congenors)
- Furans (polychlorinated dibenzofuran and congenors)
- Polyhalogenated biphenyls, terphenyls and naphthalenes
- Phosphorous
- Pesticides
- Alkali metals and their oxides and alkaline earth metals and their oxides

c) Releases to Air

- Oxides of Sulphur and other Sulphur compounds
- Oxides of Nitrogen and other Nitrogen compounds
- Oxides of Carbon
- Organic compounds and partial oxidation products
- Metals, metalloids and their compounds
- Asbestos, glass fibres and mineral fibres
- Halogens and their compounds
- Phosphorous and its compounds
- Furans
- Dioxins
- Particulate matter

d) List 1 Substances

The following substances are not permitted to be discharged to ground water:

- Organohalogen compounds and substances that may form such compounds in the aquatic environment.
- Organophosphorous compounds
- Organo Tin compounds
- Substances that possess carcinogenic, mutagenic, or teratogenic properties
- Mercury and its compounds
- Cadmium and its compounds
- Mineral oils and hydrocarbons
- Cyanides



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e) List 2 Substances

The following substances must only be released to the environment if there will be no significant contamination of water supplies used for potable consumption, and no other significant environmental impacts.

- Metals and metalloids (other than those on List I)
- Biocides
- Substances that could effect taste or odour of groundwater
- Toxic or persistent organic compounds of silicon, and substances that may cause the formation of such substances in water
- Inorganic compounds of phosphorous and elemental phosphorous
- Fluorides
- Ammonia and nitrates

Discharge of List 2 substances will only be permitted if a prior investigation of the potential environmental impact has been carried out and operators can demonstrate there will be no impact on groundwater resources.

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APPENDIX 3 INTERNATIONAL STANDARDS

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INTRODUCTION

This appendix provides information on relevant international environmental standards and guidelines, which Group Companies must take into account when preparing PPC Compliance Reports, in accordance with the ADNOC Code of Practice on Pollution Prevention and Control. These international environmental standards should also be taken into account during preparation of Environmental Impact Statements, in accordance with the document ADNOC '*Codes of Practice on EIA*' [Ref. 5].

It is important to distinguish between environmental standards, which regulate the quantity of a particular pollutant permitted to be discharged to the environment, and standards which are designed to control environmental quality (ambient standards). The former are generally referred to as source or emission standards, whilst the latter are typically called environmental quality standards/criteria. Environmental Quality Standards (EQS) may be further designated according to the environmental medium, which they are designed to protect e.g. ambient air quality standards, receiving water quality standards etc.

INTERNATIONAL STANDARDS

In addition to national standards (see Section III), Group Companies must consider other relevant standards where appropriate. Environmental standards have been developed by various international bodies and in particular:

- World Health Organization (WHO)
- United States Environmental Protection Agency (USEPA)
- European Union (EU)
- UK Environment Agency (EA).

These standards are regularly subject to change, as scientific knowledge on possible effects of pollutants on the environment increases, and as new technologies become available to control pollution. For these reasons, specific standards are not given in this report, but the sources of information for the standards are provided. Group Companies must ensure that the latest version of the relevant standards are used.

<u>WHO</u>

The WHO has developed a number of guidelines for environmental quality which are designed to protect human health. Guidelines are available for air and water quality, and a number of Environmental Health Criteria Documents have been published for specific pollutants.

• **Air Quality:** Information on current WHO air quality criteria is published in: *Air Quality Guidelines For Europe, WHO, Geneva, 2000.*

Information on WHO Air Quality Guidelines and other criteria is available from the following: www.who.dk/air/Activities/20020620_1

• **Water Quality**: WHO Guidelines for drinking water quality are published in *Guidelines for Drinking-Water Quality, 2nd Edn. WHO Geneva, 1993.*

[5] ADNOC Manual of Codes of Practice: 'Code of Practice on EIA', ADNOC-COPV2-01.



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Information on the current guidelines is available at: <u>www.who.int/water_sanitation_health/GDWQ/Sumary_tables/sumtab.htm</u>

<u>USEPA</u>

The USEPA has developed a range of environmental standards which are used by individual states for environmental regulatory purposes. These standards cover air emissions, waste, water, source reduction / waste minimization, and land. These standards are published in the Code of Federal Regulations (CFR) Title 40 – Protection of the Environment. These regulations can be accessed electronically via the internet at the following address: www.epa.gov

• **Air quality**: National air quality standards have been promulgated by the USEPA under the Clean Air Act. There are two types: primary and secondary. Primary air quality standards are designed to protect public health. Secondary standards are designed to public welfare including visibility, damage to animals and crops, vegetation and buildings.

National Ambient Air Quality Standards have been set by the Office of Air Quality Planning and Standards (OAQPS) for the following pollutants:

- Carbon monoxide.
- Nitrogen dioxide.
- Ozone.
- Lead.
- Particulate matter < 10 micron.
- Sulphur dioxide.

Information on these standards is available at: <u>www.epa.gov/airs/criteria.html</u>

Standards to seek to regulate the emissions of Furans and Dioxins are detailed in the US Toxic Substances Control Act (TSCA).

The USEPA also provides guidance on emission limits for different industries and on Best Available Control Techniques (equivalent to BAT). Relevant information is available at:

www.epa.gov/air/caa/title1.html www.epa.gov/docs/epacfr40/chapt-I.info/subch-N.htm www.access.gpo.gov/nara/cfr/cfrhtml 00/Title 40/40cfr435 main 00.html

• Surface and Groundwater Water Quality: Water quality standards are based on set limits determined for specific industrial discharges, and on the need to protect the quality of receiving waters by application of BAT. Specific standards also apply to the protection of useable groundwater. Further information is available from: www.epa.gov/safewater/regs.html



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Waste: For hazardous waste management specifically, ADNOC has adopted the system as defined in the US EPA Resource, Conservation, & Recovery Act (RCRA) [Ref. 19], which provides the standards that seek to regulate the generation, transportation, treatment, storage and disposal. In addition, and as a useful reference, the RCRA, provides a framework for the management of non-hazardous wastes in order to prevent and control pollution.

The USEPA also provides specific guidelines for the design, commissioning, operation and decommissioning of waste disposal facilities and on disposal of wastes from oil and gas drilling and production. Information on these guidelines is available from:

www.epa.gov/epaoswer/osw/laws-reg.htm www.epa.gov/docs/epacfr40/chapt-l.info/subch-l.htm

EUROPEAN UNION

The EU has prepared a number of BAT Reference (BREF) Notes which detail ELVs and BAT for a range of industries. BREF Notes are still under development and not all industry sectors are fully covered. Those relevant to ADNOC Group Companies include:

- Refineries
- Emissions from Storage of Bulk or Dangerous Materials
- Large Volume Inorganic Chemicals
- Waste Incineration
- Polymers
- Energy Efficiency

BREF Notes can be accessed via the European IPPC Bureau website:

www.eippcb.jrc.es/pages/BActivities.htm

UK ENVIRONMENT AGENCY

A range of guidance on PPC and BAT is available from the UK Environment Agency, including ELVs. The following key documents provide useful information relevant to the oil and gas industry:

- 1. Petroleum Processes: Oil Refining and Associated Processes. Chief Inspectors Guidance Note S2 1.10. HMSO, 1995.
- 2. Petroleum Processes: On-Shore Oil Production. Chief Inspectors Guidance Note S2 1.11. HMSO, 1995.
- 3. Oil and Gas Processes: Supplementary Guidance Note IPC S3 1.02. Environment Agency, 2000.

[19] ADNOC Manual of Codes of Practice: 'Code of Practice on Waste Management', ADNOC-COPV2-05.



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Adherence to the requirements of these documents is considered to represent BAT for the oil and gas industry in the UK.

This information is available via the EA website at:

www.environment-agency.gov.uk/epns

National ambient air quality standards have also been developed for the UK. These cover the following pollutants:

- Benzene
- 1,3 Butadiene
- Carbon monoxide
- Lead
- Nitrogen dioxide
- Particles < 10 micron (PM_{10})
- Sulphur dioxide.

Details of these standards are available on the Department of Environment, Food and Rural Affairs website:

www.defra.gov.uk/environment/airquality/strategy/index.htm

UNITED NATIONS ENVIRONMENTAL PROGRAMME (UNEP)

UNEP does provide a variety of protocols and study reports on how international standards can be interpreted and implemented. Details are available on the UNEP website:

www.unep.org.bh www.uneptie.org

In addition, ECOLEX provides an overview of International UN and national/regional laws/conventions/protocols/treaties and regulations that apply to the environment. This information is available via the ECOLEX website at:

http://www.ecolex.org/ecolex/index.php

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APPENDIX 4 MAIN GROUPS OF MUTUALLY INCOMPATIBLE WASTE STREAMS



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MAIN GROUPS OF MUTUALLY INCOMPATIBLE WASTE STREAMS

Based on reference Source: United States Environmental Protection Agency Code of Federal Regulations, 40 CFR 264, Appendix V.

The mixing of any **Group A** materials with any **Group B** materials may have the consequence as noted below:

GROUP 1	Potential Consequences: Heat generation, violent reaction		
	Group 1-A	Group 1-B	
Acetylene sludge		Acid sludges	
Caustic alkaline liquids		Acid and water	
Alkaline cleaning agents		Battery acid	
Alkaline corrosive battery fluids		Acidic Chemical cleaners.	
Caustic waste water		Electrolyte acids	
Lime sludge and other corrosive alkalis		Etching acid, liquids or solvents.	
		Pickling liquor and other corrosive acids	
Spent caustic solutions		Any Spent acid	
opent causile solutions		Spent mixtures of acids	
		Sulphuric, Nitric, Hydrochloric, Hydrofluoric or other mineral acids	
GROUP 2	Potential Consequences: Release of toxic or otherwise hazardous substances in the event of fire or explosion		
	Group 2-A	Group 2-B	
Asbestos waste		Cleaning solvents	
Calcined and Flux-calcined Diatomite		Petroleum, Oils, Lubricants	
'Filter-aid' powders		Obsolete explosives	
Unrinsed pesticide containers		Refinery waste	
Waste blocides		Organic solvents	
Beryllium wastes		Inflammable fluids	
GROUP 3	Potential Consequences: Fire or explosion; generation of flammable Hydrogen gas.		
	Group 3-A	Group 3-B	
Aluminium			
Beryllium			
Calcium		Any material listed in Group 1-A or 1-B	
Lithium			
Magnesium			
Potassium			
Sodium			
Zinc powder and other reactive metals and metal hydrides.			



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GROUP 4	Potential Consequences: Fire or explosion or exothermic heat generation; generation of flammable or toxic gases.		
	Group 4-A	Group 4-B	
All Alcohols		Any materials in Groups 1-A and 1-B.	
All Alkanols		Calcium	
Water		Lithium	
		Metal Hydrides	
		Potassium	
		Sodium	
		Sodium Dithionates, Sodium Hydrosulphites, Phosphides, Chlorosilanes and any other strongly hydrophilic, water reactive materials. (Complete reference list: <u>http://www.tc.gc.ca/canutec/erg_gmu</u> /search/tdwrm.asp?lang=en_)	
GROUP 5 Potential Consequences: Fire , violent reaction or explosion			
	Group 5-A	Group 5-B	
Aldehydes		Group 1-A or Group 1-B or	
Ketones,		Group 3-A materials.	
Alkanones.			
Alcohols			
Alkanols			
Halogenated hydrocarbons			
Nitrated hydrocarbons and other reactive			
Unsaturated hydrocarbons			
GROUP 6 Potential Consequences: Generation of toxic Hydrogen Cyanides or Hydrogen Sulphide gas.			
	Group 6-A	Group 6-B	
Spent Cyanide	e and Sulphide solution	Group 1-B materials	
GROUP 7	Potential Consequences: Fir	e , violent reaction or explosion.	
	Group 7-A	Group 7-B	
Chlorine, Chlorates, Chlorites		Acetic acid (Alkanoic acid) and other organic acids.	
Hypochlorites		Concentrated Mineral Acids.	
Perchlorates		Group 2-B materials	
Other Halogens and their oxidation		Group 3-A materials	
products		Group 5-A materials	
		Other compustible, flammable materials	
Porovidos			
Magnesium Dioxide (dry battery material)			
All other strong oxidizers			
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