REPORT ON INTEGRATED LARGE SCALE AUDIT

ENVIRONMENT AGENCY

Albright & Wilson, Oldbury Works

Midlands Region

2 - 9 October 1996

Upper Trent Area

CONTENTS

REPORT SUMMARY

SCOPE OF AUDIT

Large scale site audits were developed by Her Majesty's Inspectorate of Pollution (HMIP) as a supplement to the routine regulation under Integrated Pollution Control (IPC) of particularly complex sites or those which have a high potential to pollute, so that an assessment could be made of their overall environmental performance. These audits are focused on sites where the pollution potential is highest, in line with the emphasis placed by the Environment Agency on targeting resources where environmental risk is greatest. This type of site is often regulated under several of the Agency's functions, and where appropriate the Agency is now extending the scope of such audits to include Water and Waste issues.

Albright & Wilson's Oldbury Works has been used for the manufacture of phosphorus and phosphorus-based chemicals for over 120 years. The major potential environmental hazards are due to the quantities of phosphorus, chlorine, phosphorus chlorides, and phosphine gas used or produced on the site; however, a wide range of materials are produced in many processes of varying size and complexity, with potential discharges to land, air, and water.

The main objective of the audit was to assess the underlying factors affecting compliance with the IPC authorisations. This involved a detailed and critical examination of process design and development, plant operation and maintenance, and the Company's environmental policy, training, and awareness at all levels, from the Technical Director to plant operators. Staff from the Agency's Water Quality and Water Resources functions investigated surface drainage and site water use, and Waste Regulation Officers checked compliance with the Duty of Care and the Waste Management Licence for the Company's nearby landfill site.

MAIN FINDINGS

Company Environmental Policy and Implementation

On the basis of practice at the Oldbury Works, Albright & Wilson ("the Company") take their environmental responsibilities seriously and have adopted a Health, Safety and Environmental (H S & E) policy of an exemplary standard.

Written procedures are in place to cover all aspects of process operation and maintenance. Plans are drawn up on an annual basis to take Health, Safety and Environmental projects forwards and to set targets. The generic Company H S & E Manual requires that site specific policy should be generated at a local level. At the Oldbury Works ("the Works") there is a

local H S & E policy document, together with a Site Waste Management and Pollution Control Dossier covering more specific issues, but in some areas further expansion of the guidance in the generic manual has been considered unnecessary.

There are well-established systems for cascading information from management downwards and for feedback. The Audit Team however noted a tendency for environmental issues to be given a disproportionately low profile when compared to Health & Safety, particularly with respect to longer term, less acute environmental hazards. This is perhaps understandable in view of the materials handled at the Oldbury Works, where Health & Safety and short-term Environmental concerns tend to coincide; however, it has left room for improvement in some areas in terms of environmental awareness (including awareness of environmental responsibilities). A personal copy of a summary of the Works H S & E requirements has been issued to each individual worker, but the general impression is that the environmental section has been added as an afterthought; for example, while the statutory duties of the Company and individuals regarding Health & Safety are spelt out, their legal environmental responsibilities are not mentioned.

Matters which have potential for impact on the environment are duly addressed and the internally set environmental targets are met. Environmental issues form part of each manager's formal objectives; for example, the performance of individual managers is assessed against compliance with the IPC authorisations. The Audit Team expressed concern that this could in effect discourage the reporting of incidents, but were assured that the reporting system is completely open and without even implied penalty.

However, the impression received at some levels of the organisation was that environmental compliance is seen to be the responsibility of the Safety & Environment Group, rather than of the production departments. Additionally, some managers seemed to hold the view that meeting release limits and authorisation conditions is all that is necessary to comply with the authorisation. The Works management do not seem to have fully assimilated - or, perhaps more likely, communicated - all that the Environmental Protection Act 1990 (EPA90) requires; for example the concept of residual BATNEEC (Best Available Techniques Not Entailing Excessive Cost), with the requirement *in the first instance* to prevent the release (of prescribed substances), and *only where that is not practicable by the use of BATNEEC*, to reduce the release to a minimum and render harmless any such substances which are released. It is, however, fair to comment that this finding was not uniform across the site.

Training

A comprehensive, well documented, training system is in place with commitment from the top. There is a large proportion of highly qualified individuals working on the site at all levels. Individuals have their own set of identified training targets and are encouraged to be proactive with respect to their own needs. The Company have made a large training commitment to the attainment of safety qualifications at all levels in the organisation; in comparison the training relating to environmental issues and awareness of related legislation

is much less well developed. At operator level it was found that individuals were appropriately trained to discharge their duties and while in many cases they were being encouraged to undertake training to improve their technical awareness, there was little awareness of environmental issues or appreciation of the environmental consequences of the process or of the consequences of releases. It was was noted that environmental awareness training is currently underway and it is expected that the current situation will improve. Overall, there are no major criticisms of what is basically an excellent system.

Process Development and Maintenance

The system for the development of new projects is appropriate for the material hazards involved and contains sufficient checks and balances to ensure that environmental concerns are addressed at each stage. On the basis of those projects examined, this system is adhered to. Although the system has only been in place since the early 1990's, earlier project work was seen to have demonstrated this attitude in spirit. Environmental concerns are the driving force for some projects.

The maintenance systems in place were found to be sound, and were incorporated into the management of each area rather than into a central engineering function, giving greater control and more scope for flexibility. The Company are moving away from a breakdown maintenance philosophy to a reliability centred system. Environmental issues are given consideration in the risk assessment carried out for various maintenance operations. There is a good system for auditing of contractors prior to employment and for tracking their performance on site.

Incidents and Complaints

Some confusion was found concerning the interpretation of the authorisation conditions requiring notification to the Agency of environmental incidents (ie unauthorised or uncontrolled releases, or incidents or situations which could have given rise to them). The Agency could benefit from producing clearer guidance both internally and to industry on the reporting criteria. The current Works policy is to undertake a risk assessment of the occurrence and if there is no evidence of harm having been caused then it is not reported. Failure of procedures and/or loss of containment or control are not necessarily seen as reportable incidents if no actual harm is perceived to have occurred. Whether reported to the Agency or not, appropriate follow-up action is undertaken by the Works to minimise the impact and prevent a recurrence. The internal incident reporting (Z408) system is a highly effective tool for learning from incidents and instigating appropriate action.

There is a well organised system in place for receiving complaints and initiating action. It appears as though there is an informal two tier system for complaints, and purely nuisance complaints do not receive such a high level of response as others; this seems to be unintentional, rather than by design. No audit trails are produced, hence it is difficult to follow such complaints through and trends cannot be seen. Complaints which can be related to actual events are treated seriously and dealt with adequately.

Compliance with Permissions

All of the the improvement conditions imposed by the IPC authorisations at the Oldbury Works have been completed. With only minor exceptions which can be easily rectified, these were found to have been discharged adequately. Compliance with other conditions in the authorisations is generally good.

The Audit Team found some cause for concern regarding the drainage system on the Oldbury site. The ongoing upgrading work being carried out on the overhead effluent transport system is a commendable step forwards, however, in contrast, day-to-day maintenance of the underground sections of both the effluent system and the surface water drainage system seems to take a relatively low priority. The Company's release minimisation strategy centres on containment at plant level; however, outside process buildings at the Oldbury Works there seems to be a philosophy that contamination occurring while the drainage is still on site is less important because it can be caught at the effluent treatment plant. This overlooks the fact that the surface water catchment lagoon can and does overflow into the canal (on rare occasions, because the Works recognises that the discharge quality is marginal for compliance with the Discharge Consent and therefore normally diverts it to the effluent treatment plant). The potential for improvements to this aspect of the site needs to be reviewed.

The Oldbury Works no longer uses their water abstraction licence and all supplies are now mains water. Although water is metered onto the site, there is relatively little sub-metering, except on new processes, making it difficult to ascertain the water usage of any particular process. A number of projects are being successfully undertaken to reduce the amount of water used on the site by recycling.

The system for managing waste disposals from the site was found to be well set up and administered by individuals with a high level of knowledge of the subject. The Works err on the side of caution when deciding upon disposal routes and could make some cost savings if provided with further guidance on waste categorisation by the Agency. The Rattlechain Landfill Site complies with all licence conditions, and borehole samples demonstrate that it is well contained. A number of interesting projects are in progress to minimise the amount of waste arising from the Oldbury site.

CONCLUSION

Compliance with the IPC authorisations and other licences or consents is good. This is a site at which a high priority is given to minimising the impact that its undertakings have on the surrounding community and on the environment as a whole, and the audit found no cause for any major concerns regarding environmental protection.

However, scope for further improvement was noted in some areas, for example surface water drainage. In general, environmental awareness needs to be given a higher priority to bring it up to the standards applied to Health and Safety.

THE COMPANY'S RESPONSE

After presentation of the results of the audit, Albright & Wilson accepted the Agency's invitation to contribute to the Audit Report. This is their view of the audit and its findings:

Taken overall, Albright & Wilson's impression was that the audit was a useful exercise, with both the Company and the Agency deriving benefit from it. The Company welcomes the opportunity to comment both in general terms on the conduct of the audit itself, and also specifically upon some of the findings of the audit report.

1. General Comments on the Conduct of the Audit.

On the conduct of the audit, there are both positive and negative aspects, listed below:-

Positive Aspects

- *The Company was informed of the Agency's intention to carry out the audit in good time. This allowed for familiarisation of the auditing Inspectors with the site and its processes in advance.*

- *The audit was wide ranging, examining many aspects of the site's operation. This was done using a sampling approach analysing a particular aspect in detail in one or two specific areas of the site.*

- *Albright & Wilson staff found it useful to have the site and Company environmental management procedures examined by an external organistaion.*

- *The audit was discussed in an open and frank way, allowing a number of issues, both those specific to the site and also those applicable more generally to operators of prescribed processes, to be thoroughly examined. Our view is that both Albright & Wilson and the Agency benefitted from this.*

- *The audit itself helped to raise awareness of the Environment Agency and environmental regulation. Many site staff who would not normally do so had contact and discussions with Agency Inspectors.*

- *Useful feedback on each day's findings was provided by the Audit Team Leader at the end of each day. The site management team was therefore kept regularly appraised of the progress of the audit and its findings.*

Negative Aspects

■*Large scale audits inevitably require significant resources from both the Company and the Environment Agency.*

■*Because of the limitations on the time and resource available for the audit, it was necessary for the Agency to use the sampling approach, mentioned above, in order to cover all aspects of the site's activities in the time available. Unfortunately, one consequence of this was that the Agency Inspectors only had sufficient time to speak to a very small proportion of the staff engaged in a specific activity. This inevitably leads to an element of subjectivity in the audit findings.*

■*Feedback to Albright & Wilson staff at the end of each session was provided by the Audit Team Leader only. From Albright & Wilson's viewpoint, additional feedback at these sessions from the actual auditors would have been beneficial.*

2. *Specific Comments on Audit Findings*

Albright & Wilson place the highest priority on the protection of its employees, customers, neighbours and others who may come into contact with, or be affected by, its operations or products. This is the guiding principle of our Health, Safety and Environment Policy.

The audit findings demonstrate a high level of compliance with this policy from an environmental standpoint in the majority of the areas of activity audited. High levels of compliance were noted in the areas of process development, waste management, plant maintenance, compliance with IPC authorisation requirements, staff training and waste minimisation.

The Audit Report highlights a number of areas for review and improvement:

■*The philosophy and management of the site stormwater system.*

■*The suggestion that environmental matters are given a disproportionately low profile when compared with health and safety issues.*

■*The on-site criteria for the reporting of unauthorised releases.*

■*The suggestion that the site was failing to either assimiliate or communicate the requirement to apply residual BATNEEC (Best Available Techniques Not Entailing Excessive Cost) to the operation of its processes.*

Our response to these specific areas is as follows:

With respect to stormwater management, we would agree with some of the audit findings and accept the need for further improvement in some areas, mainly on older plant. However, we firmly believe that the appropriate facilities have been provided on the site's newer plant and installations. The Audit Report gives little mention of this.

Albright & Wilson's view on the issue of the profile given to environmental issues vis-a-vis *health and safety, recorded in the audit findings, is that we manage health, safety, and environmental issues as three sides of the same triangle. We believe that the overall findings of the audit confirm the effectiveness of this approach. This being said, the company accepts that some improvements in documentation can be made so as to further raise the profile of environmental matters within the organisation.*

The issue of defining the criteria for the reporting of unauthorised releases is one which has implications for all operators of processes regulated under IPC. At present there are no clear guidelines at national level from the Agency on this subject. As a consequence, operators, including Albright & Wilson, have reached their own agreements with local Inspectors on the criteria to be used for unauthorised release reporting. The Oldbury Site has adopted a risk assessment/judgemental based approach, which had been agreed with the former HMIP Inspector prior to the formation of the Agency. The auditing Inspectors felt that this approach had led to fewer unauthorised releases being reported than they believed personally to be appropriate. Albright & Wilson are working with the Agency to resolve this issue. The Company's view is that clear unambiguous guidance, similar to that produced by the HSE under RIDDOR, is appropriate, to provide a common basis for release reporting across industry.

Concerning the Company's assimilation and communication of the requirement to apply residual BATNEEC, the Company's view is that residual BATNEEC is applied and that, somewhat in contradiction with the report, the philosophy is well understood by many in our organisation. This is evidenced by the very minor nature of the Improvement Conditions required when the first IPC authorisations were granted by the then HMIP, and the good performance of the site's processes in OPRA assessments carried out by HMIP and Agency Inspectors. The comments made in the Audit Report on process development and waste minimisation further evidence this point.

BACKGROUND TO AUDIT

1. INTRODUCTION

1.1 The Environment Agency

The Environment Agency has been formed by bringing together Her Majesty's Inspectorate of Pollution (HMIP), the Waste Regulation Authorities (WRA's), the National Rivers Authority (NRA) and some units of the Department of the Environment dealing with the technical aspects of waste and contaminated land.

The Agency's functions most relevant to the regulation of industrial sites are as follows:

Integrated Pollution Control	Implement the requirements of Part I of the Environmental Protection Act 1990 for authorisation and regulation of the potentially most polluting industrial processes, covering releases to all environmental media
Waste Regulation	License and regulate the transfer and disposal of waste under Part II of the Environmental Protection Act 1990
Water Quality	Regulate releases to controlled waters, including ground water, under the provisions of the Water Resources Act 1991
Water Resources	Control water abstraction and use under the Water Industry Act 1991

In addition the Agency may call upon the expertise of its own non-technical management in assessing a company's organisational structure, philosophy, and procedures.

1.2 Large Scale Audits

Large scale audits have been developed as a complementary tool to routine regulatory activities. These intensive audits are undertaken in order to assess the underlying factors influencing the environmental performance of sites which have a high potential to pollute or which may be particularly complex. In selecting sites for audit, the criteria include the scale of operations, the variety and complexity of the processes, and the potential environmental impact.

Such audits consist of pre-planned intensive investigations carried out by a team of experienced Agency staff over a period of several days. While compliance with the release limits and process conditions set out in the IPC authorisations is examined, the primary aim is to ensure that the underlying management systems controlling compliance are appropriate

and that implied conditions such as residual BATNEEC are understood and taken into account. The formation of the Environment Agency has enabled wider environmental issues on the site concerning water usage and the quality of discharges as well as waste management, which previously fell outside of the IPC regulatory remit, to be addressed as an integral part of the audit. This greatly facilitates the development of a more complete picture of the impact of the process on the environment as a whole.

In addition to the scrutiny of process control, waste management and water quality/resource issues, such audits focus upon the existence and effectiveness of the management system and training which underpin the environmental performance of the organisation.

1.3 Albright and Wilson Oldbury Works

The Oldbury site of Albright and Wilson has been in operation since about 1852, manufacturing primarily materials derived from phosphorus and phosphoric acid. The present site occupies an area of 52 acres adjacent to the M5 motorway and surrounded by mixed industrial/residential areas (location and site plans are given in Appendix 1). The number of employees currently stands at approximately 700.

Because of the quantities of chlorine, phosphine, and phosphorus used, the site falls under the Control of Industrial Major Accident Hazard Regulations 1984 (CIMAH), and the Control of Industrial Major Accident Hazard (Amendment) Regulations 1990. An Off-Site Emergency Plan has therefore been produced by West Midlands Fire Service Emergency Planning Unit, with the assistance of the Company.

Production activities are under the control of the Works Manager who is supported by two Technical Managers and two Production Managers. The pilot plant, while under the control of the Works Manager, is managed within the Research and Development function. Systems for health, safety, and environmental protection cover all functions on the site and are coordinated by the Safety & Environment Manager, who reports to the Works Manager.

A number of discrete operations are currently carried out on site, some of which are unique in terms of process chemistry and process control. Plant ranges from modern "state of the art" to long-established processes, with similar variability in plant size and throughput. Both batch and continuous processing is undertaken. For management purposes the site is divided into two areas - "Topside" and "Bottomside" - each with its own Production Manager.

Prior to the implementation of Integrated Pollution Control within the Chemical Industry Sector during 1993/94, releases to atmosphere from the site were regulated under the Alkali &c Works Regulation Act 1906 and the Health and Safety at Work etc Act 1974. Twelve separate IPC authorisations are now in place for the prescribed processes on the site; these include regulation of discharges to the water environment and also waste handling on site, in addition to releases to the air. There is one process on the site designated for Local Authority Air Pollution Control (lime slaking); for the sake of continuity and by agreement with all

parties, this process is also regulated by the Agency following a Direction by the Secretary of State under section 4(4) of EPA90. There are also a number of other processes on the site not subject to control under Part I of EPA90.

1.4 Public Registers and Access to Information

The Agency has a legal obligation to maintain Public Registers of information relating to the various functions which come under its control. The applications made by Albright & Wilson for IPC authorisations and copies of the authorisations, together with monitoring data, are available for public inspection.

More detail can be found in the Agency publication "A guide to information available to the public" which outlines the types of information available and gives the addresses of Public Registers within each Region.

2. AUDIT METHODOLOGY

2.1 Aims of the Audit

The audit of Albright & Wilson's Oldbury Works had the following general aims:

(i) to assess compliance with section 6(1) of EPA90 for selected processes (described in Section 3):

- to assess compliance with the specific conditions of the IPC authorisations
- to look in detail at the effectiveness and coverage of the environmental management systems in place
- to evaluate the level of awareness of personnel at all levels on matters relating to environmental protection and to examine the scope and content of training given to personnel

  (section 7(10) of EPA90 specifies that BATNEEC includes, in addition to any technical means and technology, the number, qualifications, training and supervision of persons employed in the process)

(ii) to assess compliance with consented limits for discharge to controlled waters from the Oldbury site and from Rattlechain Landfill Site

(iii) to assess compliance with consented conditions for abstraction of water and consider water usage across the site

(iv) to assess compliance with the Waste Management Licence for the Rattlechain Landfill Site

(v) to examine procedures for off-site disposal of wastes, auditing of contractors and compliance with current legislation

(vi) to review authorisations, licences and consents, where appropriate to facilitate effective regulation of the site by an integrated regulatory body

2.2 Audit Preparation

Agency personnel were selected on the basis of existing regulatory responsibility for the site, and additional IPC Inspectors from Upper Trent Area and the Regional IPC function were chosen to supplement the two Site Inspectors. The Agency's Regional Personnel department provided assistance in examining management systems and training. Pre-audit meetings of the Audit Team established objectives and allowed Agency personnel with different responsibilities to adopt an integrated approach.

Because of the considerable overlap between Health & Safety and Environmental issues at the Oldbury Works, discussions with the Health & Safety Executive (HSE) were held in advance of the audit.

The Company were given prior notice, and pre-audit discussions were held in some detail in order to allow senior personnel to be available at the required times and to make the necessary substantial time committment without an unacceptable impact on their business responsibilities. They were also notified of the processes which would be audited.

The Company co-operated with Environment Agency personnel at every stage during the planning of the audit and senior managers were in attendance where appropriate during the audit. Inspectors were able to freely question Albright & Wilson personnel at all operational levels and examine operating records as required.

3. REGULATORY FRAMEWORK

A total of twelve IPC authorisations are in place covering different prescribed processes operated on this site. Four of these are "envelope" authorisations covering a range of related processes carried out using the same plant and with related process chemistries, others are for discrete processes; one is a "Small Processes" envelope covering processes with a wide range of process chemistries but with an aggregate annual production of < 250 tonnes.

The IPC authorisations examined during the audit were:

AI6100	Phosphorus Trichloride/Phosphorus Oxychloride
AO0636	Nickel Sulphamate
AM7605	Phosphine
AH7348	Pilot Plant & Development Processes
AO0644	Accomet C/Reduced Chromic Acid (RCA)
AM0023	Sodium Monofluorophosphate (SMFP)

These processes are described in more detail in Section 4. Those authorised processes not specifically covered by the audit, but visited in the course of meeting the objectives of the audit, were:

AR1086	Manufacture and Blending of Polyphosphoric Acid
AO0628	Production of Diethylphosphorochlorothioate (Ethyl PCT)
AM0805	Production of Acetodiphosphonic Acid (ADPA)
AL2225	Manufacture of Aminomethylenephosphonates (Briquest Process)
AM0040	Production of Customised Liquid Blended Products (CLBPs)

Compliance with the following other permissions was also investigated:

(i) Disposal of inert sludges and solids from the Oldbury site to the Company's dedicated landfill - Rattlechain Landfill Site. (Waste Management Licence issued by West Midlands County Council in January 1978 under the Control of Pollution Act 1974)

(ii) Consent to discharge filtered effluent from landfill to controlled waters (issued by NRA)

(iii) Consent to discharge Oldbury site surface water run-off to controlled waters (issued by NRA)

(iv) Water Abstraction License for boreholes on the Oldbury site (issued by NRA)

(v) Compliance with Duty of Care for offsite treatment/disposal of solid and liquid wastes from the Oldbury site by licensed contractors

Treatment and subsequent disposal of site process effluent to foul sewer, and the handling and storage of other liquid and solid wastes on site, are covered by the IPC authorisations. The effluent treatment plant serving the whole site is included in authorisation AI6100

Compliance with all of the above authorisations and permissions is now regulated by the Environment Agency.

4. PROCESS DESCRIPTIONS

Processes for audit were selected to provide a representative cross-section of the scale, complexity, age, and potential environmental impact of the processes on the Oldbury site. A brief overview of each of the authorised processes examined in depth is given below. More detailed process descriptions are contained within the authorisation documents and accompanying applications, which are available for viewing on the Public Registers except where subject to Commercial Confidentiality under section 22 of EPA90.

4.1 Authorisation No AI6100 - Manufacture of Phosphorus Trichloride and Phosphorus Oxychloride

This is an "envelope" authorisation which includes the handling of chlorine and also the effluent treatment plant which serves a number of processes on the site.

Phosphorus trichloride is produced by a continuous chlorination reaction by sparging chlorine gas into liquid phosphorus trichloride and phosphorus. Distilled and condensed product is stored in three tanks under a nitrogen blanket. Effluent from the process is directed to the on-site effluent treatment plant.

Liquid chlorine for the process is delivered by road tanker and off-loaded into a buffer tank by displacement with nitrogen. The Works operate a "just-in-time" policy to minimise storage requirements. The on-site user processes are fed by a vaporising system. Saturated nitrogen is fed to a dedicated scrubber containing sodium hydroxide solution and which vents to atmosphere via a 30 metre stack. The reaction with chlorine produces sodium hypochlorite solution, the majority of which can be sold.

Phosphorus oxychloride is produced by the direct oxidation of phosphorus trichloride under controlled conditions. The product is purified, cooled and fed to bulk storage tanks. Off-gases from the process are condensed and passed through a liquid separator before passing to the gas scrubbing system.

Storage tank vents, reactor seals, bursting discs, and maintenance extraction systems from the phosphorus trichloride and oxychloride processes feed to a common gas cleaning system. This consists of a two stage scrubber containing water in the first

stage followed by sodium hydroxide solution to neutralise any chlorine slippage. The system vents to atmosphere via a 31 metre stack. The spent solutions are discharged to the effluent treatment plant.

Potential environmental releases to air include chlorine gas, hydrogen chloride, and phosphorus chlorides and phosphorus acids to air; molten phosphorus is also used in the process, which is spontaneously inflammable and is therefore stored under water (storage, handling, and washing of molten phosphorus is included in authorisation AO0628).

The effluent treatment plant serves a number of processes on the site, both prescribed and non-prescribed. Treatment (to remove soluble phosphorus compounds and heavy metals) consists of primary screening, balancing, 2-stage lime slurry neutralisation, addition of flocculant and settlement. Clarified water from the settlement tanks overflows to a measurement tank and is discharged to foul sewer under a trade effluent discharge consent from Severn Trent Water. Solids removed from the effluent treatment plant are tankered away to a licensed landfill site.

4.2 Authorisation No AM7605 - Phosphine Production

Phosphine is produced on two separate production lines at a rate of 2000 tonnes per annum as a raw material feed for other production processes on the site by the continuous reaction of phosphorus with steam. Phosphorus vapour and any excess steam are removed from the phosphine stream before it flows into a sealed storage vessel. Phosphorus is recycled to the process and phosphoric acid, which is produced as a byproduct, is stored for consumption on the site. Nitrogen is used to purge the system and also to maintain positive pressure within the plant; it is treated in a combustion unit to remove traces of phosphine before discharge to atmosphere.

The headspace of the storage tanks and other potential sources of phosphate are ducted through a gas treatment system consisting of a combined water spray/filter demister system before discharge to atmosphere.

Aqueous effluent is degassed prior to discharge to the effluent treatment plant to remove dissoved phosphine. The effluent is collected into a common treatment tank for neutralisation, prior to being pumped to the site effluent treatment plant.

4.3 Authorisation No AH7348 - Small Processes Envelope (Pilot Plant and Small-scale Production Processes)

This authorisation creates a 250 tonne envelope for all pilot plant operations and small-scale development or production processes (eg "Copolymer Dip") on the site.

By the nature of pilot plant work, it is a flexible authorisation covering a wide range of process chemistry; the Company are required to notify the Agency prior to the use of new materials or release points so that, following careful consideration, they can be incorporated into the authorisation and additional conditions attached if necessary.

Discharges to water are all sent to the site effluent treatment plant; potential discharges to air include chlorine, hydrogen chloride, volatile organic compounds (VOCs), phosphorus oxides, and phosphine, but all on a relatively small scale.

4.4 Authorisation No AM0023 - Sodium Monofluorophosphate (SMFP)

This is a small plant, producing SMFP by the fusion of sodium phosphate, sodium fluoride and phosphorus pentoxide at temperatures of 700-800°C.

These components are initially blended together and then screw-fed into crucibles held within a furnace. Fusion of the raw materials takes places continuously and the molten product overflows from each crucible into a cooled mixer where the mixture solidifies. Packaging is undertaken in another part of the site.

Extraction ventilation systems remove fume and particulates from the handling and fusion processes. Gases are drawn through a water-irrigated scrubber prior to discharge to atmosphere via a 12 metre stack. Air extracted from the vicinity of product packaging operations is discharged unabated. Effluent from the scrubber is discharged into the site effluent treatment system.

The main potential releases are phosphorus oxides, hydrogen fluoride, and SMFP particulate to air.

4.5 Authorisation No AO0636 - Nickel Sulphamate

Nickel sulphamate is produced by the reaction of nickel powder and sulphamic acid in the presence of hydrogen peroxide.

Nickel powder is added to a 2.5 m^3 reactor containing a heel of weak nickel sulphamate solution. Sulphamic acid and hydrogen peroxide are added in a controlled manner whilst the reactor is held at 55°C. The resultant solution of nickel sulphamate is filtered and pumped to a holding tank, and further filtered before putting into drums for sale. Fume and particulate are extracted from the nickel loading chute and the acid addition hopper, and the air is filtered before discharge to atmosphere via a roof-top vent.

Process liquors from filter washing and plant wash-outs are collected in a sump prior to discharge to the site effluent treatment plant.

The principle potential environmental impact of this small process is the release of nickel powder or nickel salts to air, or dissolved nickel compounds to water.

4.6 Authorisation No AO0644 - Accomet C/Reduced Chromic Acid (RCA)

Accomet C is a hexavalent/trivalent chromium solution produced by the reduction of chromium trioxide ("chromic acid") with starch under reflux. Silica is then complexed with the solution to form an emulsion.

Chromic acid and water are added to a 2.5 m^3 reactor and heated. A starch solution is added such that, with the heater off, the reactor contents continue to reflux due to the heat of reaction. When the reaction equilibrium has been reached, the solution is filtered and fed to holding tanks. This chromium solution is later mixed with silica in a mixer unit to form an emulsion and then put into drums.

Local exhaust ventilation inlets are located around the silica feed point; this air is filtered prior to discharge to atmosphere via a roof vent.

Process liquors from filter washing and plant washouts are collected in a sump prior to discharge to the site effluent treatment plant.

This is another small process; its main potential environmental effects would arise from the discharge of chromium compounds or silica particulate to air, or dissolved chromium compounds to water.

REPORT

The aims of the audit were translated into specific objectives which were allocated to Agency officers on the basis of their respective fields of expertise. Each of the objectives is defined below, and the means by which the objective was met are outlined. For each objective, the findings are described, summarised in a brief conclusion and recommendations made relating to the areas investigated.

Overall conclusions, giving an overview of the general impressions, are also presented in the summary at the front of this document.

It should be noted that many of the process management procedures and techniques necessary to ensure environmental protection are also, or even primarily, required for reasons of health and safety. No part of this Report is intended to assess their adequacy in this respect, which is properly the remit of the Health and Safety Executive.

OBJECTIVE 1

To examine (i) basic Company operating philosophy, as represented in health, safety and environmental policy, (ii) the means by which it is disseminated throughout the organisation, and (iii) the means by which it is incorporated into working practices and procedures.

How this objective was met:

(i) Examination of the Company Health, Safety and Environment Policy Document and the management system in place to implement the policy.

(ii) Discussion with Directors and Works Management to ascertain their understanding of the messages passed down to the workforce.

(iii) Discussions with senior managers to establish their understanding of this message and how it is cascaded down to their staff.

(iv) Discussions with plant supervisors, operators, and tradesmen to establish how the policy requirements are translated into day-to-day activities and working practices.

(i) Health, Safety and Environment Policy and Management Implementation

(a) Health, Safety and Environment Policy

The Company has committed itself at Board level to the International Chamber of Commerce Environmental Principles. The specific Company commitment to take account of, and minimise, the environmental impact of its undertakings is made in the Company Environmental Statement. This is attached to this report at Appendix 2.

The Environmental Statement is backed up by a comprehensive Company Health, Safety and Environment (H S & E) Manual which has been approved at Board level. The Board consider that health, safety and the environment are so closely inter-related that only one policy document is needed which covers all aspects. In fact, across the site there is considerable integration of health and safety, environment and quality controls - these are seen as three sides of a single triangle.

The Company H S & E Manual is a controlled document under ISO 9000, and 12 copies are held on the Oldbury site. The manual is generic to the group of companies of which the

Albright & Wilson Oldbury site forms a part, and takes the broad policy statement and breaks it down into specific requirements, backed up by guidance as to how those requirements can be met.

The manual identifies the need for more specific guidance to be developed at a local (ie site specific) level and a local version detailing the responsibilities of named individuals was subsequently seen. However, in certain areas, the Oldbury Works management has concluded that the requirements demanded by the H S & E Manual were sufficiently detailed to preclude the need for further documentation. This view was tested by the audit team by considering the amount of detail present in selected aspects relating to environmental protection. The team accepted that, in the areas investigated, further policy documentation is unnecessary.

The corporate policy requires that a local action plan for H S & E is drawn up each year, containing targets for performance and work to be undertaken during the next 12 months. For 1996, all targets relate to the ZIP (Zero Incidents Process) Programme, which has displaced the more usual set of targets.

ZIP has been adopted as a Board initiative. It is a simple concept, designed to ensure that the full resources of the Company are used to identify and counter all possible hazards which may arise during their operations. In essence all employees are asked to consider the question *"What could go wrong?"* on the process on which they work. Working groups then consider *"What could be done to minimise the risk of it going wrong?"* and *"What could be done to minimise the consequences?"*.

The ZIP Programme is a valuable complement to the standard methods of risk analysis used by Albright & Wilson.

(b) Management of Environmental Matters

The ultimate responsibility for all matters relating to health, safety and the environment is placed upon the Chief Executive.

The Technical Director is responsible to the Chief Executive for the preparation and maintenance of the primary policy document (the H S & E Manual), and also for overseeing the implementation of the policy.

The Technical Director has responsibility for the Company Regulatory Affairs Department. This department is directly responsible for the maintenance of the H S & E Manual, and also for auditing the performance of operational units against the requirements of the Manual.

Named managers are responsible for implementing H S & E policy across specific areas of the site.

c) Company's Internal Assessment of Performance against Targets

- Auditing

Plant areas and procedures are audited on a regular basis by senior management. The Plant Supervisor carries out a weekly inspection of each plant for which he is responsible, covering housekeeping, safety equipment etc with each shift, so that each shift is covered every 5 weeks. This addresses H S & E issues. The Accomet C Process was examined in depth in this respect and it was seen that the Plant Supervisor has also initiated operator awareness training covering raw materials, their safety implications, and environmental issues.

In addition, there are routine Safety Audits involving operational staff. Safety Audits are carried out every 2 to 3 weeks by the Works Manager, looking at underlying procedures and control checks. A different area/process will be targeted on each occasion. Technical audits (which include reviewing environmental compliance) are undertaken and the permit-to-work system is regularly checked.

The site as a whole is subject to external audit by the Company Regulatory Affairs Department; this was last carried out during Summer 1996.

There are two Safety Action Groups (SAGs) covering between them the whole site, which report to the Safety and Environment Council (the H S & E policy-making body for the site, involving all senior management). These provide a monthly forum for discussion and action on H S & E matters. A monthly Safety Audit is carried out by each SAG with the involvement of the Safety & Environment Group, using a standard checklist to ensure coverage of all issues. It is normal practice for cross-auditing of each other's areas to be carried out.

During the course of the Agency audit minutes from meetings of both the Safety and Environment Council and the SAGs, together with site audit reports, were examined. There appeared to be some variability in assigning actions on the completed Safety Audit Scheme forms, although completion of actions is followed up at subsequent meetings. However, once again a much higher profile is given to safety than to environmental matters, which do not appear to explicitly feature in the Audit Checklists.

- Targets assigned to individuals

Environmental targets are incorporated into the performance assessment parameters for all senior managers and for the site as a whole. Annual salary increases are linked to overall performance against objectives, and therefore to the environmental performance of individuals and the units they manage or work in. The targets set in this way are absolute, eg "no pollution incidents or notifiable incidents".

Specific environmental responsibilities were described by one manager as ensuring that people worked to the procedures set out in the plant manuals on a day-to-day basis, and ensuring compliance with the various IPC authorisations in his area. This was set out in his management objectives. These were clear objectives which include compliance with all relevant legislation, against which he is measured.

The Company is clearly very conscious of their vulnerability, in common with all large chemical manufacturers, to adverse publicity in the event of any failure, however minor in nature. All senior staff interviewed placed considerable emphasis upon this point.

- Compliance with authorisation conditions

The Company has an internal requirement for the monitoring of environmental performance against the H S & E policy, which is achieved in part through the Technical Audit programme. However, in some areas this seems to be interpreted largely as the monitoring of performance against the limits set in various legal permissions (eg release limits to air and water), which is only one narrow measure of compliance with their environmental reponsibilities.

(ii) Effectiveness of Cascade System and Translation into Working Practices

(a) Dissemination of Information and Feedback

Guidance on health, safety and environmental matters is provided to all staff in the form of a personal copy of the "Health, Safety and the Environment" handbook (issued Q1/96). This book includes policy, a general responsibility organogram, legal requirements, and "Do/Do Not" lists of good practice. There is, however, a notable emphasis on health and safety matters - there are 35 pages on this and two on the environment. Similarly the "Legal Requirements" section is limited to sections 7 & 8 of the Health and Safety at Work etc Act 1974. There is no indication that the Company or the employee have similar statutory responsibilities under environmental legislation, although this is equally relevant.

In addition to the SAGs mentioned above, there are a number of groups within the works which act as fora for cascade of information on H S & E matters and for feedback. Some of these are plant specific, some are area wide. Some are formal and others informal.
"What If" sessions are held by plant personnel with the involvement of both production and engineering representatives. These have been introduced via the ZIP Programme, with the intention of promoting awareness of the consequence of equipment failure and how H S & E issues may be affected. There are also "Quality Work Groups" involving production and services personnel which also cover H S & E issues. Bi-monthly meetings are held with Business Managers at which a whole range of issues relating to the operation of the plant are discussed. H S & E issues will also arise here.

In addition to the above means of feeding back to management on the effectiveness of the H S & E policy, a further formal route for feedback is available via an annual review carried out by a group made up of H S & E professionals from a number of Company sites.

(b) Discussions with Operations Management and Plant Operators

Discussions were held which related both to instructions and procedures for operating the process and to the environmental awareness and level of training of plant personnel. Two areas were chosen for investigation - the Accomet C and Phosphine processes.

Environmental awareness training has been carried out down to Supervisor level and operator training on specific plant includes an environmental element. The leaders of operator teams were clearly competent and fully aware of the environmental issues and responsibilities associated with their work. Confirmation was given of the good informal routes that exist to raise environmental concerns with management, as well as more formal ones, and that they are encouraged to make use of them.

It was confirmed that supervisors and operators are included on the SAG. This provides a formal forum for discussion of environmental matters. The SAG considers all Z408 (Incidents and Dangerous Occurrences) reports, which include environmental hazards. At a lower level, health, safety, and environmental issues form part of the remit of Asset Management Teams and less formal "What If" group meetings. Examples of SAG and Asset Management Team minutes were seen. Environmental issues appear to get much less consideration than safety matters, although they do feature.

Copies of each authorisation are required to be kept in the area to which they relate and to be available to those who need to be aware of the content. Copies of relevant authorisations were seen on the plant; familiarity of process operators with the documents was variable, but there seemed to be a general awareness of the philosophy of compliance (ie numerical limits and the underlying need to operate the plant as described in the authorisation and application). This aspect is considered further under Objective 3.

A summary Night Report system is in place, copied to all senior managers, to ensure that all plants are checked and any problems identified.

Conclusions - Objective 1

Albright & Wilson have a detailed and comprehensive system in place at the Oldbury site for managing a health, safety and environmental policy which fully reflects their statutory responsibilities. The policy document, if fully complied with, should ensure a high level of environmental awareness and responsibility throughout the Company at all levels. This policy is well understood by the Oldbury Works senior management and translated into local policy,

structures, and procedures which are generally of a high standard. The policy is generally well implemented and communicated down through the management structure, bearing in mind that Environmental Awareness training at operator level is not yet complete. Communication upwards on H S & E issues also appears to be good. Operations staff are involved in a number of initiatives that derive from the H S & E policy.

However, the impression gained overall was that environmental matters are seen as very much an adjunct to Health & Safety. While it is true that there is considerable commonality, particularly on this site, the implied message is that managing health and safety issues will ensure an acceptable level of environmental performance - risking failure to address environmental issues where they do not have health and safety implications. It was also noted that in some quarters the belief persists that environmental compliance is essentially a matter of meeting release limits, ie the concept of *preventing releases, and if they cannot be prevented, minimising and rendering harmless*, and all that that implies, is not being fully understood and/or communicated. Greater emphasis needs to be given to the Company's, and the employee's, statutory duties to the environment.

Recommendations - Objective 1

(Note: the Recommendations to Objective 3 are also relevant to this area).

1. The Works should review the degree of overlap between management of health and safety and environmental issues, in cooperation with the Agency, to determine whether there are any areas for improvement.

2. The H S & E policy booklet issued to the workforce omits to mention the legal responsibilities placed on employees by environmental legislation (in contrast to the full page devoted to the Health and Safety at Work etc Act 1974). This should be rectified.

OBJECTIVE 2

Examination of in-house procedures for process and plant development/modification, particularly with respect to risk analysis/HAZOP (HAZard and OPerability studies), including assessment of potential environmental impacts.

How this objective was met:

(i) Examination of Company procedures for dealing with plant and product development to ascertain at what point and the means by which the potential for environmental consequences is assessed.

(ii) Two authorisations were selected (Phosphorus Trichloride/Oxychloride and the Pilot Plant Small Processes envelope) and the effectiveness of the procedures was followed through into actual practices.

(i) Plant and Product Development - Company Procedures

Albright & Wilson's Corporate Procedure for Programme Management was examined. This was implemented at the end of 1994 and applies to all programmes requiring contributions from several scientific or technical disciplines, including new products and processes and plant improvements, rationalisations, and decommissioning. It is adaptable to large and small programmes by adjusting the number of stages and "gates" (criteria for continuation).

This is a highly structured procedure, incorporating H S & E considerations at an early stage and several points thereafter. Waste minimisation, effluent assessment, and preliminary hazard assessments are included in initial paper exercises and laboratory evaluations. Every programme passes through a number of clearly defined stages ("Conceptual", "Feasibility", "Design", etc), all of which include H S & E checks, including formal HAZOP. An H S & E Log for every project is maintained by the Safety & Environment Group, who must formally approve every Capital Authorisation Request. H S & E studies are rigorous and independent of the scale of the project.

The Company follows a "Safe Plant" rather than "Safe Man" philosophy for process control wherever practicable. All plants are ranked on the basis of potential hazard, the ranking defining the level of Technical Audit required:

Hazard Ranking	HAZOP before implementation?	Technical Audit Frequency*
High	automatic	3 years
Medium	usually	5 years
Low	sometimes	when considered necessary

*: CIMAH Report counts as Technical Audit

Before any Pilot Plant work is undertaken, a "Project Dossier" is drawn up. This includes all technical and H S & E information, a complete assessment under COSHH (the Control of Substances Hazardous to Health Regulations), a "Substance Inventory" (including estimates of potential environmental releases), and the Project Briefing Note, including proposed operating procedures and an environmental assessment. The Project Briefing Note forms the basis of the formal submission to the Agency under the conditions of the authorisation covering Pilot Plant operations.

(ii) Assessment of the Implementation of Procedures in Practice on the Pilot Plant (Authorisation No AH7348) and the New Oxychloride Plant (Authorisation No AI6100)

(a) Pilot Plant

- Octadecyldimethylphosphonate

  The approach to the development of the manufacturing method was reviewed. The philosophy is to produce an intrinsically safe process wherever possible; detailed studies of reaction kinetics are undertaken using Reaction Calorimetry and Accelerating Rate Calorimetry (the Company has made a substantial recent capital investment in this new technique) to ensure that runaway conditions are avoided even under failure of control systems. Studies include the possible catalytic effects of common contaminants (eg iron). It was demonstrated that process design uses an "envelopes of safety" approach. Throughout the development stages the assessment of environmental issues was well documented.

- "Copolymer Dip" (Vinyl Phosphonic Acid/Acrylic Acid Copolymer)

  This was a relatively old development, prior to the current procedures, and was therefore not appropriate for audit. However, it served to demonstrate Albright & Wilson's commitment to environmental improvement, as the principal drivers for the project were environmental; having decided to manufacture the intermediate vinyl phosphonic acid themselves, Albright & Wilson developed a new manufacturing route

because the existing process was very environmentally unfriendly (producing $POCl_3$ and 1,2-dichloroethane as waste streams).

- HAZOP and risk assessments

The generic A & W HAZOP procedure was examined in the context of New Plant/Product Development, Major Modifications, Minor Modifications, Out-of-Hours Modifications and the audit/review mechanisms for pre-existing processes.

HAZOP analysis is one of the tools available for use by the Company during the development of any project on the site. HAZOP is primarily a decision aiding tool and as such its use has to be viewed in the context of its integration within the overall project management procedures used by the Company. It is also necessary that the HAZOP procedures and protocols adopted are thorough and rigorous and that these procedures are implemented by appropriately qualified individuals.

Clearly it is necessary for HAZOP to be used whenever it is appropriate to do so regardless of the "inception route" for the project, which for a major project may for example be one of the following:

- a new product - the project originating from within the commercial/marketing department

- a new process - the project originating from within the R & D or production department

- a major modification to a plant or process - with the project originating from within the R & D or production department

Management control of projects of this size is exercised in accordance with the Company's project management and financial procedures under the control of a designated project manager and Board member.

The stages of this process may be identified as innovation, concept analysis, and feasibility leading to final selection and implementation. During this process there are a number of points where the use of HAZOP analysis would or may be appropriate.

A preliminary HAZOP is carried out at the conceptual stage prior to preliminary Pilot Plant work, which can then be subsequently refined at the feasibility stage from the basic engineering calculations based on kinetic and thermodynamic data sourced from the literature or generated in the Company's own laboratories. At this stage there is no second tier guidance provided regarding the issues to address in the HAZOP, nor is there normally any peer review outside the project group of the HAZOPs undertaken. This is a possible weakness in the existing system.

The feasibility phase of a project concentrates on a single process in much greater detail, including extended Pilot Plant work, customer evaluation, and process operability and reproducibility.

A more detailed HAZOP will be undertaken at this point, and the Company follow the Chemical Industry Association (CIA) guidance. The team undertaking the work comprises the project manager, the design engineer, the project chemist, the engineering manager from the relevant process area and one "outsider". These team members will all have attended the "in-house" courses run by the corporate Health, Safety & Environment manager together with one of the senior engineers.

One outcome of the HAZOP undertaken at this stage is a the Hazard Ranking for the process. All high and medium risk processes receive a full HAZOP analysis. Whether to undertake the full study on low risk processes is at the discretion of the project manager.

Smaller process modifications are dealt with in accordance with management procedures, ie capital items are covered by the engineering procedures and company standards, with smaller projects dealt with under local revenue budgets. These projects operate to a document control system which identifies the originator of the project and the relevant production manager who acts as project manager. The document control system identifies the individual responsible for each stage of the work undertaken and each task is signed when complete.

For this type of project a safety assessment is undertaken which is based on a checklist, including questions relating to IPC changes and BATNEEC considerations. This is not a HAZOP study and is undertaken by the project engineer, who may however require a HAZOP if he considers it necessary. This procedure seems proportionate to the environmental risks related to these relatively minor changes.

(b) New Phosphorus Oxychloride Process

The initial idea for the oxychloride direct oxidation loop reactor dates from 1990. This major project was not therefore carried out fully under the current Programme Management Procedure; full compliance with it cannot be expected. However, environmental issues appear to have been taken into account from an early stage, and were one of the drivers for the development (the original 1950's $POCl_3$ process was difficult to control from an environmental viewpoint, and the competing multi-column direct oxidation process was also considered to have safety and environmental disadvantages). Extensive pilot work was carried out and a preliminary HAZOP was completed in 1991 before the project proceeded to commercial review in 1992. HMIP first became involved when the Capital Authorisation Request (CAR) was submitted in 1993; this required the preparation of a Design Dossier including a full

environmental assessment. The detail design of the plant was developed in 1994, including further HAZOPs and BATNEEC reviews (with HMIP).

The commissioning process was reviewed. This included formal assessment of the plant's environmental performance against the Design Dossier Environmental Impact Assessment.

Conclusions - Objective 2

Albright & Wilson's procedures for new product and process development (and also plant improvements, rationalisation, and decommissioning) are comprehensive and of a high standard, and would appear to take environmental issues into account fully and from an early stage. Environmental issues are well represented among the driving forces for new developments. Systems are in place to ensure full documentation of these procedures.

Current projects appear to comply with the procedures; older projects, or those whose conception pre-dates the current procedure, do not necessarily fully comply, but reflect the same responsible attitude to environmental protection.

Recommendations - Objective 2

1. Albright & Wilson's HAZOP procedure might benefit from a greater use of peer review and personnel outside the project group at the pilot stage.

OBJECTIVE 3

To ascertain the degree and cover of operator training, the adequacy of written procedures and operator familiarity with procedures.

How this objective was met:

(i) **Company/Works procedures covering the training of operators, maintenance staff, supervisory staff, relevant managers and contractors were examined, along with the means by which the effectiveness of training is assessed. The way in which written procedures are produced was also considered.**

(ii) **The written procedures for two processes (Phosphorus Trichloride/ Oxychloride and Nickel Sulphamate) were examined in detail and then a comparison made with actual on-plant practices. The level of training and familiarity with specific procedures was assessed by discussion with both plant operators and supervisors.**

(i) Company Policy on Training

The Company have achieved the IIP (Investors In People) Award, which serves to acknowledge the considerable amount of management time which is devoted successfully to the development of employees. Discussions with operations management, supervisors and operators, and checks of records served to confirm that management deliver training of impressive standards throughout the organisation down to the shop floor level.

At all levels the need for training and development is identified through appraisal systems. At managerial/staff level this is based on two-way discussion, and at operator level the needs of individuals are identified in terms of improving flexibility/competence levels by supervisors/managers.

Operating instructions exist for all plant and these are incorporated as controlled documents under the ISO 9000 standard. Because of the inherent hazards and the need for close control this led naturally to IIP and close links exist between this and the approach to ISO 9000.

It was apparent however that the standards attached to training in environmental issues did not match those applied to health and safety aspects of the business. The relative training emphasis given to environmental issues compared to health and safety is similar to that in the H S & E handbooks issued to all personnel, ie it takes very much a secondary position.

(ii) On-plant Practices

(a) Phosphorus Trichloride/Oxychloride Process

The Phosphorus Trichloride and Oxychloride plants are covered by a single IPC authorisation (AI6100) and comprise the following activities:

Chlorine handling
Phosphorus trichloride production
Phosphorus oxychloride production
Phosphorous Acid Flake (PAF)
Drum filling and tanker loading

This grouping of activities has come about following a recent restructuring exercise. A shift team of five (including the Team Leader) operate this section. At present at least two members of each shift team are able to carry out all tasks in the above five areas, with most teams having 3 - 4 members who can work in all areas.

Recent new plant includes chlorine handling and the Oxychloride plant. This has required a considerable amount of training effort. The issue of process operator "multiskilling" to increase the number of operators who are trained on all the above areas is currently being progressed by a Quality Work Group (QWG), which contains management, supervisors, and process operators.

A mixture of supervisors and operators in this area were interviewed to assess training issues. The message from all those interviewed was that training was becoming an increasingly important part of their jobs, especially with respect to new activities and processes. They all believed that training was a fundamental aspect of the culture of the Oldbury Works. Individual training needs were identified in an annual review and took the form of on-the-job training and familiarisation, in-house training on issues such as the Permit to Work system, problem solving, management, risk assessment etc, and formally recognised external training such as NEBOSH (National Examination Board in Occupational Safety and Health), HNC in Process Engineering etc.

Environmental training took the form of an overview of Integrated Pollution Control delivered by the site Safety & Environment Group.

"On the job" operator training is carried out under the control of process supervisors. Assessment takes the form of a question and answer session. There are pre-set questions on the recently installed Oxychloride complex, but not on the older plants. Thus there is potential on these older plants for different supervisors to ask different questions and so have a different standard of acceptance.

Interviews with individual process operators were generally satisfactory in confirming all the above. However, when questioned, three operators had not seen the IPC authorisation for this area and were not aware of its existence.

(b) Nickel Sulphamate

The Nickel Sulphamate process (authorisation AO0636) is part of the Transition Metal Complex (TMC) - four small processes with common operators and supervision:

Accomet C/RCA - AO0644
Nickel Sulphamate - AO0636
Copper Pyrophosphate - non-prescribed
Micromet - non-prescribed

There is also some commonality of staff with the adjacent Hypophosphorous Acid (HPA) process. The Transition Metal Complex runs in campaigns on a five shift system, with small shift teams trained for all four processes.

Training programmes, both general and specific, appear to be in place and records are maintained. Operator training on the process is given by the Supervisor, and a formal assessment is carried out and recorded on completion of each training module. A Modification Certificate system is currently being trialed on TMC, which requires the formal assessment of operator competence after any significant plant modification.

The Authorisations were both on display on the noticeboard outside the operators' rest room. However, there is no specific mention of the Authorisations or Integrated Pollution Control in the Training Programme, and the plant operator was clearly not aware of the significance of the Authorisations or saw any particular distinction between Health & Safety and Environmental hazards. The Supervisor was more aware, and identified environmental concerns mainly in terms of housekeeping and the specific issue of heavy metals going to drain (to the effluent treatment plant).

The full Operating Procedures for the plants are very good. These are used mainly for reference and training; the operators normally work to the "Quality Addendum" (ie QA procedures) and the process Batch Sheets, which provide written evidence of compliance with the Operating Procedures.

There is also a "Safety Addendum", and more detailed Safe Operating Procedures for tasks with particular hazards (it was not clear whether this included environmental hazards). These are produced by the Supervisor, with two levels of line management approval.

Procedures were then discussed with the operator on the Nickel Sulphamate plant. He seemed generally well acquainted with the process, but it was evident that recent modifications

involving the installation of particulate alarms on the discharges from the LEV (Local Extract Ventilation) had not been included in the procedures.

Aqueous effluent from the plant (and from Accomet) drains to a sump, which is pumped out by the operator when it overflows into the bunded area around the plants. It is pumped to a secondary sump (recently installed), and then to the effluent treatment plant. The contents are not normally checked for their heavy metal content unless suspect. No procedure governing this operation seemed to be available at the time of the audit

Conclusions - Objective 3

The Company appears to have a comprehensive and largely appropriate training programme for its supervisors and operators at the Oldbury Works.

Within the Chlorides Complex there was ample evidence that the training policy enunciated at senior management level was being translated into practice at all levels of the Works. There is considerable effort put into Health & Safety training, emergency response, risk analysis etc. Whilst all this will contribute to environmental protection it is felt that environmental issues could be given a higher profile, especially with respect to the requirements of EPA90. None of the process operators interviewed on this occasion remembered having seen the IPC authorisation document for this process.

In the Transition Metal Complex, similarly, little specific emphasis seems to be given to the environment with the result that it tends to be absorbed into Health & Safety. Although the potential environmental impact of these small processes is not high, it is not insignificant, and there seemed to be less significance attached to the systems in place for environmental protection than on other parts of the site. In other respects the staff appeared to be well trained, motivated, and aware of their responsibilities.

With regard to assessment of operator training it is felt that the structured approach developed for the Oxychloride plant should be extended across all processes on site to ensure common standards are applied.

Recommendations - Objective 3

1. Environmental Training should be given the same profile and raised to the same standard as Health & Safety; all process operators should be familiar with the environmental issues and IPC authorisations relevant to their areas of responsibility.

Note: At the time of the Audit, plans were in hand to develop Institute of Occupational Safety and Health (IOSH) training for first line supervisory staff. This includes an element of training in environmental regulation.

2. Environmental Training requirements should be incorporated into managerial targets.

3. The structured approach to operator training assessment used on the oxychlorides plant should be extended across the whole site, as the opportunity arises.

4. Works policy documents should be reviewed and rewritten as necessary to give appropriate emphasis to environmental issues - legislation, authorisation processes, waste disposal etc.

5. ISO 9000 controlled documents covering operating practices should have key environmental issues highlighted within them.

6. Operating Procedures, especially in the Transition Metal Complex, should be reviewed to ensure adequate coverage of control of environmental releases.

OBJECTIVE 4

4. The examination of maintenance procedures relating to both Company employees and contractors, permit-to-work systems, training, incorporation of environmental considerations and process operating aspects into the planning and execution of maintenance work.

How this objective was met:

(i) Written procedures covering plant maintenance issues, permit-to-work systems, the preparation of plant for maintenance work were examined. The incorporation of environmental considerations into these procedures was scrutinised.

(ii) Several processes were selected and the written maintenance procedures covering these processes were examined. The familiarity of tradesmen and operators with specific procedures was assessed by way of on-site discussion, as was the suitability of their training to carry out the work. The instruction given in procedures vs actual practices was also assessed.

(i) Works Structure with Regard to Maintenance

Each area (Topside and Bottomside) has an Area Production Manager who is responsible for both production and maintenance issues. Each area has its own Area Engineering Manager, who controls a team of Plant Engineers, Engineering Supervisors, Planning Engineers etc. Area Engineering Managers and Plant Engineers are graduate Mechanical Engineers. Engineering Supervisors are generally time-served craftsmen who have progressed to this position.

It is Company policy that all Area Engineering Managers and Plant Engineers receive nationally accredited health and safety training (NEBOSH certification). Supervisors may go through the Institute of Occupational Safety and Health (IOSH) course, which now includes an environmental component. There is, however, no equivalent to NEBOSH certification yet available in environmental training.

- Overall Company philosophy with regard to maintenance

  The profile of the Maintenance Policy at Oldbury has changed over recent years. Preventative maintenance now has a much more widely accepted profile (as evidenced

by the Area Engineering Department Policy - Appendix 3). Previously emergency response/breakdown maintenance was the norm.

The Works operate an equipment condition monitoring system together with proactive planning. Dedicated lubrication systems are also used. CIMAH requirements also impact on the maintenance requirements of the site.

All IPC areas have been subject to a Reliability Centred Maintenance (RCM) study. The RCM study team is very broadly based to reflect different points of view and fields of expertise. Studies are revisited periodically. This approach is proactive and relies upon condition monitoring, preventative work etc. It is now Company policy for all new plant to have an RCM study carried out and an RCM programme put in place when the plant is brought into use. The recently installed Oxychloride plant has such a programme in place.

The Works also undertake periodic technical audits (see Objective 2 section (i)). The audit team is again broadly based and involves individuals from many different disciplines. Maintenance requirements are an essential part of this audit.

The site as a whole operates a maintenance reminder policy and also includes a limited amount of built-in equipment redundancy, which will impact on plant down-time.

- Spares holdings

The Works are currently in the course of centralising all spares holdings. It has been common practice to have "satellite" spares stores located around the site but this practice is to cease. A very high level of spares are held on the site. They have also entered into a corporate Company-wide arrangement with selected suppliers to keep additional spares. The level of spares is chosen after analysis of critical equipment in which essential items of equipment are identified and relevant spares are held accordingly. In deciding on the importance of a piece of equipment, environmental considerations are given equal status to health and safety issues. The general philosophy appears to be to accept the need to hold, as a minimum, the level of spares recommended by the above analysis.

- Use of contractors

There are three areas in which contractors are used:

i) Production areas

ii) Capital projects

iii) Work initiated by the Corporate Engineering Department

Very few contractors are used in day-to-day maintenance tasks. All contractors are approved by the Buying Department, who also carry out audits of contractor performance. All subcontractors must have their own safety and environmental procedures in place and these procedures are assessed by Albright & Wilson prior to any contracts being placed. Those selected generally have a long standing relationship with the Company and are very familiar with the site as a whole. Pre-planned maintenance specifications are prepared and discussed with subcontractors prior to work being undertaken.

Each contractor has a unique identification that is used by everyone on site. In this way the Z408 incident reporting system can be interrogated to see whether any particular contractor is performing particularly badly. In addition, any small projects within the production areas will be handled by a Project Engineer who will carry out his own assessment of outside contractors.

- Permit to work system

The use of "Permits to Work" is well established within the chemical industry, and provides a means for ensuring that maintenance work carried out on process equipment is done so in a way that ensures the equipment is safe to work on and the risk of accidents or exposure to process chemicals is minimised. Although Permits to Work address primarily worker health and safety they also have an important role in protecting against the release of process chemicals into the environment. Albright & Wilson have a well-developed Permit to Work system at Oldbury which was assessed during this audit.

The Engineering Department policy statement is attached at Appendix 3.

(ii) Examination of Selected Processes

(a) Topside: Phosphorous Acid Flake (PAF) plant

Maintenance work was carried out during the two-week shut down period and had been pre-planned and a specification and completion programme prepared. The work involved Albright & Wilson personnel and subcontractors, as well as production personnel. Permits to Work were required.

The programme of work was studied in depth by the auditor and it was seen that, in general, targets had been achieved. It also highlighted that the Albright & Wilson maintenance approach was flexible and capable of rapid modification to allow additional work to be incorporated without detriment to the overall objectives.

Some criticism was made however of the Permit to Work system following the discovery of incomplete paperwork, and a particular Permit to Work relating to a tank cleaning operation which did not identify which tanks out of several possibilities were safe to enter. In this case the matter was more of a safety issue than an environmental one.

(b) Bottomside: Effluent Treatment Plant (ETP)

The ETP is in continuous operation, receiving effluent from the entire site, and can only be shut down for periods of about four hours. Prolonged shut-downs to allow extensive routine maintenance work are not possible. Because of this the plant is subject to a considerable amount of routine checking and monitoring, with an attempt to carry out more involved "annual" repair and maintenance during the summer months when some production plant is shut down. Typical routine activities are daily cleaning and buffer checks on all pH probes, weekly calibration of all pH probes, and monthly vibration monitoring of all pumps and most drives. A number of critical spares are held.

The computerised maintenance planning system ("IDHAMMER") generates job tickets for all routine tasks, and requires completion of tasks to be notified. Examples of completed ETP tasks were examined.

Discussions with the ETP operator revealed a good understanding of the plant and how it worked. The importance of pH control and the items of equipment that were critical to the plant operation were clearly explained by the operator, and the routine activities covered were all confirmed by him.

(c) Phosphorus Pentasulphide Decommissioning

Phosphorus pentasulphide is a solid material at room temperature that reacts exothermically with moisture in the air to produce hydrogen sulphide. It was produced at Oldbury by the reaction of phosphorus with sulphur. Production has now ceased and the plant was decommissioned and partially dismantled during 1996. Decommissioning was set up as a project under the overall management of a named individual from the Corporate Engineering Department (CED). A detailed programme was drawn up and a team assembled comprising a Team Leader with volunteer operators and craftsmen. Weekly progress meetings were held and risk assessments carried out on each discrete operation. This risk assessment included environmental considerations.

The key environmental issue which needed to be addressed was the vigorous fume generating reaction of phosphorus pentasulphide should it be allowed to come into contact with water. The philosophy adopted therefore was to carry out as much physical decontamination as possible, with CO_2 blanketing of vessels and pipework containing pentasulphide.

In order to assess progress, weekly risk assessment meetings were held, chaired by the Area Production Manager, at which the previous week's activities were reviewed and the risks associated with the forthcoming week's activities assessed. This in turn resulted in the production of a weekly decommissioning plan. Comprehensive documentation was retained; the decommissioning programme, the minutes from the weekly meetings, the outcome from the various risk assessments and the detailed weekly programmes were all collected within the decommissioning file.

All process waste was collected in drums. These drums were dealt with under the control of the site waste disposal staff.

Upon completion of the decommissioning/decontamination work, and after all plant designated for removal had been removed, a safety inspection of the plant area was carried out and the project closed.

The auditor undertook a brief inspection of the pentasulphide plant building. In view of the detailed and rigorous manner in which the decommissioning and equipment removal had been planned and documented there was some surprise at the poor state of housekeeping within parts of this area.

d) Pilot Plant

The Pilot Plant is included in the IDHAMMER maintenance planning system, with an outline ("skeleton") framework of tasks to be carried out and detailed schedules of work drawn up.

The Pilot Plant is a multi-purpose plant with an envelope authorisation covering a wide range of activities. It has various common facilities for environmental protection, eg the plant fume extraction and scrubbing system and the system for effluent collection and transfer to the Effluent Treatment Plant. These are included in the maintenance routines. There are very few continuous monitoring points on the Pilot Plant so routine work is limited to checking scrubber pumps, fans etc.

The spares holding philosophy is identical to that on production units: critical items (eg scrubber pumps) are held and, where possible, standardised with other similar items on site.

The whole of the Pilot Plant is a Zone 1 Flameproof Area, hence a Permit to Work system is in operation for maintenance operations.

Because of the nature of Pilot Plant operations there is no scheduled annual repair and maintenance shut-down; work tends to be routine inspection or plant modification and development.

Conclusions - Objective 4

The Works has a well structured maintenance organisation and a preventative maintenance policy. The system appears to translate well from policy to practice. There is a good system for identifying important routine tasks and monitoring progress by management. Environmental considerations do feature in the planning and execution of maintenance work. The need to keep abatement plant operational at all times is understood, as is the importance of maintaining supplies of the necessary spares.

There appears to be a sound approach to contractor selection and monitoring. General policy on the use of subcontractors is very good. Albright & Wilson do not use the cheapest; their priority is to use good quality, experienced and reliable contractors.

Discussion with plant operators and engineers verified the translation of policy to practice, and indicated that health and safety issues were well understood and the level of awareness of legislation and other aspects was high. Environmental understanding, however, did not seem to be at such a high level.

The poor housekeeping found on inspection of the decommissioned Pentasulphide Plant raised some concern over attention to detail during maintenance related activities.

The Permit to Work system can be improved, as demonstrated by problems with those permits issued for work on the PAF plant.

Recommendations - Objective 4

1. The existing sound level of understanding of health and safety issues amongst maintenance staff should be extended to incorporate environmental issues.

2. The Site Inspectors should further review attention to detail with respect to maintenance issues as part of the routine compliance inspection programme.

3. The apparent shortcomings observed within the Permit to Work system should be reviewed in further detail by the Works and the Environment Agency.

OBJECTIVE 5

To assess the Works' monitoring of plant environmental performance against the conditions in the relevant authorisations regarding release monitoring, compliance monitoring and reporting.

How this objective was met:

(i) Documentation held by the Works was assessed against the record-keeping requirements of the relevant authorisations. Records held by the Agency were checked to ensure that all required returns had been made by the Works..

(ii) Procedures for actual emissions testing (sampling and analysis) were examined and assessed against procedures specified in the application and authorisation.

(iii) Works records of unauthorised releases notified to HMIP and the Agency were compared against Agency records for consistency. The criteria used to decide whether to report incidents and the follow-up actions taken were examined.

(i) Assessment of Documentation and Submission of Relevant Information by the Works

An inspection of the documentation for authorisation AI6100 (Phosphorus Trichloride/Oxychloride process), and its variations AO9498 and AT3043, was undertaken as part of the audit. This included inspectors' case files and the Public Register held at the Agency Area offices. The information required by the authorisation and subsequent variations was compared against that received from the Works.

(a) Requirements of the Authorisation

Several instances were found where limits for releases to air or to sewer had not been set by the Agency. These were not set at the time of authorisation due to insufficient information, and had not been updated as the required data was submitted. The substances for which annual mass releases are required to be submitted was also still unclear in some cases. The Agency needs to provide clarification to Albright & Wilson.

A further observation was that, after two variations to the original authorisation, the monitoring and reporting requirements have become confusing. Issue of a more user-friendly summary template by the Agency would be of benefit.

(b) Data Supplied by the Works

This was found to be good on the whole, with a few minor omissions. There was some confusion concerning the requirement to submit quarterly returns with respect to flow data on releases to sewer; this had been submitted instead as an annual figure (this had been noted prior to the audit). Some deviations from the requirements of the authorisation (the mercury content of bought-in sodium hydroxide had not been provided, and results for hydrogen chloride had been reported as a 10 minute average rather a one hour average) were identified which had been agreed with the previous Site Inspector but not incorporated into the authorisation by variation.

(c) Public Register Data

Some monitoring data from 1994, which Albright & Wilson had submitted to HMIP, was found to be missing from the Register. Except for this and the minor omissions mentioned in (b) above, the Public Register record is in order.

(ii) Monitoring and Analysis of Releases from the Site

A large proportion of applications for authorisation received by the Agency specify that sampling and analysis will be carried out with regard to NIOSH (US National Institute for Occupational Safety and Health), US Environmental Protection Agency, or British Standard methods. In responses to improvements or variations, Albright & Wilson have indicated some of their monitoring and analytical methods, although these are not very detailed. As Albright & Wilson have not received a response to the documents they provided, they have assumed they are acceptable to the Environment Agency.

a) Pilot Plant

The person responsible for monitoring of emissions and releases from the Pilot Plant has a series of procedures that cover investigations carried out on sampling methods, the sampling train and analytical methods. Where necessary, the final sampling and analytical methods used were adaptions of one of the standard methods.

b) Main Works

As with the Pilot Plant, a named person is responsible for sampling and monitoring. The procedures for sampling and analysis are contained on a computer file with further information in a document entitled "Compliance with standards required to conform to IPC Regulations". The sampling procedures held on the computer appear to have been developed from laboratory practice and from methods used for workplace monitoring as required by the Control of Substances Hazardous to Health (COSHH) Regulations. These procedures do not appear to have been assessed against the standards mentioned in the various IPC applications. For example, particulate monitoring is carried out by taking a single velocity reading at the centre of the stack and sampling isokinetically from the same point. This bears no relation to the standard. In summary, these methods and procedures appear to give reasonably representative results but cannot be said to conform to any standard method.

(iii) Unauthorised Releases

Albright & Wilson are required to inform the Agency following any unauthorised release from the authorised processes on the Oldbury site (see below). This is taken to include releases to any environmental medium. The type of information required is specified in the authorisation document. Notification is required as soon as possible and within 24 hours, with a more detailed report at some later time when investigation by the Works has been completed and/or action has been taken.

The Works maintains a database containing details of those incidents notified to the Agency. This record is a part of the IPC Emissions Monitoring Database. A total of nine records had been entered since authorisations have been in place. The decision as to whether to notify or not is based upon a risk assessment which considers the potential for harm. However, the Works seemed to be uncertain as to what type of events they were required to notify.

The standard authorisation condition for Notifications (numbered 1.13 in the majority of authorisations) requires that

"the Operator shall notify the Environment Agency:-

(a) of the detection of the release of any substance which exceeds any relevant limit or criteria specified in relation to the substance in this Authorisation;

(b) of the detection of the release of any other substance which might cause harm except in a quantity so trivial that it would be incapable of causing harm or its capacity to cause harm is insignificant;

(c) of any malfunction or breakdown of plant, equipment, technical means or technology if the malfunction or breakdown has potential to cause serious pollution of the environment."

The uncertainty arises from the lack of definition of "trivial" and "serious pollution". The Agency obviously has an interest in the larger releases. However the smaller releases are of equal interest because we need to see that (a) these do not occur on too frequent a basis indicating poor control, and (b) an effective system of follow-up investigation with subsequent appropriate action is in place.

Notwithstanding the above, it appeared that the unreported incidents were all fully investigated and followed up effectively, even though they had been defined as trivial by the Works and so had not been notified to the Agency.

The following were examined in detail:

- Follow-up and internal reporting on a release which *had* been notified to the Agency
- The Z408 Dangerous Occurrences Reporting System
- Follow-up and reporting of an incident on the Z408 system which *had not* been notified to the Agency

(a) Notified Release

An incident occurred during March 1996 when an eruption of hydrogen chloride occurred during the wash-out of a phosphorus trichloride reactor. No injuries occurred and off-site effects were minimised by use of a water curtain.

The action taken after the event consisted of a full investigation and it was demonstrated that appropriate measures had been taken to prevent a recurrence. This particular process is well established with experienced operators. It has not been possible to establish the cause of the incident with certainty; two possibilities were identified, both of which were sufficiently unusual that they had not been noted in the full risk assessment procedure which had been previously applied to the process.

A written procedure for reactor wash-out had been in place before the incident, but later scrutiny of this procedure as part of the follow-up investigation came to the conclusion that it relied too heavily on operator experience. A more detailed stop/go procedure was developed in consultation with plant operators and the Agency Site Inspector and subsequently trialed and amended. Every stage of the wash-out operation now has to be signed off. Operational changes have also been made to prevent the build up of solids during the process reaction stage; the presence of these solids as residue in the reactor may have been the

indirect cause of the incident when the wash-out was performed. It is the opinion of the Agency that that the Works have taken responsible and appropriate actions on this matter.

(b) The Z408 Dangerous Occurrences Reporting System

The Z408 system is a reporting system based around a database which is accessible site-wide at various levels. Facilities exist in all work areas to allow incidents to be reported on the system. For those areas which do not have convenient access to a computer terminal, or for those personnel or contractors who are not familiar with the system, a paper system runs in parallel. All paper entries are entered into the database by the Safety & Environment Group to give a site-wide picture.

Incidents reported are mostly related to health and safety, but it is intended that incidents or "near misses" with environmental impact potential should also included. This was demonstrated to be the case in practice, although not under any separate heading. It is strictly a "no penalty" system to encourage full reporting at all levels; data can be entered either by plant operators or by their supervisors. Each entry requires comment to be entered by supervisors/line managers, with a note of actions to be taken to correct and prevent recurrence of the situation, before passing to the Safety & Environment Manager who will approve/append comments. The file cannot be closed until all actions have been completed, (or marked as "ongoing") and all comment boxes have been filled.

All managers routinely check the system for new and outstanding actions at each shift handover. Manager performance is assessed against their effectiveness and efficiency in investigating these incidents and taking appropriate corrective action.

A number of these records were randomly interrogated, most of which related to health and safety incidents. This system works in parallel to the Notifications Database. The Z408 reports relating to incidents later notified to the Agency were seen. (It would not have been possible to check that all the relevant Z408 reports had been notified without going through all Z408 records. This was not done).

There is evidence that the Z408 Database ties in with the Notifications Database, but it could not be demonstrated that the reverse was true.

(c) Z408 Incident Not Notified

Z408 Report No 96/296 was reviewed. This incident occurred in the chlorine storage/transfer area; the initial incident report, summarised in the SAG minutes, stated that following maintenance a vent valve on the chlorine main had been left open, resulting in a chlorine

discharge to the scrubber for approx. 90 minutes. The scrubber was overloaded, resulting in a release causing an operator to report "a horrendous smell of chlorine" in the local area.

Subsequent investigation had revealed that the incident involved a 1" vent line downstream of the Cl_2 evaporator system. The actual discharge time was in fact only about 10 minutes; about 0.5 kg/sec of Cl_2 was estimated to have been released to the scrubber, resulting in a release to the environment peaking at an apparent concentration of 109 mg/m^3 (however, the continuous Cl_2 monitor is considered to be unreliable, and this measurement is not used for control purposes).

The scrubber takes the venting from tanker off-loading; the system would appear to have shut down automatically when the scrubber overheated.

The incident had been fully investigated by the Safety & Environment Manager, including dispersion modelling to assess any environmental impact. This had concluded that the incident did not fall into category (b) for Notifications under the authorisation, but had resulted in revised operating procedures.

Albright & Wilson had unquestionably taken appropriate action to identify the cause and prevent a recurrence; however, the incident clearly constituted a "malfunction or breakdown of plant, equipment, technical means or technology where the malfunction or breakdown has potential to cause serious pollution of the environment". It should therefore have been reported to the Agency under condition 1.13 (c) (as given above) of the authorisation, even though modelling indicated no significant environmental impact and the incident did not cause off-site complaint.

Conclusions - Objective 5

(i) Submission of Returns

A few omissions were identified but as a rule these could be attributed to lack of clear guidance from the Agency. Submission of data by the Works was considered to be good and generally in accordance with the requirements of the various authorisations.

(ii) Test Methods

The Pilot Plant approach is an acceptable way of developing a sampling and monitoring strategy. The main works should adopt this approach to developing procedures for sampling and analysis. However it is important that monitoring procedures used by authorisation holders are developed from, or calibrated against, standard methods. Deviations from accepted standards should be agreed with the Agency.

(iii) Unauthorised Releases

There seems to be genuine uncertainty over which incidents should be notified to the Agency, and guidance has been requested by the Works. Beyond this, it appears as though, whether notified or not, appropriate corrective follow-up action is taken.

The Z408 system seems to be well conceived and effectively used. It is an excellent tool for continuous improvement in H S & E. Investigation and follow-up preventative action seems to be timely, adequate and appropriate. The system might benefit from having a separate heading or identification for those incidents which have potential for environmental impact so that they can be flagged up separately from Health & Safety related incidents.

Recommendations - Objective 5

1. The Agency need to clarify certain release limits and reporting requirements which were identified by the audit as either being confusing or not having been imposed pending the supply of data which has now been submitted.

2. The Works should ensure that all monitoring and analytical procedures, and changes to these methods, have been agreed with the Agency. The Environment Agency should have a copy of all monitoring procedures.

3. The Agency should clarify its definition of an unauthorised release or notifiable occurrence, and also the criteria for reporting. The Works have been advised to consult the Site Inspector if they are uncertain whether they are required to notify an incident. *Note: The Agency is working with Albright & Wilson to clarify this issue.*

OBJECTIVE 6

To examine the effectiveness of, and adherence to, Works procedures relating to the handling of complaints and subsequent incident investigation.

How this objective was met:

The relevant Works procedures were examined and specific complaints from both Agency records and Works records were selected and followed through to completion to determine the efficacy of response.

The Company H S & E policy requires a procedure to be in place for the handling of complaints about the site; such a system has been in place since the 1970's and was last reviewed in 1993.

There are effectively three different systems for dealing with complaints and incidents:

1) Inside normal working hours

All telephone calls are put through to the Works Manager's office. If he is not present, a series of senior managers are designated to receive and deal with the call. Having received a complaint, it is normal practice for the actioning officer to either telephone, visit or write to the complainant. There are no guidelines relating to timescales but it appears as though this is carried out as soon as reasonably practicable.

2) Outside normal working hours

All out-of-hours calls are diverted to the Lobby. Details are taken and passed through to the Topside Shift Supervisor for actioning. A note relating to any out-of-hours complaints is passed to the Works Manager the following morning. However, if the complaint is deemed to be serious enough, the Works Manager may be contacted at home and may decide to attend to take control of the complaint investigation.

3) Major incident

The Albright & Wilson Oldbury site is covered by the Control of Industrial Major Hazard Regulations 1984 (CIMAH) (and subsequent amendments). These regulations are enforced by the Health & Safety Executive and are designed to mitigate the effects of major accidents to both people and the environment. The Oldbury site is covered

by these regulations because of the storage of liquid chlorine, phosphine, and elemental phosphorus. If a major incident takes place the above procedures are superseded by a detailed emergency response plan involving the Works, Local Authority and the emergency services.

Most complaints are received by telephone. As the nature of complaints is typically wide and varied, the procedure has deliberately been designed to be easy to use. Complaints can also be raised at the quarterly Residents Association meeting held between the Works, local residents and officers from the various bodies who are involved in regulating the site.

Most of the complaints received during the past 18 months relate to airborne pollution. Other recorded complaints lie outside the regulatory remit of the Agency and relate to parking, traffic and noise. There have been no complaints relating to water quality or to Rattlechain Landfill Site.

Complaints are recorded using the description given by the complainant. The system does not categorise by type of complaint or location, hence it is difficult to ascertain trends. A call will be recorded as an official complaint if it fulfills two criteria:

(i) the incident can be substantiated, and

(ii) there is insufficient evidence to state that it was *not* from the site.

More emphasis appears to be given to complaints that can be related to actual incidents on the works, as opposed to unattributable "nuisance" complaints.

There is a standard reporting sheet for logging complaints. This contains a summary of the findings upon investigation but will not contain any further detail, for example the results of a sample sent for analysis. Detail of this nature is only logged for significant incidents.

The Company has a good relationship with the local community and work hard to maintain it. They host quarterly meetings to hear local views, to discuss new plans and to advise generally on matters relating to the impact of the site on the community. They respond rapidly and at a high level to complaints. All relevant complaints received by the Works are copied to the Agency, together with any comments on the subsequent investigation. This is a considerable benefit to the Agency and aids our own incident investigation.

A site newsletter is also issued to local residents keeping them up to date with Company initiatives and setting out environmental performance data.

Conclusions - Objective 6

The Company have a good relationship with the local community around the Oldbury Works and work hard to maintain it. The procedure for handling and investigating complaints is effective and appears to be adhered to; complaints are responded to rapidly and at a high level.

Recommendations - Objective 6

1. The system would benefit from a system of categorisation; this would enable trends or recurring themes to be identified more readily. A suggested hierarchy might be:

    A. Plant failure

    B. Plant identified but no known failure

    C. Odour noticed downwind of works but no source identified

    D. Complaint unlikely to have been caused by works (e.g. wrong wind direction)

2. All details relating to a particular investigation should be recorded.

OBJECTIVE 7

To assess progress with the improvement conditions set out in the IPC authorisations.

How this objective was met:

(i) **A summary of all required improvements, together with specified completion dates was collated. Satisfactory completion of these items by the required date was noted.**

(ii) **A number of specific requirements which had been notified by the Company as having been completed were followed up on the site to confirm whether the work had been carried out to the satisfaction of the Agency.**

(i) Compliance with Improvement Programmes

The Works has no outstanding improvement conditions, other than one which is conditional on the publication by the Agency of Technical Guidance Note E1 on BPEO Assessment. Compliance with IPC improvement conditions is given a high priority and included in individual managers' performance targets.

The Company has been assiduous in completing its Improvement Programmes for processes on the Oldbury site. However, experience on the Transition Metal Complex implies that the training requirements associated with some of the improvements have not always been thought through.

(ii) Follow Through on Selected Improvement Conditions

The following improvement conditions within two authorisations (AM0023 and AM0040) were selected at random for site inspection to assess completion:

AM0023 - Condition I2

"The Operator shall install equipment to control the water flow to the individual furnace scrubbers".

AM0023 - Condition I4

"The Operator shall install a low flow alarm on the recirculation liquor of the main plant scrubber".

AM0023 - Condition I7

"Release Points A1 and A2 shall be increased to a minimum of 3 metres above the top of surrounding buildings and structures and directed vertically upwards".

AM0040 - Condition I8

"The Operator shall provide bunding around the loading points of the potassium and sodium hydroxide bulk storage tanks".

All the above were inspected and found to be complete. However, the alarm annunciator for the recirculation liquor low flow (AM0023/I4) was not engraved with the loop number or alarm function, with the result that this alarm condition could not be immediately identified if it occurred.

Conclusions - Objective 7

The Company have carried out the various improvement requirements contained within their IPC authorisations. However, there are some indications that the final integration of these into operational procedures can be improved.

Recommendations - Objective 7

1. All improvement requirements should be assessed on site by Agency staff as part of the on-going routine inspection and enforcement role.

2. The Oldbury Works should review whether process modifications brought about by these improvement conditions have been fully integrated into training programmes, operating procedures etc.

OBJECTIVE 8

To assess compliance with permits for discharge to controlled waters. To examine the controls in place to prevent exceedance of consented discharge limits.

How this objective was met:

(i) Procedures for taking samples of discharges were assessed, and historical monitoring data held by the Works was re-examined.

(ii) The pattern of surface water and effluent drainage systems across the site was investigated with a view to identifying any potential for contamination. The means by which the different streams are segregated was considered.

(iii) Procedures for dealing with liquid spillages were examined.

OVERVIEW OF DISCHARGES OF LIQUID EFFLUENT AND SURFACE WATER

There are three routes by which liquid effluent can leave the Oldbury site. Process effluent is either tankered off-site for disposal by a licensed contractor or disposed of directly to the Severn Trent sewerage system (via the on-site Effluent Treatment Plant (ETP)). Surface water run-off from buildings and open areas on the site (rainwater) also normally flows to the ETP and thence to sewer. However, at times of heavy rainfall storm water can overflow to controlled waters, namely the Chemical Arm Canal (an offshoot of the Birmingham Canal, Wolverhampton Level). This discharge is permitted and is controlled by the Agency under a separate discharge consent.

The ETP receives effluent from a number of processes on the site, both prescribed and non-prescribed. The ETP is included in IPC authorisation AI6100 (the Phosphorus Trichloride/Oxychloride process). This authorisation imposes limits for discharge of a number of substances from the ETP to foul sewer. In assessing BATNEEC for this discharge, note was taken of the limits imposed by Severn Trent.

As mentioned above, the surface water run-off is not specifically covered under any IPC authorisation, although in practice this water flows into a lagoon at the lower end of the site and is pumped into the adjacent ETP and so forms a part of the discharge to sewer. In periods of heavy rainfall the storm water can overflow from the lagoon to controlled waters. The water quality at the point of discharge is not classified; however, the Birmingham Canal, Wolverhampton Level has a River Quality Objective of RE5 (ie water of poor quality which is likely to limit coarse fish populations).

The disposals to Rattlechain Landfill Site are primarily sludges with a solids content of around 5 to 10%. The solids settle out and the resulting liquid is filtered before discharge under Agency licence to the Birmingham Canal, Wolverhampton Level.

Responsibility for discharges to sewer and to the canals from both the Oldbury site and from Rattlechain lies with the Works Manager.

AUDIT - OBJECTIVE 8

(i) Discharge Sampling and Monitoring Results

During the period 1.1.93 - 1.10.96, 36 routine inspections of the consented canal discharge point for the Oldbury site were made by officers of the National Rivers Authority / Environment Agency. Although on many of these occasions heavy rain was falling, surface water flows were being pumped to the ETP; on only three visits was any discharge being made to the canal. There is also a facility to remove solids from surface waters by the use of an off-line sand filter. There have been no breaches of consent limits or conditions in the samples taken.

The Rattlechain Landfill Site has an Agency target sampling frequency which is related to the consented volume of the discharge, hence inspections by Agency officers are less frequent than at the Oldbury site discharge point. During the period 1.1.93 - 1.10.96, 13 inspections were undertaken by Water Quality officers and nine samples taken. There have been no breaches of the discharge consent during this period, with values for all determinands well within consented limits.

(ii) Segregation of Discharge Streams

The primary objective was to examine the potential for contamination of both underlying land (hence groundwater) and surface water run-off by process effluent or other contaminants present on the site. Authorisation AI6100 contains general conditions which are aimed at preventing such contamination. These relate to the use of bunds and impermeable hardstanding around storage tanks, process vessels and loading/unloading areas, the use of oil/water separators to remove entrained oil from process and surface waters, etc.

- Site drainage layout

  The site has both effluent drains and surface water drains. These are detailed on the site drainage plan, a copy of which was made available to the Audit Team. This plan appears to be as up-to-date as it reasonably can be; the age and development of the site over the years has to be considered in this respect. Not all the staff interviewed

appeared to be aware of this plan, reliance being placed upon the knowledge of individuals rather than the plan itself. Effluent drains throughout the site are marked "E", often as a welded symbol; a yellow marking is also used to assist in identification. There is no colour coding of surface water drains, and no marking on the majority of open grill drains to identify the route they take or the destination.

There is an on-going programme for upgrading of the drainage systems, tied in with the plant modification programme. Underground effluent-carrying pipes are being replaced with overhead lines in order to minimise the potential for leakage to ground. Long pipe runs are being moved overhead wherever practicable; where shorter or more complex underground pipes are to be retained, these have mostly been relined. This programme has been implemented as new plant has been installed or upgrades undertaken and at present stops short of the ETP; the main pipe goes underground for the last leg of its journey. The tarmac and general ground cover is broken and undulating in this area, presumably due to heavy traffic loading; the condition of the underlying pipe was last surveyed when it was relined 2 years ago.

Note: Subsequent to the audit, this area has been resurfaced and the pipe confirmed to be still sound.

The routine maintenance programme for the drainage system was not inspected during the audit. Repair work, except for the on-going work to put the effluent lines overhead, is largely on an "as necessary" basis, in contrast to plant maintenance as described in Objective 4. The state of maintenance in some areas, particularly around the ETP, seemed to be poor, for example open topped grilles which were completely blocked. Underground effluent tanks are designed and built to maintain their integrity, and are subject to a yearly internal structural inspection. Separate checks for leaks are not carried out.

Some surface water discharges drain to the ground inside of process buildings where the potential for contamination is relatively high; this is collected directly by the effluent system. In many cases outside roof drainage pipes end short of ground level, and discharge to hard surfaced areas or run to open topped grills, allowing relatively clean water to come into contact with any surface contamination that may be present before joining the surface water drains. Clean effluent (eg blowdown condensate) may also be discharged into roof water drainage systems. Some areas of the site are currently subject to demolition or remediation work; the housekeeping in these areas was poor and this may also lead to contamination of run-off into the lagoon.

The Works is aware that the quality of the lagoon water is marginal for discharge to the canal under the existing Consent, and therefore normally divert it to the effluent treatment plant; however, the above practices are contrary to accepted best practice, which seeks to avoid unnecessary loads on the sewerage system through the basic principle that clean storm water, wherever practicable, should not be discharged to foul

sewer. On this site the effluent load is also added to by a stream which runs through the site drains (see Objective 9).

Some effluents which cannot be treated by the effluent treatment plant are disposed of to licensed waste disposal contractors. This is a very small amount compared to that processed by the ETP. Some effluent is also brought by road tanker from Albright & Wilson's Avonmouth site and discharged at a controlled rate to sewer within the conditions of the Oldbury Works discharge consent. The Agency is in the process of reviewing whether the waste licensing conditions regulating this practice should be included in the IPC authorisation covering the ETP.

- Ground contamination

The Company acknowledge that past activities at Oldbury have caused contamination of the ground with phosphorus. Arsenic contamination of surface water has also been a problem in some areas of the site. This is the rationale given for diverting surface water run-off to foul sewer rather than discharging to the canal, as the consented discharge limits may otherwise be breached. The full extent of the contamination is unclear to the Agency at present.

If the ground contamination cannot be dealt with, then where localised sources of surface water contamination can be clearly identified, the surface water from that part of the site should be segregated and dealt with separately to avoid unnecessary contamination of larger volumes of water.

- Initiatives to re-use surface water

Albright & Wilson intend to consider the treatment and subsequent re-use of surface water flowing from the site. This would entail the collection of flows at the lagoon, followed by pH adjustment, chemical separation, and ultrafiltration or reverse osmosis. The costing of such a scheme is currently under investigation; it is not considered to be cost-effective to collect smaller volumes of cleaner effluent from cleaner areas of the site.

- Consented discharge point to the Chemical Arm Canal

Discharges to the canal from the lagoon are regulated by the Agency under a discharge consent. The lagoon is essentially a blocked-off end section of the canal arm and has brick lined walls and the original clay puddled canal bed. Segregation from the canal is by means of a number of metal piles which form a wall facing a concrete barrier; these are badly corroded.

Several years ago a bed of calcium carbonate (limestone) gravel was placed in the lagoon to aid the removal of metals. This encourages the deposit of a sludge on the

lagoon bed. The lagoon has not been desludged since and the calcium carbonate has become blinded. This sludge build up reduces the available capacity of the lagoon, and hence the retention time and the balancing capacity. It was noticeable that some sludge had been carried over into the discharge channel.

Wooden scum boards and oil absorbent material have been installed on the outlet channel from the lagoon. There is also a V-notch arrangement across the channel which is the agreed sampling point. The flow measurement device at this location no longer works and hence it is not possible to obtain an accurate figure for the volume discharged to the canal.

Note: Subsequent to the audit, planning permission has been granted for a development involving filling in part of the Chemical Arm canal adjacent to the lagoon. Two 18" pipes are to be provided to take the lagoon outflow. However, Albright & Wilson are aware that the canal sometimes flows back towards the lagoon, and have expressed concern that a low flow from the lagoon may allow sedimentation and blockage of the pipes.

(iii) Spillage Procedure

A copy of the site spillage procedure was provided by Albright & Wilson. This document forms part of the overall site emergency procedures manual, which was last reviewed in 1994.

Current Company policy requires a risk assessment for spillage to be included at the design stage for new processes and process modifications, in line with the philosophy of containment at source, and where bunds are present for bulk storage, they were found to be in good condition and of sound construction. However, a tour of the site found vulnerable surface water drains - drums and IBC's were found stored in unbunded areas close to open grille surface drains. While it is likely that any spill would be initially captured at the lagoon, if rain is falling there is potential for it to be carried over to the canal arm, either through leaks or overflow via the discharge point.

If a spillage does occur, the procedure outlines various methods to contain the spill including sand, drain seals and use of catch pits. However, once the initial spill has been dealt with, the procedure becomes ill-defined, and could allow contamination of surface water drains during the final clean up.

Conclusions - Objective 8

The move to overhead lines for the effluent transportation system is to be commended, as is the construction of process-specific effluent sumps. The level of preventative maintenance carried out on the Effluent Treatment Plant itself cannot be faulted. However, while those parts of the older underground pipework transportation system which are to be be retained

have been upgraded, the maintenance programme in this area does not seem to be up to the general site standard.

The lagoon end barrier was in a poor state of repair, and some drainage channels were seen to be blocked. The possibility exists for a spill to reach the canal, or for it to contaminate groundwater underlying the site. Although some storage/process areas were seen to be effectively bunded, in the view of the Audit Team too much reliance is placed on capture of a spillage at the lagoon and ETP. This is very much an "end of pipe" approach to pollution prevention, and accepted best practice views containment at source as preferable - which is demonstrably the Company's attitude elsewhere on site.

Contamination of surface water may be occurring as a result of contact with contaminated soil underlying the site. This may be further added to by the practice of allowing relatively clean water to pass over potentially dirty areas. As a result, most of the surface run-off has to be discharged to sewer via the ETP, inconsistent with the best practice principle that clean storm water, wherever practicable, should not be discharged to foul sewer. The preventative view that the Company generally take on health, safety and environmental issues does not seem to be as fully implemented in their approach to handling surface water run-off on the Oldbury site.

Recommendations - Objective 8

1. The Oldbury site surface water drainage system should be brought under IPC by inclusion in an appropriate authorisation envelope.

2. Parallel to Recommendation 1., the system for surface water management at the Oldbury Works should be reviewed by Albright & Wilson and the Agency and an Improvement Programme developed to ensure that BATNEEC and BPEO are applied. This should include:

   (i) review of the design and capacity of the lagoon and discharge channel to the Chemical Arm canal to minimise carry-over of sediment

   (ii) review of the release limits to be placed on the discharge to the canal

   (iii) unnecessary contamination of surface water should be avoided by effective separation of clean and dirty streams and review of housekeeping practices

   (iv) all chemical storage areas should be properly bunded and containment at source should be fully implemented wherever practicable.

3. The barrier separating the lagoon from the canal arm should be repaired.

4. The lagoon should be dredged and the blinded calcium carbonate replaced with fresh material. This should become a routine operation to ensure this system is maintained in an effective condition at all times.

5. The extent of contamination of surface and ground water by contact with contaminated soil underlying the site should be further investigated.

6. The excellent site-wide planned preventative maintenance philosophy should be applied to the effluent and surface water handling systems, and include more frequent inspection of the condition of drains and underground sumps.

7. There should be a requirement on the Company to provide flow data for the discharges from Rattlechain Landfill Site to the canal.

8. Arsenic should be included in the sampling suite for the Rattlechain boreholes.

OBJECTIVE 9

To assess compliance with the water abstraction licence and to examine the Company philosophy on water usage and minimisation.

How this objective was met:

(i) An assessment of the water usage on site was undertaken and the Company's approach to water recycling/conservation was examined.

(ii) A detailed study of water usage and potential for conservation was undertaken for a selected process.

(i) Water Usage on the Oldbury Site

The site uses only mains water at present. All process water is taken from one break tank whilst domestic and fire hydrant supplies are fed directly from the mains. The Works are not currently utilising their abstraction licence which permits water to be abstracted from several local sources.

The abstraction licence is a licence of right issued in 1966 as a requirement of the Water Resources Act 1963, which enabled existing abstractors of water to have automatic entitlement to a licence provided that they had abstracted during the 5 year period up to 1.4.65. Abstraction is permitted from a total of six sources for the purpose of providing cooling water. This water was collected on the Oldbury site in the Mill Pool until 1990, when the need for a higher grade of water was realised (despite the higher cost of mains water). This collecting point has now been infilled to allow alternative use of the land.

- Metering

  There are several meters on incoming mains water. These are read on a monthly basis by the Works, and the information is used to assess the general trend of water consumed on the site. This data is compared with the volume discharged to sewer from the effluent treatment plant. There is some metering of flows from the break tank but, in general, the supply to individual processes is not metered. Meters are installed, however, on all new processes and plant.

- Actual consumption

  Water consumption data is used as a management tool to identify trends, but can also be used to highlight any significant losses. Work has been undertaken to provide a

summary of the water requirements of each process and to identify the major water users on the site.

Figures submitted by the Company for August 1996 show a total site consumption of 36,000 m^3, equating to an average daily consumption of 1200 m^3. However, the discharge figures show an average discharge of 2045 m^3 per day. This discrepancy is likely to be due to the inclusion of surface run-off and a stream which rises on the site.

- Water conservation

Periodic reviews of the consumption/discharge data are undertaken and trends in the consumption of particular processes as they evolve are assessed. Water usage across the site was scrutinised during an internal audit carried out by the Company two years ago. As a result, various modifications were undertaken in order to reduce water consumption.

An example is the installation of a condensate plant on the Phosphorous Acid Flake (PAF) process. It is estimated that the cost will be recouped within 18 months.

(ii) Study of Water Usage on a Selected Process

The process selected for detailed study was the Dicalcium Phosphate (DCP) plant. This process is non-prescribed, and is therefore not covered by an authorisation under EPA90. It is however one of the biggest water users on the site, accounting for approx 19% of site water usage.

The key elements of the process are:

(i) addition of lime and phosphoric acid

(ii) lime slaking (iii) pre-reaction

(iv) batch reaction (temperature controlled)

(v) filtration (vi) drying

(vii) milling (viii) blending

(ix) packing

Filtrate is caught in a tank and fed into the pre-reaction system which uses a proportion of the water. The balance is passed to drain.

The vacuum pump discharge is the largest potential saving. Consideration has been given to recycling water into the process but this has proven not to be viable. Consideration has however been given to diverting this water to a different process on the site. It has been decided that with suitable modification to this process the water could be used in the Briquest plant water ejectors. This would use the majority of the water but some would still pass to drain.

The following projects on the DCP plant are in progress or have been completed during 1996:

- Feed pumps

  The feed pumps have been upgraded and water from the seals on the three new pumps is now collected in the cooling water tank on the DCP plant and re-used in the cooling water system. As a result effluent volumes and make-up water requirements have been reduced by 0.33 m^3/hour.

- Vacuum pumps

  At present the water from the three vacuum pumps runs to drain. A project is currently being undertaken to divert this water for use on the water ejectors (Transvac system) on the Briquest plant. Effluent volumes will be reduced by 3.6 m^3/hour.

- New ejector system on the lime plant

  A new ejector system is to be installed which will reduce process water (and flow to effluent) by 3.5 m^3/hour.

- DCP cooling water tower

  Automatic blowdown has been fitted to the tower, replacing a manual system. The increased efficiency of the system has resulted in water savings and reduced effluent volumes of 1.2 m^3/hour.

Following the completion of these modifications, the total daily reduction in effluent volumes will be around 210 m^3. This is a reduction in overall site effluent of approx 10%. The daily water usage (1994 figures) was 360 m^3, which will be reduced substantially as a result of these projects.

Conclusions - Objective 9

The Works are not utilising their extant water abstraction licence but wish to retain it. Due to changes on the site, the sources listed do not reflect the existing situation, hence the licence should be varied by the Agency.

There is insufficient sub-metering on the site to carry out an accurate water balance. Modifications have been undertaken on the DCP plant to conserve water, and once the work has been completed it is estimated that a total of 10% of process water will be saved. However, with no metering it is impossible to provide a definitive figure for water used or saved on this plant. It is clear that, as new processes are developed and plant installed, water consumption is considered and meters are fitted. However, it is not entirely clear what use is made of the metering data.

Several projects were seen to have been completed or are in progress with the intention of reducing water consumption on the site as a whole.

Recommendations - Objective 9

1. The discrepancy between water consumption and discharge figures needs to be fully accounted for and a site-wide water balance established.

2. In order to provide more accurate identification of water usage by process, water metering should be extended across the site.

3. Although the Company wish to retain the abstraction licence for possible future use, various points mentioned in the licence no longer exist and updating of the conditions is needed. A review of the need for the flow data currently submitted by the Works is similarly required.

OBJECTIVE 10

To undertake a survey of the handling of wastes on site, disposal routes and compliance with Duty of Care. To assess compliance with the Waste Management Licence covering use of Rattlechain Landfill Site.

How this objective was met:

(i) Personnel responsible for waste handling on site were interviewed and records were examined. A brief inspection of selected waste storage areas on the Oldbury site was undertaken.

(ii) A full inspection of Rattlechain Landfill Site was undertaken by Waste Regulation and Water Quality officers.

(iii) The potential for waste minimisation was studied.

(i) Waste Management, Training of Staff, and Oldbury Site Practices

The Company generate both special and non-special wastes on the Oldbury site. All special wastes (as defined by the relevant legislation) are disposed of via licensed contractors for off-site disposal or treatment. Non-special wastes are either taken to the dedicated landfill site (Rattlechain) which is owned and operated by the Company, or disposed of via licensed contractors. A variety of materials (scrap metal, paper, glass) are sent for recycling.

The movement of waste from the Oldbury site is administered by two trained staff and the Safety & Environment Manager. These individuals demonstrated that their knowledge included recent changes in legislation and how it impacted upon the wastes generated on site. Some considerable effort had clearly been put into classifying the various waste streams. An in-depth knowledge of the nature of waste arisings on the site and treatment/disposal methods and routes was evident. Others involved in movements of waste have attended, or will be attending, an internal Environmental Awareness Seminar in which IPC, special waste, and COSHH are covered.

- Auditing of disposal routes

  The Company have a comprehensive formal procedure for auditing waste disposal contractors. Waste disposal contractors are vetted before they are employed, disposal sites are visited, consignments are accompanied to witness their disposal and a literature search is conducted to reveal prosecutions.

The H S & E policy document also sets out the requirement for updating the audit on each existing contractor on an annual basis. This is not currently undertaken, but there are plans to carry out annual "checks" with full audits at 3 - 5 yearly intervals, providing that they have experienced no problems with a particular contractor in the interim.

A minor shortcoming lay in the fact that the Works' efforts have all been directed towards the more hazardous end of the range of wastes produced and no checks had been made on movements of non-special waste. They undertook to correct this in the future.

- Industrial waste survey

A standard industrial waste survey was undertaken. Twelve special and seven non-special waste streams were identified. The disposal routes being used were found to be appropriate.

- Inspection of waste records

The Works hold waste disposal records in two forms. A consignment note register is required by the Control of Pollution (Special Waste) Regulations 1980, in Regulation 13 for wastes produced on site and Regulation 14 for waste deposited at a site (Rattlechain), and more recently by Regulation 16 of the Special Waste Regulations 1996; a computer database is also maintained.

Working from a printout obtained from the Agency Pollution Control Information System which contained 243 records of waste movements made since January 1994, a random selection of 24 records was made and the Works were asked to show the required copies of the documentation. 22 were found almost immediately and the remaining two after a slight delay.

The computer system had been introduced on 1 January 1995 and contained records of all special and non-special waste movements. One of the randomly chosen records was so recent that it had not yet been loaded into the database, but all others expected were found. A minor criticism of this system is that the fields on the database dealing with the disposal method did not have enough options to accurately reflect the method used; waste going for chemical treatment was shown as having been landfilled, although this did not affect the actual disposal route. The Works undertook to correct this.

At the time of the audit the new Special Waste Regulations had only been in effect for a period of one month. Pre-notices received by the Agency suggest that the Works are coping well with the legislative requirements.

- Inspection of waste storage areas

  Four areas of the Oldbury site were selected at random for inspection.

  The Novomasse storage area was found to be adequate with product stored in well maintained 50 litre drums with sealed lids raised on pallets on a hard surfaced area. (Novomasse is a solid mixture of 40% red phosphorus in phenol formaldehyde resin).

  The lime slaking area produces lime for the Effluent Treatment Plant and a variable waste consisting of a mixture ranging from small stones to lumpy calcium hydroxide. This was stored in an uncovered walled area. The surrounding ground was white from lime contamination.

  The area around the Effluent Treatment Plant also had a coating of lime. One set of drainage channels in the yard were found to be blocked although a water jetting truck was just setting up to start cleaning. Sludge from the cone-bottomed settlement tank (largely calcium phosphate) is tankered to the Rattlechain Landfill Site. There were no signs of leakage from the plant.

  The solvent storage compounds were also inspected. These are surrounded by wire net fencing with a low retaining bund. The compounds were locked, with access via named keyholders. The drums and IBCs used for waste storage were fit for purpose and were stored tidily. Any leakage from a container in this area would enter the drainage system and pass via an interceptor ultimately to the Effluent Treatment Plant. A water-miscible solvent would be left untreated by this plant but the dilution would be high.

(ii) Compliance Inspection of Rattlechain Landfill Site

The Rattlechain Landfill Site is owned and operated by Albright & Wilson under a waste management license issued in 1978. The site has been used for forty years or more and, as a result, a layer of calcium phosphate several metres thick lines the pit. This has a permeability similar to Bentonite clay. Wastes defined as "effluent treatment sludge" and "water contaminated with elemental phosphorus, phosphoric acid or sulphur" are tankered from the Oldbury site and gravity fed into the landfill via an extended pipeline. Solids (typically 5 - 10% of the sludge) settle out, allowing the liquid to clarify. After filtration through a sand/gravel causeway the supernatant liquid is pumped from the collecting area to the Birmingham Canal, Wolverhampton Level under a licence issued by the National Rivers Authority and now regulated by the Agency. Solid wastes may also be deposited in this site; these are defined as "inert solid wastes contaminated with phosphorus" and "inert solid wastes".

The Company installed six monitoring boreholes around the site perimeter in 1990. Samples of groundwater are taken on an annual basis to ensure that deposits at the site are not contaminating groundwaters. The most recent report by the National Rivers Authority some five years ago states that there was no indication of contamination. In terms of the potential for contamination of the canal, the elevated level of the canal makes it more likely that it will leak into the landfill site rather than vice versa.

An inspection of the landfill site was undertaken by Waste Regulation Officers. Prior checking of records showed that the Company have not exceeded the quantities of waste permitted by their waste management licence.

The site was in compliance with the conditions of the licence, with only a few minor criticisms relating to the state of repair of the access road which is shared with an adjoining landfill site. There was evidence of run-off from the adjacent landfill site onto Albright & Wilson's property, but the wet area did not appear to be polluted. The filtered water awaiting discharge in the collecting area, which is separated from the main lagoon by a causeway, supported a variety of rushes and grasses along with a number of coots and ducks.

(iii) Waste Minimisation Projects

The Company have clearly expended some effort on waste minimisation at Oldbury. Specific areas that were discussed were:

- An ethyl acetate/monochlorobenzene mixture which had previously been sent for incineration at the rate of 50 tonnes per year is now recovered by distillation. The ethyl acetate is used as below and the monochlorobenzene is recycled at the Company's Avonmouth site.

- Ethyl acetate that had previously disposed of is now re-distilled off-site and used in the thinners market.

Other areas where minimisation is planned are:

- The copper pyrophosphate plant is being refurbished and updated, moving to a more highly automated system which minimises manual handling and consequent spillages, and plate and frame filtration will be replaced with fluidised bed drying. It is hoped to reduce the amount of waste produced from 5 tonnes per year to less than 1 tonne. The product is in powder form and releases to air both within the building and outside will be minimised by the improvement work.

- New instrumentation is to be installed on the sodium hypochlorite plant to improve the quality of the product and thereby produce a more saleable by-product.

- Packaging, paper and glass are collected separately for recycling and pallets are refurbished.

- Condensate recovery from the chlorine offloading and storage area, PAF process, and Oxychloride process is being undertaken with resultant savings in terms of loss of energy, water and water treatment chemicals. This in turn has reduced the amount of effluent going to the ETP, and fuel used to replace the lost heat with consequent reductions in emissions to atmosphere.

Conclusions - Objective 10

The system for disposing of waste is well organised and documented, and managed by people who are well trained and very knowledgeable on this subject. Wastes are disposed of in a responsible manner via contractors who are thoroughly audited prior to employment.

A high proportion of waste sent for disposal is from Research and Development. The Works tend to err on the side of caution when consigning some of the more unusual types of waste and will dispose of it as special waste at a higher cost. There appears to be some potential for cost savings.

The site inspection found waste storage arrangements to be variable in terms of both appearance and the protection afforded to the site surface water system. Some areas were very good and others needed attention to housekeeping. The same comments apply as made following the examination of the site surface water and effluent systems, ie that the preference seems to be to capture and treat at the ETP rather than to contain at source.

The Company have put considerable effort into waste minimisation and a number of projects are currently being undertaken to reduce the wastes generated by the Works. These have the potential to lead to quite significant cost savings for the Company whilst minimising disposals to the wider environment.

Recommendations - Objective 10

1. Albright & Wilson should undertake occasional auditing of contractors handling non-special waste removal from the site and set up a system for the auditing of existing contractors on a more frequent basis.

2. The Works should review the status of some of the more unusual wastes, where there may be potential to save on disposal costs.

3. Housekeeping in the lime slaking area could be improved.

GLOSSARY

Abbreviations Used in the Text:

ADPA	AcetoDiPhosphonic Acid
BATNEEC	Best Available Techniques Not Entailing Excessive Costs
BPEO	Best Practicable Environmental Option
CIA	Chemical Industry Association
CAR	Capital Authorisation Request
CED	Corporate Engineering Department
CIMAH	Control of Industrial Major Accident Hazard
CLBP	Customised Liquid Blended Products
COSHH	Control of Substances Hazardous to Health
DCP	DiCalcium Phosphate
ETP	Effluent Treatment Plant
EPA	(US) Environmental Protection Agency
EPA90	Environmental Protection Act 1990
Ethyl PCT	DiEthylPhosphoroChloroThioate
HAZOP	HAZard and OPerability study
H & S	Health and Safety
HMIP	Her Majesty's Inspectorate of Pollution
HSE	Health & Safety Executive
H S & E	Health, Safety and Environment(al)
IOSH	Institute of Occupational Safety and Health
IIP	Investors In People

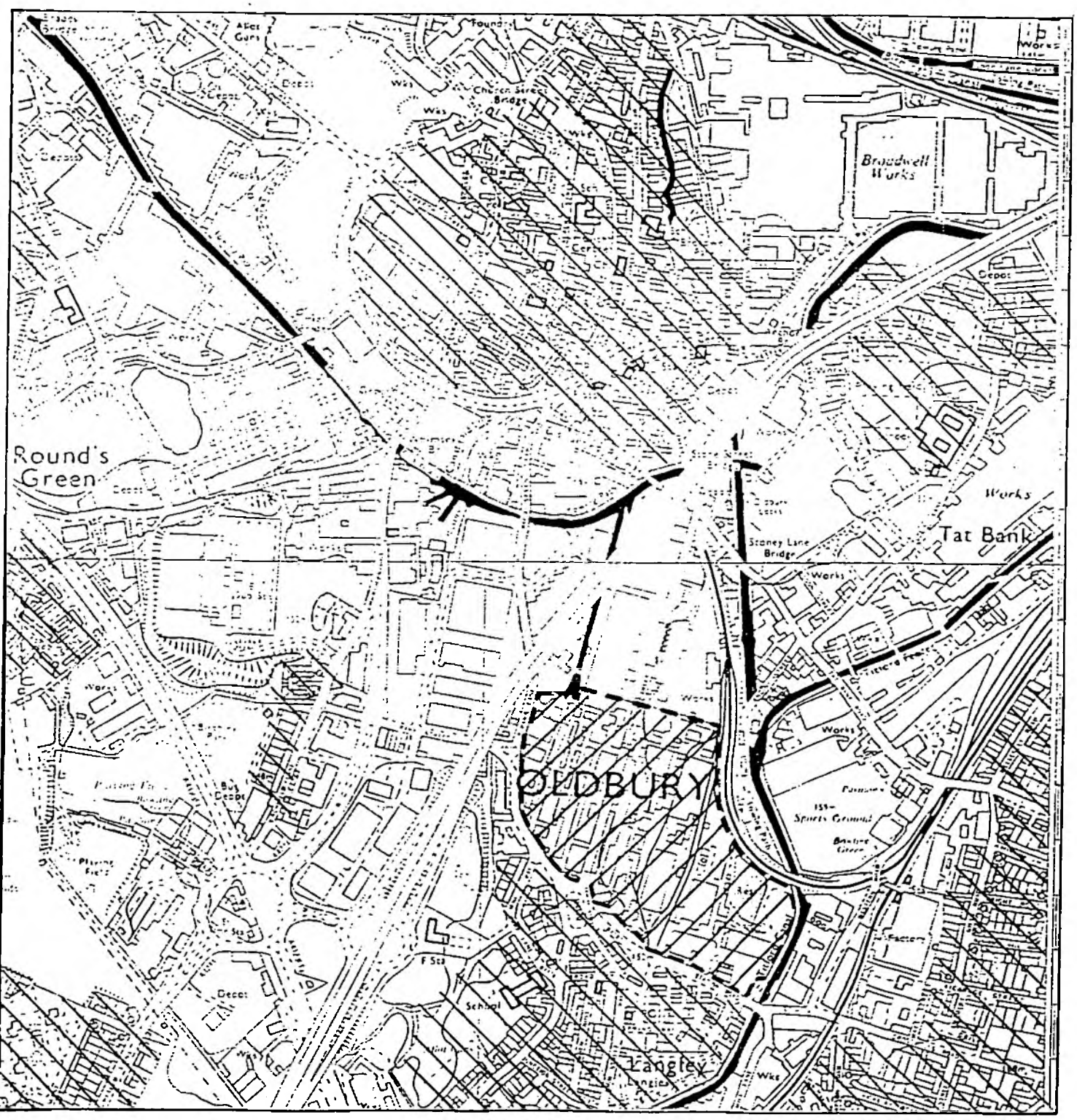
IPC	Integrated Pollution Control
LEV	Local Extract Ventilation
NEBOSH	National Examination Board in Occupational Safety and Health
NIOSH	(US) National Institute of Occupational Safety and Health
NRA	National Rivers Authority
PAF	Phosphorous Acid Flake
QWG	Quality Work Group
RCA	Reduced Chromic Acid
RCM	Reliability Centred Maintenance
SAG	Safety Action Group
SMFP	Sodium MonoFluoroPhosphate
WRA	Waste Regulation Authority
ZIP	Zero Incident Process

APPENDICES

1. LOCATION MAP AND SITE PLAN
2. COMPANY HEALTH, SAFETY & ENVIRONMENT POLICY
3. AREA ENGINEERING DEPARTMENT POLICY

APPENDIX 1

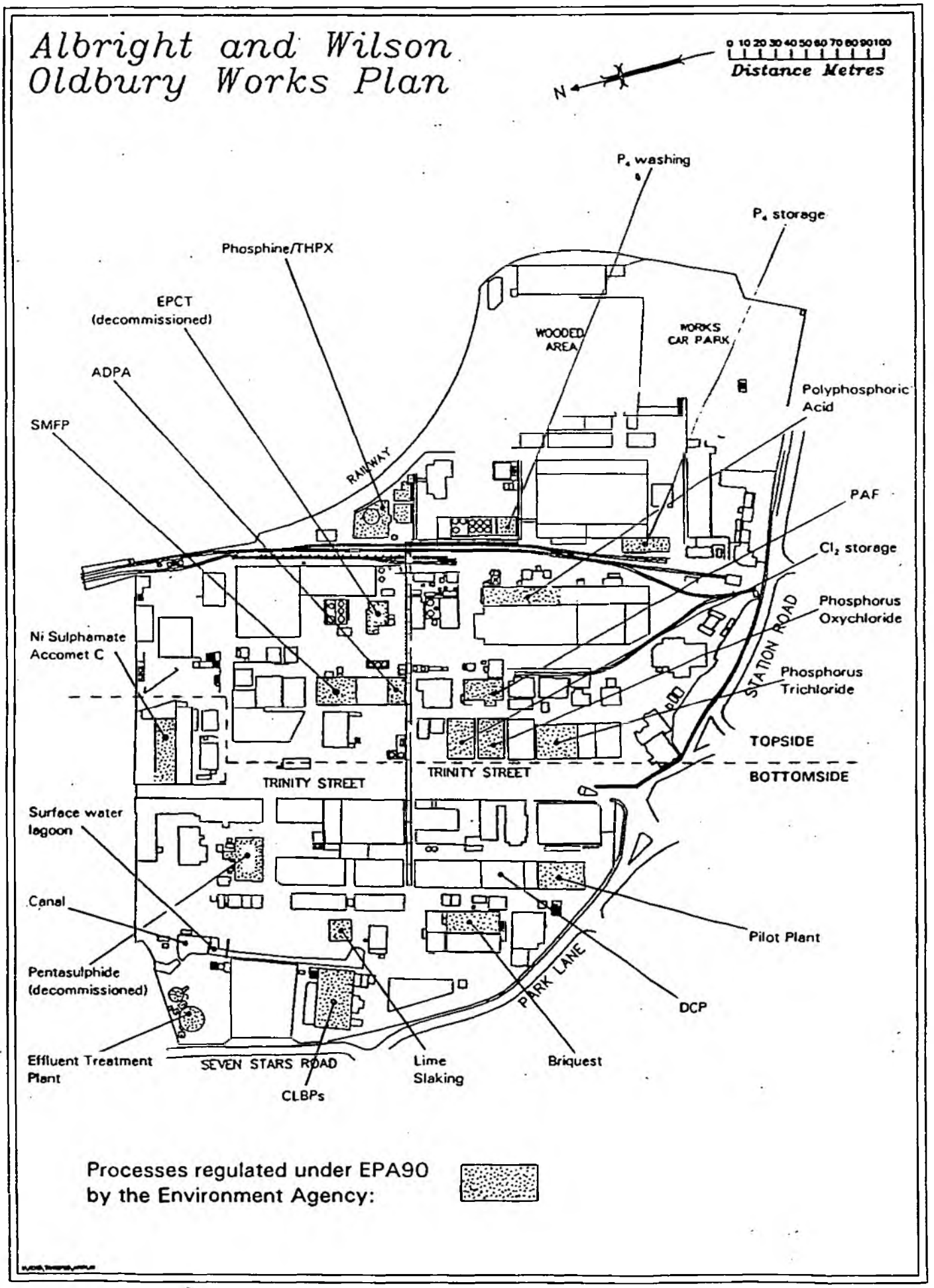
1. Albright & Wilson, Oldbury Works - Location Map



Site Boundary: **Controlled Waters:** **Town Centre & Mainly Residential Areas:**

2. Site Plan

Location of activities referred to in the text.



APPENDIX 2

Company Health, Safety, & Environment Policy

Albright & Wilson attaches the highest priority to the protection of the health and safety of its employees, customers, neighbours and others who may come into contact with, or be affected by, its operations or products. It recognises equally its duty to protect the environment both in the vicinity of its operations and elsewhere by the responsible management of waste materials.

Albright & Wilson will meet these objectives through the proper design, construction, commissioning, operation, maintenance and decommissioning of all its equipment, plant and facilities, through seeking the active involvement of all its employees and through co-operation in good faith with governments, regional and local authorities, and others who share these common interests.

APPENDIX 3

Area Engineering Department Policy

To provide a world-class engineering service to the production areas.

This will be achieved by an engineering department with Business, Health, Safety and Environmental needs as its focus.

Reactive maintenance will be reduced through proactive and preventative techniques, using condition monitoring, NDT testing and an RCM philosophy.

Plant improvement, debottlenecking and modifications will be engineered using the appropriate Company "Health, Safety and Environmental Standards".

Personnel within the department are involved in an ongoing training, quality and improvement program.