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# 環境保育管理研習

The theory and practice of an integrated approach in Pollution control: Lessons from case studies in the UK


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內容摘要：

This dissertation aims to explore the gap between the theory and practice of an integrated approach in pollution control, mainly through two case studies in the UK. The best practicable environmental option (BPEO), best available techniques not entailing excessive cost (BATNEEC), and the best available techniques (BAT) are the central pillars in IPC/IPPC. The operators should apply them to achieve a high level of environment protection taken as a whole. Whilst they are recognized as good concepts in theory, they incurred lots of arguments within the regulated companies. The main complaints are that too much effort has been spent on justifying the extent of pollution prevented, reduced or rendered harmless, rather than instigating the improvement.

In reality, the integrated approach in pollution control is an extremely complex issue, needing more time to develop its infrastructures. From the research findings, three recommendations are given for the future development: firstly, more efficient use of information; secondary, more incentive credits in statutory permit conditions; and lastly more emphasis on the integration of resources to take more advantages of one-stop-shop.

## 壹、前言：

Salford University 位於英國中部的 Salford City 屬大曼徹斯特城市之範圍，該校分有四大學院十六系所，包括 Art, Media& Social Science、Business & Formatics、Health & Social Care、Science Engineering & Environment 等四大學院。本人研習之課程為 Environment Life & Sciences 系下所設之 MSc/Pg Diploma in Environment Protection, 隸屬於 Science Engineering & Environment 學院。該校擁有精良實驗設備及圖書資源，師資及研究與教學於 2001 年經評鑑等級為優良。

因該校位於大曼徹斯特城之郊區，該校具有廣闊且綠草如茵的校園，值得一提的是校園中到處是綠油油的草地及公園，最大的一片大草原足足有三個標準足球場大，愛好足球的英國人於假日必呼朋引伴到此大草原切磋球技。此外該校擁有四座大型圖書館分設於不同學院內，各個系所另亦有圖書資源室，每座圖書館皆有最新(每年更新作業平台)電腦設備供學生上網查詢資料，不但校內圖書館之書籍及雜誌借閱及歸

還可互通，亦可以與大曼徹斯地區的各大學圖書館相通借閱。另外任何書本或論文雜誌文章只要寫的出文章名稱或作者與發表時間書名或雜誌名稱，皆可透過學校圖書室與大英帝國各圖書館連鎖系統找到，學生只要支付一英鎊代價圖書館就可提供這一項服務，擬借閱的書本於一至二週內找到後即通知借閱者至館內辦理借閱手續，如是雜誌文章則直接將所要該篇文章影本寄至學生住處，真是超方便的。這項措施嘉惠不少薪薪學子，能提供這項服務主要建立在該國擁有豐富之學術資源，學術書籍及雜誌之研究性文章多且廣，分門別類令人嘆為觀止，且管理制度健全值得國人效法。本人於就學一年期間即利用此管道收集不少資訊，獲益非淺，對此項服務之超大功能深感佩服。

此外，該校亦具有相當完備的育樂設施，包括溫水游泳池、健身房、籃球場、迴力球場等，不過需要付費的；娛樂方面則有設於學生活動中心內之國內外旅遊諮詢與代辦服務中心、學生酒吧、餐廳、電影院、書店、理髮店、雜貨店及心理諮詢輔導室等服務，另因該校離大曼徹斯特城的中國城甚近，採購中國口味食物亦甚為方便。

一年碩士學位課程為九月至隔年的九月，一年內需修完八門課程且通過考試可以取到 120 個學分，每門課程 15 個學分，學期最後三個月需完成一論文，以取到 60 個學分，總計一年需得到 180 學分始能取得碩士學位。

感謝環保署長官及英國文化協會將學金給我這次研習機會，讓我經歷了一年（2001~2002）的艱苦但有趣的學生生活。很順利地我通過了各項考試，取得了碩士學位。更可貴的是認識不少外國朋友並增廣不少見聞。真是一生難得的經驗。

## 貳、研習課程內容介紹

一年的課程主要為研習內容為英國及歐盟之環境法規、政策、執行方式及環境資源永續管理之理念，涉及領域包括空氣污染、廢棄物、水污染防治及噪音防治技術與管制策略。課程安排除由系內之教師授課、分組與個別研究報告、小組定期討論外，並佐以校外專業人士(他校之老師、政府機關、顧問機構及環保團體)之學術演講、校外現場參觀教學等多變化之教學內容。考試方式則包括 close book 及 open book 筆試、撰寫報告、簡報等方式，分個別及分組方式之報告或簡報。

有關研習課程內容作一簡介：

Environmental Law and Administration

- Infrastructure of pollution control in the UK.
- Relationship of the land use planning and pollution control regimes.
- Historical development of UK legislation.
- Influence of the European Union and international agreements.
- Relative roles of civil and criminal law.
- Review of the intentions, characteristics, success and limitations of the law relating to land, air and water pollution

control.

Environmental Policy

- Sustainable development as a political theme.
- Mechanisms of environmental control: legislation, market forces, self-regulation, voluntary agreements and education.
- Roles of the key players:
  - 
    - Environmental policy development in the EU.
    - Environmental and sustainable development policies of the major political parties.
    - Environmental policy development in local government and Local Agenda 21.
    - Environmental pressures on business and environmental management systems.
    - The environmental lobby.

Environmental Resource Management

- Examination of the concept of environmentalism
- Introduction to sustainable development.
- Economic, social and ecological perspectives of sustainable development.
- Risk assessment and risk management.
- The concept of environmental assessment.

Air Pollution Control

- Nature and significance of contemporary air pollution problems:
  - Scientific basis.
  - Policy options and commitments.
- Local air quality management.
- Introduction to combustion technology.
- Principles of gaseous and particulate pollution control technologies.
- Principles of stack emissions monitoring.
- Chimney height calculations.
- Introduction to dispersion modelling.

- Review of selected industrial emission sources and relevant controls.
- Vehicle pollution.
- Energy management and air pollution control.

Water Resource Management

- Water resources policy and planning.
- Sources of water supply.
- Factors influencing quality and sufficiency of supply.
- Water quality standards.
- Water treatment systems.
- Nature, significance and impact of water pollutants.
- Assessment of surface and ground water quality.
- Waste water treatment systems.
- Water pollution remediation.
- Water and health.

Waste Management

- Waste management policy and planning.
- Waste minimisation.
- Reuse and recycling of wastes.
- Landfilling.
- Incineration.
- Selected waste streams, e.g. radioactive waste, clinical waste, etc.
- Contaminated land policy, site investigation and remediation.

Noise Pollution Control

- Noise parameters.
- Noise measurement and assessment.
- Planning and noise.
- Legislative controls and regulatory framework: industrial, construction, road and rail traffic, recreational and domestic noise sources.
- Noise prediction techniques.
- Technical and engineering controls.
- Counselling and arbitration.

Research and Research Methods

- Characteristics of natural and social science research.
- Principles, objectives and nature of research.
- Research design and techniques.
- Communication of research findings.
- Fundamental statistical concepts.

## 參、研習論文摘要：

本次研習選定之碩士論文題目為 "The theory and practice of an integrated approach in pollution control: Lessons from case studies in the UK"，探討英國及歐盟各國正推動中之整體性污染管制制度的理論與實際。摘述如下：


**ABSTRACT：**

This dissertation aims to explore the gap between the theory and practice of an integrated approach in pollution control, mainly through two case studies in the UK. The IPC/IPPC performances of the two companies are the main emphasises in research.

The best practicable environmental option (BPEO), best available techniques not entailing excessive cost (BATNEEC), and the best available techniques (BAT) are the central pillars in IPC/IPPC. The operators should apply them to achieve a high level of environment protection taken as a whole. Whilst they are recognized as good concepts in theory, they incurred lots of arguments within the regulated companies. The main complaints are that too much effort has been spent on justifying the extent of pollution prevented, reduced or rendered harmless, rather than instigating the improvement.

This dissertation has disclosed the performance problems of an integrated pollution control and their essences. The initial purpose of protecting the environment taken as a whole is the main concern in this research, but it has been found that there are some difficulties in integrating the environmental impact of emissions to three media. In practice, there is limited knowledge about the factors used to assess the impact. There is the possibility of expending greater resources on the assessment itself than could be justified by any environmental improvement.

So far integrated pollution control appears to be a kind of bundled approach rather than an integrated approach. Whilst integrated pollution control is still regarded as good in theory, it has not yet been fulfilled in practice. In reality, the integrated approach in pollution control is an extremely complex issue, needing more time to develop its infrastructures. From the research findings, three recommendations are given for the future development: firstly, more efficient use of information; secondary, more incentive credits in statutory permit conditions; and lastly more emphasis on the integration of resources to take more advantages of one-stop-shop.

## 肆、結論與建議:

一年之研習時間甚為密集與緊湊，剛剛才適應英國的氣候、生活方式與教學就要結束行程了。回想剛到英國時有些水土不服，要回台灣時反倒是有些依依不捨。這趟一年英國求學之旅提供我不少新觀念與新視野。感謝環保署長官之支持及英國文化協會獎學金之協助讓我無後顧之憂完成學業。

英國為一已高度開發的國家，有關環境保護之理念與政策皆已發展得相當成熟，尤其環境管制理念方面之研究更是多且廣。環境問題除兼顧地區特性需求及整體國家環境需要，並考量及歐盟整體法規制度推動之一致性，由歷史資料顯示歐盟法規制度與英國法規制度之衍進實互有影響，未來並將趨於統一的方向前進。雖然西方的文化背景與東方式的文化存有差異，但一些基本環境管理之理念，實值得國人參考借鏡。建議爾後類似之研習仍應持續辦理。

本次研習論文題目之選定即是有感於英國及歐盟整體性污染管制策略推動之理念為未來污染管制之趨勢，將空氣污

染、水污染、廢棄物污染等一併考量於一許可內，並以 **BATs** (Best Available Techniques) 作為中心思考，以尋求對環境傷害之最低及整理環境成本效益之最高。尤其歐盟國家對 Best Available Techniques 作更廣定義與考量，Techniques 之意義除一般所謂 equipment technologies 外亦含括人員、作業及財務之最佳化管理，如人力素質、工作方法、維護保養、設備或作業程序設計之觀念等，實在值得國人未來推動空、水、廢、毒污染許可管制之重要理念參考。

# 附　錄

# The theory and practice of an integrated approach in pollution control:

# Lessons from case studies in the UK

A dissertation submitted to The University of Salford,

School of Environment and Life Sciences Department

Submitted in Partial Fulfilment of the Requirement for the Degree of

Master of Science in Environmental Protection

2002

By

ng-Luh Yeh

Declaration

No portion of the work referred to in this dissertation has been submitted in support of an application for another degree or qualification of this, or any other University or institute of learning

# CONTENT

# CHAPTER 1
# Introduction

## 1.1 Background

In most advanced industrial countries the legislation associated with industrial environmental management has normally developed in an additive and incremental way. Such emissions to different environmental media are likely to be addressed separately under different pieces of legislation (Gouldson and Murphy 1998). Such a fragmented approach in traditional pollution control has sometimes led to a failure in viewing the environment as a whole, i.e. disregarding the possibility of transfer between different media. When individual bodies control separate sectors there was often a reluctance to deal with a problem on a unified basis. However, if overlapping responsibilities are imposed in two separated bodies, create tremendous logistical difficulties and misunderstandings might arise. Also Inter-departmental communication has its own problems, which leads to inefficient control. Ball and Bell (2000, p.377) stated that in many cases there appeared to be "*too many cooks spoiling the broth*".

A separate licensing procedure for every possible emission from a large plant obviously leads to high costs, both for the industry and the bureaucracies involved. It can be expected that industry would welcome an integrated approach, because the industry has to apply to "*one counter only*" (Michael, *et al.* 1996, p.113). Haigh and Irwin (1990) stated that there are some specific problems that encourage the adoption of integrated pollution control.

Firstly, the traditional fragmented approach to pollution control may merely transfer problems from one media to another. Perhaps the tendency was for pollution to be diverted toward the medium that was covered by the least stringent legislation or was regulated by the least demanding regulator at any given time. Secondly, the legal and institutional framework of environmental protection had developed over time in an ad-hoc way; opportunities to improve the efficiency of mandatory regulation remained un-addressed. Last but not least, there is increasing recognition of the need to simplify administrative and regulatory systems. Due to the complex legislation and institutional structures industry is often required to report the same information to different authorities but in different formats.

The three problems above reveal explicitly the necessity of an integrated approach in environment protection policy. Nevertheless, there also appears to be a few questions that have to be answered, such as:

- What is going to be integrated in pollution control?
- Who is responsible for integration?
- How to implement an integrated pollution control policy?
- What are the aims of an integrated pollution control?
- Are there any problems in practical performance?
- What are the essences of an integrated approach?
- Is it achievable in practice?

Fortunately, a lesson about the performances of integrated pollution control in the UK can be learned. The UK acted as a pioneer in adopting an IPC (Integrated Pollution Control) policy in 1990. The IPC regime was enacted in the Environmental Protection Act 1990, and since then the integrated

approach policy has been implemented. It intended to take account of the emissions to air, water and land at the same time, and encourage the industry to choose the best option to prevent or minimise the pollution.

Since the implementation of the IPC regime, there were a number of disputes in industry. ENDS (1993) who reviewed the performance of integrated pollution control regime in UK reported that the integrated approach failed to meet its objectives. This report showed that fewer than half of the applicants made any attempt to justify their pollution control techniques by reference to BATNEEC (Best available techniques not entailing excessive cost) or BPEO (Best Practicable Environmental Option) required by the policy.

Not long after the implementation of IPC, an IPPC (integrated pollution prevention control) policy based on EC Directive came into force in 2000. Although IPPC takes a wider range of environmental impacts into account than IPC, many procedural aspects of the two systems are broadly similar. Both systems take an integrated approach to the protection of all environmental media, and the BAT (Best Available Technique) adopted in IPPC is very similar to the BATNEEC under IPC (Ball & Bell 2000 and DEFRA 2001).

Unfortunately, in 2001 another official survey of IPPC applications suggested that history might be repeating itself with the implementation of the new IPPC regime. Most applicants for the IPPC permit fail to adequately demonstrate that they are using the BAT to control emissions (ENDS 2001). CTCE (2001) revealed that there is very little evidence of benchmarking within the majority of the applications. Only a minority of applications considered how their

emissions and performance compared to that of other similar activities within the same sector. Additionally, the majority of applicants found the guidance to be less than satisfactory, and called for better guidance on a sector basis. The Environment Agency's latest figures show that a total of 247 IPPC applications have been received but only 72 permits issued since IPPC came into force in August 2000 (ENDS 2002).

If the integrated pollution control could bring about benefit to the environment in theory, what are the problems affecting their performance in practice? It is arguable that there is a gap between theory and practice of IPC and IPPC.

### 1.2 Aims and Objectives

The overall aims of this research were to investigate the theory and practice of an integrated approach in pollution control, and to disclose its essential features and influencing factors through the article review and the two case studies of IPC and IPPC performance in the UK. These aims include the following objectives:

- To probe the original intention of IPC/IPPC
- To examine the performances of BATNEEC/BPEO/BAT
- To explore the problems in practical performances of IPC/IPPC
- To identify and analyse the essential features of IPC and IPPC
- To analyse the extent to which IPC/IPPC have achieved in integrated approach in practice.
- To provide a lesson for other countries outside Europe, if they want to approach a feasible and effective integrated pollution control policy.

## 1.3 Structure of dissertation

This dissertation starts with the reasons to employ an integrated pollution control to the teething problems of its performances in the UK. Subsequently it defines the scope of the intended research, and then sets the aims and objectives.

The second chapter of this research is the introduction of methodology. It shows where the data came from, how the data was collected, how they were analysed, how were the results presented, and a logical thinking in the approach of this dissertation.

Chapter 3 and 4 are concerned with the evolution of integrated pollution control, the intentions of IPC/IPPC, the theoretical concepts and legislative meanings of BATNEEC/BPEO/BAT in IPC/IPPC, through a variety of regulations and literature reviews. The concepts of BATNEEC/BPEO/BAT in approaching a holistic pollution control are emphasised. The differences between IPC and IPPC are disclosed as well.

Chapter 5 and 6 are two case studies, which are central topics in this research. They explore IPC/IPPC application documents of the two companies, Corus Engineering Steels at Stocksbridge Works and Castle Cement Ltd at Ribblesdale Works. The main issues in their application are discovered and represented in this research. The arguments from the companies and the inspectors in charge of the IPC and IPPC authorisation are also included in these two chapters. The practical way to justify the

steel-making and cement-producing processes/installations have been scrutinised in order to reveal the extent of applying integrated concepts.

The findings and discussions are provided in Chapter 7, where the problems incurred and the crucial factors affecting the development of IPC/IPPC are analysed. The main essences of IPC/IPPC are also discussed in this chapter, revealing the gap between theory and practice.

Chapter 8 focuses on the integrated approach, in that the meaning of integrated approach are examined and interpreted in a broader and deeper view. The achievements of integrated approach in pollution control in the UK are disclosed as a result.

Conclusions drawn are provided in Chapter 9. The cause of arguments in IPC/IPPC authorisation has been attributed to the flexible regulations based on principle. The recommendations have been brought out for the future performances. The prospect of a practical integrated approach in pollution control is still expected in the conclusion.

# CHAPTER 2
# Methodology

This research intends to examine and identify the essences of an integrated approach in pollution control through two case studies. Interview with the two regulated companies and inspectors, and examination of public register documents are the main sources of information. By examining the disputes between the regulators and the operators, and studying the relevant regulations and guidance, the problems in practical performances will be revealed and essential feature of an integrated pollution control will be disclosed. The central focus is the theoretical and practical performances of three central pillars, BATNEEC, BPEO and BAT, in IPC/IPPC.

In order to check and enhance the research findings, some critical information about IPPC or IPC are collected from literature reviews of books, journals and specialist scientific literature as well as statutory and non-statutory material from the public register, regulated companies, Environment Agency, Department for Environment, Food & Rural Affairs.

## 2.1 Case study

Case study is an ideal methodology when a holistic, in depth investigation is needed (Feagin *et al* 1991). Yin (1994) argued that a case study is a strategy for doing research, which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence. Marinetto (1998) suggest that qualitative case studies have an

increasingly more important and relevant role to play. The preference for the collection of qualitative data reflected both the contemporary natures of the subject of IPC and IPPC and interpretations of specific terms and phrases associated with IPC and IPPC.

Yin (1994) identifies three type of case study: Exploratory, Explanatory, and Descriptive. Exploratory case is sometimes considered as a prelude to social research. Explanatory case studies may be used for doing casual investigations. Descriptive case requires a descriptive theory to develop before starting the project.

This research uses more the explanatory and exploratory type. It uses a range of data collected from IPC/IPPC Public Register, interviews with the representatives of the regulated company, the inspectors responsible for the two case studies, one Regional Manager in Environment Agency, and information from articles reviews, such as ENDS Report in order to enhance the research findings. Through the arguments from regulated companies and the regulators to highlight the problems incurred in practical performances of IPC/IPPC, and by triangulating these various pieces of evidences, it is intended to form as clear a picture of the essential feature of an integrated approach in pollution control.

In order to highlight the traditional industry in approaching a high level environmental protection, Engineering Steels at Stocksbridge Works and Castle Cement Ltd at Ribblesdale Works have been assigned as the studied cases.

## 2.2 Interview

The interview process has been likened to a series of conversations with a purpose of gaining information (Burgess 1984, Moser and Kalton 1971). Yin (1994) noted that interviews are an important source of information in the case study and that in more open-ended interviews the respondent often becomes more of an informant. However, the interview procedure involving questioning and discussing topics with individuals represents a very useful and simple technique for collecting data (Blaxter *et al* 1996).

In this research the interview procedure accompany a questionnaire. In order to strengthen the information gained via the interviews, the IPC and IPPC application document, and the theories of IPC and IPPC in publication documents were reviewed and referred to. The questions have been designed as a prepared questionnaire before the interview. The information obtained through both the interviews and literature review have enabled the development of case studies highlighting factors of best practice and problems in term of IPC and IPPC.

Data collecting during interviews have been analyzed following steps adapted from Kvale (1996). The first step: during interview a series of questions are answered to describe an experience in IPC/IPPC as it is felt or undergone (Blaxter *et al* 1996). At this stage there is no attempt to interpret or discuss the responses. The second step: the interviewee starts to explore other associated issues and qualify specific points in IPC/IPPC with corroborative

evidences. Step 3: the interviewee has been led to particular issue in IPC/IPPC through on-going dialogue. This allows the interviewer clarify specific points and issues, and ensures that irrelevant information is not transcribed. Step 4: condense the meaning of interviewee's responses. Step 5: check the key points have been asked and thank the interviewee for his or her time.

The tape recorder has been employed under the agreement of interviewee in this research, though some of the interviewees appear some conservative in talking during the interview. During the interview some of interviewees do not like to give specific answers, instead just present the general ideas of IPC/IPPC. In this situation the insufficient information has been supplemented by the public register documents.

Table 2.1 The itinerary of interview

| Date | Company | Interviewee | | NB |
|---|---|---|---|---|
| | | Title | Name | |
| 28/06/02 | Corus Engineering Steels | Environmental & energy section manager | John Rockett | |
| 28/06/02 | Corus Engineering Steels | Environmental engineer | Allen Gorringe | |
| 16/07/02 | Castle Cement Ltd. | Safety, Health & environment Adviser | Chris Fish | |
| 12/07/02 | Environment Agency | Inspector | Martin Barrett | In charge of Corus |
| 09/07/02 | Environment Agency | Inspector | Paul Stevens | In charge of Castle Cement Ltd |

| | | | | |
|---|---|---|---|---|
| 24/07/02 | Environment Agency | Regional Manager | Ian Haskell | |

## 2.3 Questionnaire

In formulating the questions used for requesting information it is important to appreciate that before respondents can interpret a question, as the researcher wants, it is essential that the respondent understand each word in the same way as the interviewee understands it (Foddy 1995). Foddy (1995) states that there are three important issues, which need to be taken into account. Firstly, the topic should be properly defined so that each respondent clearly understands what is being talked about. Secondly, the applicability of the question to each respondent should be established: respondents should not be asked to give information that they do not have. Lastly, the perspective that respondents should adopt, when answering the question, should be specified.

Hague (1994) describes 3 different types of questionnaires: structured — most questions pre-defined; semi-structured — mixture of questions with pre-defined answers as well as those where respondents are free to say; unstructured — checklist of questions where respondents are free to answer question in their own words.

As some of the background literature had been reviewed and the IPC/IPPC application documents in the Public Register had been inspected before using the questionnaire during the interviews, the preferred questionnaire appears to be the semi-structured type and straightforwardly referred to their IPC/IPPC application documents but the respondents are free to answer question in

their own words. The content of questions for the two regulated companies and two inspectors are specific on the their IPC/IPPC application, whilst the questions in interview with the regional IPC/RAS manager focused on clarifying the information that has been semi-analysed in order to double check some findings. Although the respondents are confined to the person who has involved in IPC, IPPC or relevant experiences, some difficult or nebulous words or terms are avoided. Due to the time limit, each interview lasted on average for one and half hours. For easy communication and more efficiently collecting information the questions are flexibly adapted to the interviewees, and the language used during the interview is as simple as possible. The central questions are around:

- The problems incurred in practical application of IPC/IPPC;
- The arguments in compliance with authorization conditions;
- The way to justify BATNEEC, BPEO and BAT;
- The considerations in authorizing a permit; and
- The extent of integrated approach in practical performances.

**2.4 Public register**

PPC Regulation requires the regulator to maintain registers containing information on all the installations they are responsible for. The register might include copies of applications, details of the regulator's determinations and monitoring information. In this research the public register are employed to explore the arguments from both regulator and the regulated companies and investigate the way of demonstration of BATNEEC/BPEO/BAT in IPC/IPPC

application. It takes four full days to collect the application documents. Most of the information represented in this research comes from the public register.

Table 2.2 Itinerary of Public Register

| Date | Location | |
|---|---|---|
| 12/06/02<br>13/06/02 | Rings Area Office<br>Phoenix House global Avenue<br>Leeds LS11 8PG | For Corus |
| 18/06/02<br>24/06/02 | Regional Office<br>Richard Fairclough House<br>Knutsford Road, Warrington WA<br>1HG | For Castle<br>Cement Ltd |

**2.5 Data analysis**

Analysis is the process in which the researcher engages with the data (Strauss and Corbin 1998). Data in their raw form do not speak for themselves; the messages stay hidden and need teasing out (Robson 1977). Data analysis consists of examining, categorising, tabulating, or otherwise recombining the evidence to address the initial propositions of study (Yin 1994). The researcher needs to rely on experience and the literature to present the evidence in various ways, using various interpretations (Tellis 1997). There may be multiple perspectives held by different individual, with each of these perspectives having equal validity, or truth (Creswell 1998; Guba and Lincoln 1988). One goal of a quality study then, might be to reveal the nature of these multiple perspectives.

A qualitative approach to the research was selected because this approach is concerned with collecting and analysing information in an as many forms,

chiefly non-numeric, as possible (Blaxter et al 1996). Blaxter stated that this approach has relevance because the term of qualitative implies a direct concern with experiences as it is lived or felt or undergone, it has the aim of understanding experience as nearly as possible as the participants feel it or live it. In this research the qualitative data obtained through literature reviews, interviews and public register in two case studies will be used to address the questions and objectives of this research outline in 1.1 and 1.3.

Qualitative evaluation requires a creative approach in order to achieve the effective coding and categorising of information (Patton 1999). Creswell (1998) has described a data analysis spiral, the steps are: (a) to organise the data, perhaps in the form of stories, sentences or individual words; (b) to peruse the entire data set several times to get a sense of what it contains as a whole; (c) to identify general categories or themes; and (d) to integrate and summarise the data for the readers. This is equally applicable to a wide variety of qualitative studies (Leedy and Ormrod 2001).

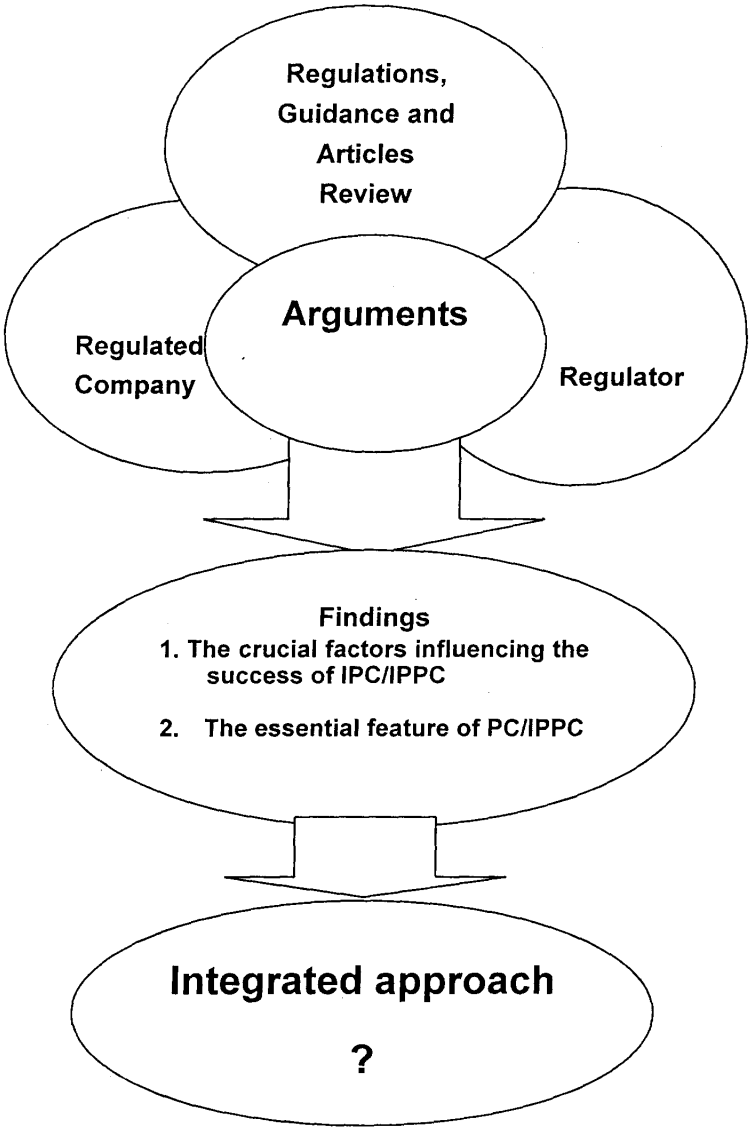
Accordingly, in this research those significant issues under the integrated environmental protection have been analysed and categorises into different categories to highlight the gap of theory and practice of an integrated approach in pollution control. The essences of integrated approach have been disclosed. The outcome forms as a lesson of approaching a real integrated environmental protection. The overall picture of approaching data and findings are displayed in Figure 2.1.

**2.6 Limitations**

Oppenheim (1992) argues that we are inevitably involved in interpretation of the responses, imposing some significance or categorisation of our own on them. He notes that the level of interpretation is crucial to its reliability, and that the more we indulge in interpretation the less objective we be come. There is scope for interviewer bias during the interview situation as the interview could carelessly guide the respondent to give an appropriate answer.

In order to minimise the extent to which the prior expectations and opinions enter into final analysis, the multiple and variety information from regulated companies, regulator and articles review have been cross-employed on the interpretation of issues and events in the final report.

Figure 2.1 The overall picture of approaching data and findings



# CAPTER 3

# Integrated Pollution Control

## 3.1 The evolution of IPC

In 1976 the RCEP (Royal Commission on Environmental Pollution) criticized the fragmented nature of industrial environmental regulations in the UK. Their Fifth Report, Air pollution control: An integrated approach (1976), called for a system of integrated pollution control. They pointed out that single media controls can merely shunt the pollution to other environmental media, for example heavy metal removed from air emissions by filter bags is disposed to landfill instead. The RCEP believed an integrated approach was required, which considered release to air, water and land together, and which sought the best practical environmental option, taking account of the total pollution from a process and the technical possibilities for dealing with it. Therefore, they recommended the creation of a new, unified inspectorate to administer integrated pollution control, and the air Inspectorate forming the basis for the new regulatory body. They considered the old concept of BPM (best practical means) approach should be maintained but should be integrated across media. Their recommendations remained within the discretionary, flexible tradition of UK industrial pollution control.

The RCEP claimed more transparencies would be brought to the BPM system by introducing a consent-based approach to regulation. Regulatory conditions would be included in a consent issued by the Inspectorate to operators. The consents would be held on a public register by the local authority, as would

monitoring results. Furthermore, the RCEP wanted to see more participation than just the narrow inspectorate-industry policy community in determination of BPM. The RCEP recognized the inspectorate's expertise on pollution control technologies, but pointed out that inspectors did neither possess the accounting expertise to assess a company's local financial circumstance, nor the economic expertise to consider cost and benefits to the nation. Actually, the RCEP wanted to see mechanisms for the inclusion of local authorities and other interested parties in the determination of abatement programmes and BPM.

However it took a long time for UK Government to develop an integrated pollution control system. The important legislation was passed in 1990; the Environment Protection Act (1990) contains the legal framework of integrated pollution control, which established two systems of control with one dealing with emissions to all media categorized as "Part A" and the other, containing the same principal mechanisms of control, dealing with atmospheric emissions alone categorized as "Part B", which is subject to Local Authority pollution control. Section 2 of the Act give the Secretary of State power to make regulations specifying the processes which need to obtain the authorization before they can be carried on. It is noticeable that control is primarily exercised over processes, whilst most release of substances will be regulated subsequently as part of the process authorisation. For the implementation of IPC, a number of pre-existing central government pollution inspectorates were combined to form HMIP (Her Majesty's Inspectorate of Pollution).

### 3.2 The meanings of IPC

The important objectives set down in Section 7(2)(a) of the Environment Pollution Act (EPA) 1990 reveals the true meanings of IPC.

"ensuring *that, in carrying on a prescribed process, the best available techniques not entailing excessive cost (BATNEEC) will be used* N

*for preventing the release of substances prescribed for any environmental medium into that medium or, where that is not practicable by such means, for reducing the release of such substances to a minimum and for rendering harmless any such substances which are so release;*"

Section 7(7) of the Act requires that BATNEEC will be used:

"*For minimizing the pollution which may be caused to environment taken as a whole by the releases having regard to the best practicable environmental option available as respects the substances which may be released*":

It is clear that there are twofold meanings (DoE 1996):

- To prevent or minimise the release of prescribed substances and to render harmless any substances which are released.

- To develop an approach to pollution control that considers discharges from industrial processes to all media, taking environment effect as a

whole.

In other words, it means that BATNEEC with BPEO will be used to prevent or minimize emissions taking into account the transfer of pollutants amongst three media.

Allott (1994) argued that another key aim of IPC was to introduce greater transparency and public accountability to the control of industrial pollution. As RCEP advocated maintaining an audit trail to ensure that the BPEO procedure is transparent, or open to independent scrutiny.

Additionally, Barrett (1995) argued that the IPC approach the following aims, these were also identified by DoE (1996):

- Improving the efficiency and effectiveness of HMIP
- Streamlining and strengthening the regulatory system
- Providing a one-stop-shop on pollution control
- Producing a clear and transparent system to maintain public confidence in the regulatory system.
- Providing a flexible system responding to changing pollution techniques
- Meeting the international obligation.

In view of the above abstract concepts and expectancies, it is envisaged that the IPC might be a sophisticated regime and that BATNEEC and BPEO are considered as the cornerstones of implementation of IPC. IPC's success as a driving force for environmental improvement might largely stand or fall on the

practical interpretation of these broad concepts.

### 3.3 How to integrate?

#### 3.3.1 What is BATNEEC?

Since the concept of BATNEEC appeared in EPA 1990, it has replaced the old concept of the BPM (best practicable means) that underpinned the UK's industrial air pollution control policy for many years. The important change is from "*best available technologies*" to the "*best available techniques*". BATNEEC requires more than simply the use of certain technology or equipment. Instead it includes also adequate personnel and premises, i.e. the matters such as numbers, qualifications, working method and maintenance of buildings, and the concept and design of process.

There is no legislative definition of BATNEEC, but the conventional interpretation makes it clear that "*Best*" will be taken the most effective option for preventing, minimizing or rendering harmless polluting emissions. There might be more than one set of best techniques. A technique will be considered available if it has been developed or proven at the appropriate scale anywhere in the world. "*NEEC*" allow the deviation from the BAT if the cost of applying BAT exceeds the benefits of environmental protection. The definition of BAT seems to be very clear and remains unchanged for many years. However, the debate was focused on the interpretation of "*not entailing excessive cost*", i.e. to what degree of deviation from BAT should be allowed, or how to judge the "*excessive cost*".

However, in previously HMIP guidance had generally avoided specifying particular techniques so as to leave operator more flexibility in defining BATNEEC. It stressed that the onus was on the applicants. They have to be aware of the best available techniques for their processes and should not cite the note in an attempt to delay the introduction of improved, available techniques (Allott 1994). It means that applicants should be prepared to go further than the suggested options, and not view the guidance note as absolute targets.

Usually the emission limit values (ELVs) given are achievable by all new processes using the BAT described in guidance notes. The BATNEEC prescribed in guidance are not the sole basis on which authorization ELVs are to be set, information such as site-specific environmental and technical data, plant financial data and other relevance will also be considered.

It is believable that the existing processes always depart from BATNEEC. Therefore for them BATNEEC necessitate the adoption of on-going programmes of environmental management and control, which focus on continuing improvements aimed at prevention, elimination and progressive reduction of emissions.

### 3.3.2 How to determine BATNEEC?

In the identification of BATNEEC, emphasis is placed on pollution prevention techniques, including cleaner technologies and waste minimization, rather

than end-of-pipe treatment. Techniques identified are considered to be current best practice for the purposes of setting emission limit values. These techniques are representative of a wide range of currently employed techniques appropriate to particular circumstances.

According to the EA (1992), the approach to be used in selecting BATNEEC is based on the following hierarchy.

- Process design/redesign changes to eliminate emission and wastes that might pose environmental problems.
- Substitution of fuels etc. by environmentally less harmful ones.
- Demonstration of waste minimisation and reduction by means of process control, inventory control and end-of-pipe technologies etc.

However, the meaning of BATNEEC will be different in new processes and existing processes. For new processes, the IPC guidance notes in 1991 and 1993 claimed that in many cases it is expected that BAT and BATNEEC will be synonymous. DoE (1996) stated the principles to be followed as:

- The cost of BAT must be weighed against environmental damage from the processes
- If after applying BATNEEC serious harm to the environment would still result, an application should be refused.
- An objective approach, i.e. the lack of profitability of a particular business should not be taken into account in the determination of BATNEEC.

On the other hand, for the existing process the degree to which IPC will drive the upgrading of existing process has been a major bone of contention. Allot (1994) stated that there were some factors which DoE general policy should take into account when upgrading existing process. Thes were:

- The process's technical characteristics;
- The length of remaining life and its rate of utilization; and
- The desirability of NEEC.

It is noteworthy that there are no statutory methods and procedures to determine the BATNEEC. The guidance acted as a main mechanism in the performance of IPC by which policies are applied in practice, although they have no statutory force.

### 3.3.3 what is BPEO?

The concept of the BPEO emerged in 1976 with the publication of the Fifth Report of RCEP. It proposed that pollution release should be directed to the environmental medium where the least environmental damage would be done. Subsequently, in RCEP's 12$^{th}$ Report in 1988, it stated that BPEO as the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long term as well as in the short term. Meanwhile a seven-step approach to determining the BPEO was given in that Report (RCEP 1988).

As with BATNEEC the Environmental Protection Act 1990 does neither define the BPEO, nor allow for any wider interpretation of this term. The Act set the objective that BATNEEC should be used for minimising the pollution which may be caused to environment taken as a whole, having regard to the BPEO.

### 3.3.4 How to determine BPEO?

An integrated approach was proposed by HMIP in 1994. Subsequently in 1995 the final drafts of the technical guidance were produced. In general a three-phase approach is considered in the proposal (HMIP 1994).

- Identify pollution released and compare to environmental quality standard, then select practicable process and abatement options in terms of releases to the environment.
- Carry out an environmental assessment taking care of long-term and short-term effects on environment and derive an integrated environmental index, which is the sum of the contribution of emissions to air, water and land.
- Determine the BPEO by taking account of the excessive costs through a cost analysis in each option. However, if the previous two phases have showed the best option, then no further cost analysis is required in this phase.

EA (Environmental Agency) guidance note stated that the methodology of an integrated approach is not compulsory. It is an example of how a BPEO

appraisal could be carried out. This revealed that it should not be used in a mechanic way.

In the context of integrating the environmental impact of releases to air, water and land, a major difficulty stems from the need to identify in practicable terms the effects on different sectors of the environment of any course of action. The problem is how to combine the effects of releases to all environmental media in a single integrated Environmental value or how to compare with each of effect in different compounds and media. Barrantt (1995) argued that the quantitative inventory of amounts released from the process might be simple, but comparing the two production options simply on the basis of the quantities or qualities of pollutants released might fail to address their relative potential to cause harm to the environment, for example, how to equate an impact on pollution of a lake against one on global warming.

Technology standards relate primarily to engineering concepts and do not take into account the social implications and value judgments that are an inevitable part of environmental decision making. Risk-benefit or cost-benefit analyses may address the risks and trade-offs that are necessary, nevertheless costing the environment and determining an acceptable risk are usually thorny problems

O'Riordan (1990) criticised that the concept of BPEO is all but impossible to achieve in practice. It involves computations of emission comparability that cannot be identified in either technical or in economic terms. A pilot study carried out by HM Inspectorate of Pollution took 200 persons hour and was

still only partially successful.

However, an integrating approach was proposed by HMIP in 1994, the key concern is the use of an IEI (Integrated Environment Index) to express the long-term impact of all releases from a process as a single value. This involved the use of a basic dispersion models to predict the maximum environmental concentration of each release. Add to this the actual or estimated background concentration of pollution at that point, and then compare this PEC (Predicted Environmental Concentration) to each release with any statutory limit, EQS (Environmental Quality Standard), or an EAL (Environmental Assessment Level) to get a quotient. The proportion of (PEC) / (EQS) or (PEC) / (EAL) for single release can be summed to create a tolerability quotient for each medium, then each medium quotient be summed up in one single index. This allows an operator to identify the BEO (Best Environmental Option). By integrating other factors including economic consideration into the equation, the best practicable environmental option should emerge.

The argument is a single value representing the effects of all pollutants to all media over time resembles the controversial stage of life cycle analysis when attempting to integrate. The statutory EQS or EAL (Environmental Assessment Level) is based on different assumption of risk level and precautionary principles. ENDS (1995b) critics that the methodology attempts to "*add apples and pears*". Subsequently, this has been confirmed in a study carried out by Ian Walpole of Castle Cement Ltd in 1995. A wet process emerged with an IEI value 25% lower than the dry process despite its much

higher mass emission. The main reason for the contradiction is that the higher exhaust temperature from the wet process produce greater plume rise, therefore the wet process has got better dispersion and low predict environmental concentration on the ground level.

In face of this argument HMIP has been trying to increase factors in the overall assessment rather than IEI only, and continued to say that in most cases the index would be expected to have the greatest importance when weigh environmental benefits against the cost of process option. Subsequently, the Environmental Agency (1997) stressed that the guidance set out a framework, which can be applied flexible and imaginatively as appropriate to particular circumstances. The proposed methodology is not compulsory, but provide an indication of the degree of detail and rigour, which is expected by the Agency in any alternative approach (ENDS 1997). The agency expected that the index would reveal a break point where additional environmental expenditure yields insignificant environmental protection and ensures greater consistency and transparency to the weight of economic considerations in decision of authorization.

However, it is noteworthy that the RCEP in its seminal work on BPEO concluded that some aspect might require qualitative assessment, which is best, summarized not by a score but by symbols or words (Barratt 1995).

Indeed, the BPEO Assessment Methodology for IPC (EA 1997) itself also stated that the integrated assessment of the impact of release on the environment as a whole is extremely complex, in practice, knowledge about

the factors used to assess the impact is limited. There is the possibility of expending greater resources on the assessment itself than could be justified by any environmental improvement, although the assessment of the BPEO is a key element in evaluation of the impact of releases on the environment.

The RCEP observed that restriction of HMIP's responsibilities to certain aspects of pollution has precluded it from pursuing the full BPEO concept (ENDS 1995a). It failed to take account of numerous off-site factors such as raw material extraction, emissions from off-site power generation, and the impacts of waste disposal that are outside IPC's regime.

In light of the above arguments, on one hand it is believable that the interpretation of BPEO is too narrow due to its focus on pollution release only. On the other, there are high potential uncertainties and difficulties in the integrated assessment to achieve the goal of IPC. This revealed that there is a gap between the theory and practice of the assessment of BPEO.

However, for the existing processes the preferred option might be the existing techniques unless there are already plans to upgrade the process, such as a requirement of an improvement programme.

### 3.4 Summary

The RCEP initiated the concept of integrated pollution control. It claims that pollution release to air, water and land should be considered all together in a permit system and more transparencies and participations are required. The

important obligations to implement the IPC are imposed on the concept of BATNEEC and BPEO. It is believed that the success of IPC depends on the performance of those two concepts.

Whilst the concept of BATNEEC was created to prevent or minimise the release from the prescribed processes, and replace the old concept of BPM, the concept of BPEO is used to consider releases to all media, taking the environmental effect as a whole.

The options departure from BATNEEC have to be justified and the impact it caused should be assessed. The regulators also have to explain any cases where they have permitted any deviation. These works involve the cost-effectiveness analysis, comprehensive environmental assessment and some form of expert judgment.

It is believed that the determination of BPEO implies an integrated approach in environmental protection. But many bombards were over its impracticability of the comparing different emission effects in different media. The methodology of BPEO assessment was criticized as theoretical only. Similarly for BATNEEC, another pillar in IPC, only principle rules are given in the guidance in considerations of improvement of the existing process under IPPC authorisation. Every decision appears to be determined case-by-case.

It is noteworthy that whilst the perfect concept of "*taken environmental as a whole*" was incorporated into EPA 1990, there are no statutory definition of the BATNEEC and BPEO in the Act. Therefore non-mandatory guidance

performs an important role in the interpretation of regulation and provision of methodologies to fulfill the objectives of IPC.

# CHAPTER 4

# Integrated Pollution Prevention Control

## 4.1 The evolution of IPPC

Whilst the IPC provisions were being implemented in UK, the European Commission was putting forward an integrated permitting proposal, a draft IPPC Directive, for industrial processes in 1993. Both the UK government and industry were keen on shaping the debate on the draft IPPC Directive at a very early stage. The draft Directive resembled the IPC regime established by the UK.

In the early time of development of draft IPPC Directive there were two main questions that gave rise to heated discussions. One was the possibility to achieve an integrated pollution prevention and control, and the other was the Directive's flexible approach too flexible (Doppelhammer 2000). However, the IPPC Directive was finally adopted on 24 September 1996, and came into force in 30 October 1999. The aim is to introduce an integrated approach to pollution prevention and control in order to achieve a high level of protection for the environment as a whole.

For the sake of compliance with the EC Directive the PPC Act (Pollution Prevention and Control Act) was enacted in the UK in 1999 which empowers the Secretary of State to make regulations to establish a new pollution control system, PPC (Pollution Prevention and Control) Regulation 2000, which came into force on 1 August 2000. A new authority, the EA (Environment Agency),

which merged the Her Majesty's Inspectorate of Pollution, Waste Regulation Authority and National Rivers Authority, was also instituted in 1996 for the implementation of IPPC Directive. In many ways, the Directive echoed the existing IPC system in the UK although there was a shift from control over environmental emissions to wider environmental impacts and from isolated industrial processes to a wider definition of activities and installations.

According to the 2000 Regulation the existing installations are being phased in on a sector-by-sector basis between 2000 and 2007, and it will eventually replace the IPC regime.

**4.2 What is IPPC?**

The rationale for integration is that the single medium focus may result in the transfer of pollution to the other media; therefore taking into consideration the interdependence between the different media, with a view to preventing cross-media effects will obtain greater protection of the environment.

DEFRA (2001) states that the main aim of IPPC is to achieve:

*" A high level of protection of the environment taken as a whole by, in particular, preventing or, where that is not practicable, reducing emissions into the air, water and land."*

IPPC is similar to IPC. It intends to encourage innovation, protect the environment as a whole in a precautionary mindset, and also provide a

one-stop-shop for administering applications for permits to operate. However, under IPPC a wider range of environmental impacts across a wider spectrum will be taken into account than with IPC. More broad issues are considered in the IPPC regime, such as energy efficiency, raw material, waste avoidance or minimization, accident avoidance, minimization of noise and vibrations, and decommissioning which are not required in the IPC regime. Furthermore the IPPC is directed at activities connected to the whole installation not at a particular process as happened with IPC. The range of activities controlled under IPPC is larger than under IPC. It is estimated that in total some 7000 installations will fall within IPPC. This compares with approximately 2000 under IPC.

Gouldson (1998) argued that after the enforcement of IPPC the true integration of many of the pollution control functions might take place.

### 4.3 how to integrate?

#### 4.3.1 what is BAT?

Whilst the IPC regime refers to BATNEEC, the IPPC regime refers to BAT (Best Available Techniques). BAT is unlike BATNEEC and BPEO having no statutory definition. The IPPC Directive and Section 3 (1) Part I of PPC

Regulation defined BAT as:

*"The most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where this is not practical, generally to reduce emissions and impact on the environment as a whole"*:

And *"available techniques"* means *those techniques which have been developed on a scale which allows implementation in the relevant industrial sector, under economical and technically viable conditions, taking into consideration the cost and advantages."*

Obviously, the definition of *"available"* for BAT under IPPC allows it to be both "technically and economically viable". In consideration of the balance of cost and advantages, it might mean that a technique may be rejected as BAT if its costs would far outweigh its environmental benefits. This reveals that the BAT has combined both function of BATNEEC and BPEO.

The essential of IPPC is to require operators to choose the BAT to achieve a high level of protection of the environment taken as a whole. This, together with a consideration of local circumstance, provides the main basis for setting ELVs (Emission Limit Values). But it is arguable that the adoption of BAT could necessarily guarantee no harm to the environment. Therefore, it should be born in mind that an emission would cause serious harm, even after applying BAT, the regulator may impose stricter permit conditions or other

addition condition otherwise the permit could be refused (DEFRA 2000).

### 4.3.2 How to determine the BAT

A Practical Guide (DEFRA 2000) states that the principles of determining the BAT include identifying options, assessing environmental effects and considering economics. The principles of precaution and prevention are also relevant factor for the BAT. They are very similar to the determination of the BPEO in IPC. The procedure are represented as:

- **Identify options:** comparing the techniques that prevent or reduce emissions and identifying the best one in terms of the lowest impact on the environment.
- **Assessing environmental effects:** The main focus will be the effects of releases. The assessment should identify and quantify possible releases of polluting substances into any media. It should also quantify their effects. Additionally the consumption and nature of raw materials, energy efficiency, waste, accidents and site restoration are also taken into account in assessment. The local factors, such as existing use, sensitivity of environmental receptors, and absorption capacity of the natural environment shall be taken into account.

- **Economic assessment:** the approach is to take account of the balance of costs and advantages. The assessment includes operating costs and capital cost. The lack of profitability of a particular business should not affect the determination. Conversely the regulator should not impose

stricter standards than BAT just because an operator can afford to pay more. However, if the best option has been disclosed through the previous two steps then economic assessment is not necessary.

- **Expert judgment:** in comparing relative significance of different environmental effects in different media an expert judgment will be involved. The overall assessment and comparison of options should normally include significant qualitative element. They generally use simple numerical analysis to compare or aggregate different types of environmental effects should be avoided.

In IPPC, more information about BATs has been provided than BATNEEC in IPC due to it involving more indicative techniques from EC's BAT Reference documents. Whilst the IPPC sector guidance and BREF note (BAT Reference documents) have produced a number of indicative BATs and ELVs for several individual sectors, the operators are encouraged to find better ways of operating installations other than relying solely on benchmark standards in guidance. At times, some permits may allow them to have all of their permit conditions set by a general binding rule rather than being individually tailored.

Similar to IPC, in IPPC the operators should justify any proposed departure from the indicative requirements, which may include additional environmental assessments. Even new installations may be a deviation from the BAT due to the site-specific factor. However, for the existing installations the principles for determining BAT will be the same as the new installations. But the strategies become more flexible, which require them to be upgraded to the BAT

standard as soon as possible over a specific period of time. Nevertheless, the improvement programmes should be justified on the grounds that their advantages exceed their costs. The timescale should only reflect what is reasonable on availability grounds. For an installation which is scheduled for closure and its effects are not excessive in respect of other aspects of the PPC Regulations, it may be appropriate for the regulator to impose only limited BAT controls. This should be assessed on a case-by-case basis. However, for an existing installation, in practice how soon should the existing installation approach the BAT will depend on the local and plant specific circumstances.

There are some obligations imposed on the regulators in the authorization, which are summarized below:

- Decide whether to accept any arguments the operator might have made for not following the indicative requirements;

- Imposing improvement requirements with appropriate deadlines based on their own considerations, if it is necessary;

- Explain any cases where they have permitted any deviation so that the permitting process remains open and transparent;

- Adequately assessing environmental effects and control techniques before granting a permit, if there are some uncertainties remained;

- Impose interim standards until it has a chance to investigate any uncertainties or refuse the permit.

### 4.4 Summary

IPPC is derived from EC Directive but the Directive resembles the IPC regime in the UK. For the sake of compliance with the obligation as one of the EU member state, the UK enacted the PPC regulations referred to in the EC IPPC Directive. IPPC is very similar to IPC. The authorized processes have been expanded to include installation. The authorized items have been extended to incorporate energy, noise, accidence, and more environmental impact concerns. It gave a chance for the UK to refresh its IPC in environmental protection policy.

However, the concept of BAT in IPPC is similar to BATNEEC/BPEO in IPC basically, but more detail guidance was issued and more indicative BATs are prescribed in the guidance. ENDS (2001c) stated that under IPC, BATNEEC was a more nebulous concept, likened to an ever-tightening elastic band, whereas IPPC guidance contains clear indicative requirements.

The EA revamps BPEO guidance for a new *BAT appraisal* (ENDS 2001a). But so far the new IPPC guidance is still not yet finalised. The BAT assessment methodology might follow the concept of BPEO and require the operators to justify their choice of BAT where more than one option exists or where their proposals deviate from BATs. The IPPC sectoral guidance indicated a flexible way to justify the operator's option. It explicitly stated that

the option justification and its impact assessment might vary from a simple statement to a full cost benefit analysis. Since the sectoral guidance of IPPC sets out explicitly indicative BAT requirements, it is unclear whether operators will be expected to appraise the BAT if they are meeting indicative BAT requirements (ENDS 2001b). It is also unclear whether the new BAT assessment methodology will embody the concept of integrated approach in practical performances. It can be envisaged that if the game rule were not clear-cut it would confuse the industry about the way to approach them in practice.

In terms of the integrated approach, some important considerations of the differences between IPC and IPPC have been pointed out and showed in Table 4.1. The IPPC integrated concept diagram shows in the following Figure 4.1.

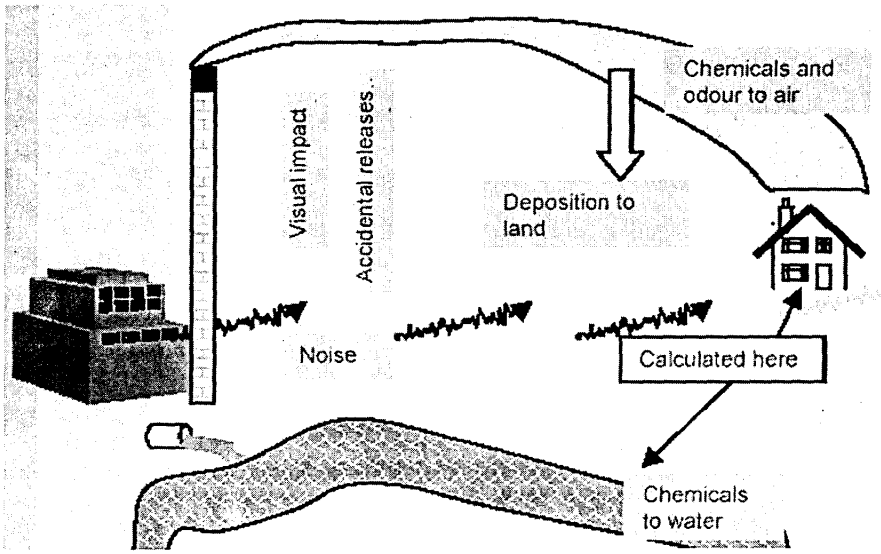



**Figure 4.1 The IPPC integrated concept diagram adapted from IPPC H1 (2001)**

Table 4.1 The comparison of integrated approach in IPC/IPPC

| | IPC | IPPC |
|---|---|---|
| Principle | ♦ Precaution and prevention | |
| Objective | ♦ A high level of protection for environment as a whole.<br>♦ Prevent, minimise pollution releases and rendering harmless<br>♦ Taking environment effect as a whole.<br>♦ One-stop-shop<br>♦ Streamline and strengthen the regulatory system<br>♦ Improve the efficiency and effectiveness of authorities<br>♦ Continue improvement | |
| Prescribed activities | Process | Installation |
| Process Standard | BPEO/BATNEEC (no indicative BATs)<br>ELVs | BAT (indicative BATs in guidance)<br>ELVs<br>GBRs (general binding rules) for certain types of installation |
| Integration components | ♦ Emission release to air, water and land | ♦ Emission release to air, water and land<br>♦ Energy efficiency,<br>♦ Raw material,<br>♦ EMS<br>♦ Waste avoidance or minimisation,<br>♦ Accident avoidance,<br>♦ Minimisation of noise and vibration,<br>♦ Decommissioning |
| Integration consideration | ♦ The balance of cost and benefit<br>♦ Site-specific<br>♦ Remaining life time and its rate of utilization<br>♦ Current best practice<br>♦ Case-by-case<br>♦ No consideration of individual plant financial position<br>♦ Environmental effect from air, water and waste pollution release | ♦ The balance of cost and advantages<br>♦ Site-specific<br>♦ Remaining life time and its rate of utilization<br>♦ Current best practice<br>♦ Case-by-case<br>♦ No consideration of individual plant financial position<br>♦ Environmental assessment including effects of releases, consumption and nature of raw materials, energy efficiency, waste issue, accidents, site restoration |
| Assessment method | E1 BPEO Assessments Methodology for IPC:<br>♦ Integrated environment index (IEI)<br>♦ Expert judgement involved | H1 IPPC Environment Assessment and appraisal of BAT:<br>♦ Environmental Quotient<br>♦ Professional judgement involved |

# CHAPTER 5

## Crous Engineering Steel Stocksbridge Works

### 5.1 Introduction

Corus (Crous Engineering Steel at Stocksbridge Works) has used the Arc Furnace method to carry out steel making, rolling and finishing on the Stocksbridge site since the early 1950's. The main raw material is a waste material, namely ferrous scrap from sources such as scrap automobiles, white goods and constructional scrap. The plant combines ingot casting with continuous casting of billets. The information collected in this chapter is from the IPC/IPPC application document and the interview with both Environmental & Energy Section Manager N John Rockett and Environmental Engineer N Allen Gorringe in Crous Engineering Steel at Stocksbridge Works, and the IPC/IPPC application documents in Public Register.

According to IPC/IPPC application documents of Corus Engineering Steels from Public Register documents, the application of iron and steel processes for IPC started in March 1995, and was authorised in August 1995. Whilst the application has referred their processes to BPEO and BATNEEC, such as the justification of the current Arc Furnace method as BPEO, the use of BATNEEC in water system, etc, twelve improvement requirements were imposed on its permit. Later in January 1999 they were extended to nineteen conditions, which required the operator to re-examine the release of pollution in the process and provide justification of BATNEEC and BPEO, including minimisation of water use and wastewater, the BPEO of the red filter dust,

assessment and evaluation etc.

In light of the above discussion, the information in the initial IPC application seems to be insufficient to explain an integrated pollution control in view of the regulator. So the improvement programmes have been kept going until all the requirements have been completed. The variation notice was finalised in October 2000. Curiously the finished conditions were recorded as "completed" in the final IPC Variation Notices.

Subsequently the IPPC regime appeared, and intends to replace the old IPC. Apart from the previous information in IPC lots of broad information, such as the energy use, accidents, noise and vibration, and decommissioning have been imposed on Corus Engineering Steels for the new IPPC application in August 2001. There are similar requirements as in IPC application but the more in depth assessments have been required in IPPC thereby assisting in the determination of BAT. However, until the end of June 2002 the new IPPC authorisation is still underway and only draft one has been issued.

**5.2 Scenario**

According to the IPC application documents in Public Register Corus engineering Steels submitted its IPC application for its iron and steel process in March 1995, and the authorisation was issued in August 1995. But there were 19 following improvement requirements that were imposed on Corus Engineering Steels by the regulator. Obviously the regulator did not satisfy the justification of Corus's process as BPEO/BATNEEC.

However, the Corus Engineering Steels has completed these requirements one by one. No strong arguments are shown in the public register documents. But the problems were found during the interviews, where Corus Engineering Steels complained that those improvement requirements from the regulator were not cost-effective and with no justification from the regulator. The Environmental & Energy Section Manager of Corus argued that there were no explanation for why those requirements should be done, and no response to what Corus Engineering Steels had done to meet the requirements. He even said that the regulator might exacerbate those requirements. Indeed, in the public register documents there are neither any comments on the finished requirements, but merely recorded "completed", nor were the decision documents found. It is interesting to investigate the disagreements of Corus Engineering Steels and considerations of the regulator in his decision of authorisation.

The questions asked were:

- How did the regulated company justify its processes?
- What are the disagreements between the regulated company and the regulator?
- What are the benchmarks in authorisation of IPC/IPPC?
- What are the viewpoints of IPC/IPPC performances from regulator and operator?

## 5.3 Arguments from Corus

The following information collected is from the interview with Environmental & Energy Section Manager and Environmental Engineer and from IPC/IPPC application documents in Public Register. The arguments have been divided into four sections:

- the way of justification of BATNEEC;
- the problems in application of IPC/IPPC;
- the comments on integrated approach; and
- the drivers of IPC/IPPC.

### 5.3.1 The way of justification of BATNEEC

#### 5.3.1.1 The manufacture process is BATNEEC/BAT

Corus claimed that the Arc Furnace method it has adopted in steel making is the most suitable for the quantities of steel production on the site. The environmental benefits include:

- Landfill saving: Due to the main raw material, scrap, being a waste material, without the Arc Furnace route to recycle these material it would have to be disposed of in an alternative manner such as land fill.
- Natural material saving: the recycling of ferrous scrap also reduces the requirement for abstraction of iron ore.
- The Arc Furnace route uses significantly less energy per tonne of

steel produced when compared to alternative steel making processes i.e. integrated iron and steel process.

- Energy saving: a portion of steel is directly cast to the size required by the customer. It eliminates the need for reheating and then rolling of the material, which thus minimises the releases to air, land and water associated with those processes.

The main pollution source from electric Arc furnace steel-making facilities is the melt shop. An extensive fume extraction system was installed in the melting shop consisting of both primary and secondary extraction for the furnaces and secondary steel-making units. Primary fume capture is via a fourth hole in the furnace roof with secondary capture by roof hoods within the building. The roof hoods have been automated using obscuration meters and plant sensors to maximise fume capture. Continuous monitoring of the system has also been installed to assist fault finding. The bag house employs fabric filters for dust collection, which is considered to be the BAT.

5.3.1.2 The water use and waste water generation were minimised

Water is primarily used for cooling equipment and steam generation. The works utilises a number of closed and open circuit cooling systems. The total water used on the works is less than 3.5% of that abstracted from the Little Don River, most of which is returned to the river. Due to the collection of rain water from hard surfaces and buildings, and discharges of used potable water supplied by

Yorkshire water, the total amount of wastewater discharges into the river from its consented outfalls is about 1,629,926 $m^3$, while the works abstracted 1,246,736 $m^3$ from the river in 1998.

There are no releases of prescribed substances to the water. The discharges are regularly analysed, including oil and grease, suspended solids and particular metals in order to ensure that releases are within levels acceptable to the Environment Agency.

The company has listed each discharge outlet and examines their alternative recycling and reduction options. The main discharges from the works are via outlets 8, 14 and 17. The justification of BPEO for each outlet control measure is explained below. The main reason is the negligible effect on the river from the existing system according to the data from its regular monitoring discharge system, and the physical difficulty for further construction which is not cost-effective.

- Outlet 8:

Wastewater could be collected and recycled from outlet No 8. the cost to do this was estimated at £70k. However, since virtually all water abstracted is returned to the river for reused further downstream, recycling water from outlet No 8 would have no environmental benefits and could not be financially justified.

- Outlets 14 and 17:

Installing collection and pumping facilities at outlet 14 and 17 would

be very difficult and expensive, due to the civil works required in the vicinity of exiting buildings and structures.

- Alternative option:

The cooling system, with thirteen cooling towers are used on the site, could possibly be replaced with air blast heat exchangers, but due to the small water temperature difference the exchangers would have to be very large and impossible to achieve.

5.3.1.2 The waste (red field dusts) disposal is BPEO

Corus Engineering Steels recycles significant quantities of its wastes and by-products; red dust from the arc furnace represents the single largest waste material, which is not recycled. The EAF dust raisings were 8257 tonnes in 1998, and the main constituents are iron and zinc. The contents of zinc is between 20% and 25%, which is the most important oxide when considering the potential revenues accrued from treatment process. It is these substances that will determine any recycling options. Although a number of processes have been considered worldwide over the past few years, none of these processes are economically viable in the UK.

The red dust was land filled with other steelworks wastes at Morehall Landfill. A river that runs along the boundary of the landfill site has been monitored. The data shows no evidence of any environmental effect from this source.

Corus has argued that at the landfill site red dust does not cause environmental pollution. The only pollution arising from this operation is from transport emissions. It has examined twelve recycling options, and also identified that all options require large-scale plants with high levels of investment with the exception of Carbofer and Briquetting. Although these two options depend on other processes to treat the zinc-enriched dust, they may provide the most economical alternatives to land fill in the future. However, over 500 tonnes of briquettes have been processed on a trial at Corus with very variable results.

Consequently, Corus stated that trial work is still required and the complete financial and environmental impact of this process needed to be further evaluated, but currently this disposal is BATNEEC.

5.3.1.4 The EQSs are met and environmental impacts are insignificant

Importantly, Corus Engineering Steels claimed that an ambient air survey in 1994 has demonstrated that particulate is the most important pollutant in the electric arc furnaces, and emissions from this factory were very low when compared to international standards.

Additionally, the subsequent impact assessments report have also found that Corus has a minimal chemical and water budget impact on the Little Don system, and the emissions that would be expected to

contribute less than 0.2% of the relevant EQS (Environment Quality Standard) or EAL (Environmental Assessment Level). The predicted and measured concentrations in the vicinity of Corus Works do not exceed the relevant short-term and long-term EQSs.

5.3.2 The problems in application of IPC/IPPC

Corus Environmental & Energy Section Manager argued that improvement requirements are not cost-effective, and emphasized that the improvement conditions imposed on Corus by regulators are not BATNEEC at all. They are not cost-effective and there was a lack of justification for the requirements. *"The regulator exacerbates those requirements"*, said the Environmental and Energy Sector Manager. The examples underpinning its arguments collected from the interview have been reorganised and represented below:

A. The regulators demanded further reduction in the amount of oil discharged into River Don without considering the already poor quality of the River, whilst oil is not even a parameter measured to determine river quality. There was no explanation for why these reductions should be done, but simply because the regulators believed that the company can meet them rather than reducing the environment impact of the emissions. There is no consideration into the fact that the river quality might be exacerbated by other downstream companies not managing to meet the same stringent standards as the upstream companies have done.

B. The regulator required the company to reduce emissions from the wet precipitator from 50 to 40 μg/m3. This is regardless of the fact that this equipment is twenty-eight years old.

C. In air quality protection works, the emission limit is too strict and unreasonable. The major contributory source of $NO_x$ is from traffic in the Stocksbridge area, but the EA set a stricter emission limit on the factory, requiring the plant to continue to reduce its $NO_x$ emission rather than taking more action on traffic. Additionally, the regulators' focus on reduction of $NO_x$ emission from furnaces might be wrong as there are low level but high volumes of $NO_x$ emissions from bag plant whilst only 20% of emissions are from the furnaces.

D. The environmental impact assessment has showed that air quality impact is negligible and the BAT has been used to control emissions, but the regulator still demand monitoring ambient quality around the site. It costs a lot of money, yet with little benefit.

E. Since the previous limits of lower standard were not having an impact on the environment, why should the new standards become stricter? Why should the company strive to continually improve its environment performance if it is then going to be penalised by imposition of stricter environment standard without justification?

F. There are similar types of approach with other department of

government. Corus's Environmental and Energy Sector Manager in the interview argued that ETSU give energy advice but the assumption is that if you can implement the advice you should do it N no consideration is given to the commercial importance of pay back time.

Corus Engineering Steels argued that why is the inspector still addressing the same improvement conditions in the IPPC permit when he has had 10 years of IPC authorisation to do so? Inspectors produce a wish list of thing they want to happen, regardless of whether or not these conditions are guaranteed. The company might think the only action they can take is to appeal to Secretary of State, but for the sake of maintaining good Public Relation image the appeal has not been done.

5.3.3 The comments on integrated approach

5.3.3.1 IPC is good in principle but not yet been fulfilled

In the interview, Corus's Environmental and Energy Section Manager and Environmental Engineer both said that they believed that IPC is good in principle but poor in practice due to some technical problems yet to be addressed in the enforcement stage.

One-stop-shop, combining 3 separate regulators, is warmly welcomed by industry due to it uniting the application of three different authorisation together therefore simplifying the application

procedure. Additionally, it focuses on the environment impact taken as a whole. Therefore it was expected to be a more efficient regulation, more professional, and more communicated discussion with regulator.

However, those expectancies have not yet been fulfilled. The Corus Environmental & Energy Section Manager stated the general problems include: less experienced inspectors; new inspectors are unwilling to provide support and consultation; the inspectors tend to follow a regulation just for the sake of regulation; and the regulations has become more bureaucratic, prescriptive and at arms length as well.

In the view of Corus the benefit from IPC is very little, whilst the burdens are huge, i.e. the heavy cost of compliance. The greatest burden is the time and cost involved in monitoring and reporting; £ 11,500 in paying for the regulator's verification monitoring and in-house monitoring.

5.3.3.2 IPC/IPPC are checklist approach

During the interview the Environmental and Energy Sector Manager argued that there are no great differences between IPC and IPPC. Those issues are newly included in IPPC but not in IPC and have already been addressing under other regulations by the company. In the eyes of the regulated company IPPC is aiming for

an industrial culture change, but it is an extension of IPC in practice, with more focus on an environmental effects. The company argued that the way regulators have approached in IPPC has been far in excess of what was required. Too much effort was required whilst there is no benefit at all.

The Environmental and Energy Sector Manager said that IPPC might not result in an integrated approach; on the contrary, it is like a checklist of things to certify rather than working out the interaction of one issue on the other. The IPPC application cost the company £27,600 and one person with 3 months fulltime work, plus the use of 4 specialists for certain sections.

The EA only gives the priority to the regulations rather than how to improve the environment, i.e. the importance of regulation rather than techniques. (Large companies own more improvement resources to find out its BAT). There is no help from Environment Agency.

5.3.3.3 The BPEO/ BATNEEC is not practical

The company agrees that BPEO and BATNEEC are both central to IPC. They are valid for new processes but not for existing processes. BPEO assessment is very sophisticated which requires huge efforts and generates lots of information. It involves a lot of paper work, but sometime dose nothing to the real

improvement on the environment. In reality, there are so many physical and financial constraints that inhibit their performances. As a result, it is not practical at all. For an existing process the cost-effectiveness of taking a BPEO assessment is doubtful.

### 5.3.4 The drivers in IPC/IPPC

The company stated that the threats to drive the company to comply with IPC/IPPC are prosecution and fines, but more importantly it is the public image. Actually, the company sets its own environmental performance target. The internal targets are more important than external drivers'; i.e. poor performance may result in the loss of jobs. Company's internal drivers could result in the company applying BAT rather than BATNEEC. Company policy dictates better standard than that of the regulator.

However, the company stated that there were many advantages from having an EMS (Environmental Management System) i.e. ISO 14000, without this the task it would have been more difficult. It is relevant to IPC/IPPC. In fact EMS is essential to meet IPC/IPPC requirements.

## 5.4 Arguments from the regulator

Compared to the mountain of complaints from Corus Engineering Steels the attitude of the Environment Agency inspector is more conservative according to the information collected from the interview. Basically the inspector has no

specific comments directly against the claims from Corus, instead he emphasised on some principle arguments. The inspector implied that the more specific the arguments or reasons for the authorisation decision the more flaws would be picked up in any appeal. Anyway, the inspector stressed the importance of professional judgement in decision-making by experiences.

These arguments of the regulator collected form the IPC/IPPC application document and the interview with the Environment Agency inspector are represented and divided into 4 units:

- the comments on the improvement requirements;
- the comments on integrated approach;
- the lead of approaching integration; and
- the drivers and problems in IPC/IPPC.

5.4.1 The comments on the improvement requirements

In the interview, the inspector argued that the operator has the obligation to continue improving its process. The purpose of IPC/IPPC is to encourage the operator to prevent pollution, if it is impossible, then to minimise or render the process harmless through continual improvement. The 19 improvement requirements imposed on the operator in this case aim to approach this purpose. The precautionary mindset might be an important factor in requiring of continuing improvement.

The improvement process required a fundamental examination of the

process and a searching examination of opportunities for improvement to reduce the generation of waste products. The operator is the person who knows this process most. The onus of justification of BAT/BATNEEC/BPEO is on the operator, not the inspector, although sometimes the inspector needs to encourage the operator to take actions. Basically, the operator should show its best techniques to control release with respect of management techniques relating to the procedures and practices for designing, building, operating and maintaining a process; process techniques relating to the use of available opportunities to reduce release from activities. However, Corus has its own environmental department, it is believable that it definitely knows what are the best techniques for its processes in terms of environmental protection. Even if the emissions are below standards the Corus still has to improve its process, because things have been released by Corus long ago, which might cause harm. The inspector implied that the polluter has the obligation to reduce its pollution instead of arguing that it is merely satisfying the environmental quality.

5.4.2. The comments on integrated approach

The inspector argued that an integrated approach is a concept more than practice. The IPC/IPPC were conceived to provide a holistic approach to environmental protection to minimise the overall impact of releases from an industrial process. However, it is difficult to compare an impact on the environment with three different media, because it involves the global warming effect, local air, water, and land pollution. In one case the effect

may be local but in another it may be regional or global.

Similarly in the selection of best cost-effective and harmless option it is only possible to assess the cost-benefit in terms of cost per unit of pollutant abated. It is difficult to assess the environmental impact in terms of cost. It may arguable that it is possible to carry out a health impact assessment to express increased emission concentrations in term of number of deaths brought forward in a local community based on epidemiological data, e.g. 20 deaths brought forward per 1 μg/m3 of fine particulate. But to what extent it can be incorporated into the decision-making? It is a doubtful question.

5.4.3 The lead of integrated approach

In the interview the inspector argued that both BATs and EQSs were the important approach in setting the emission standards. He emphasised that the selection of BAT/BATNEEC/BPEO is a tool to improve efficiency and achieve environmental quality by the minimisation of waste. The BATs in the guidance tend to condition process operators to accept that improvements to the process may be necessary to achieve BATs for an application is made. Whilst the technical driver might be BATs, the pressure exerted by the regulator depends on whether the process has significant local effect on health derived from EQSs (environment quality standards). The inspector stated that whilst at present the integrated pollution control assessments tend to be made against EQSs, in the future more effort will be devoted to defining more sustainable practises,

particularly with regards to waste recycling in the UK.

However, the options identified in a theoretical way to achieve BAT may not be practical. There are often other confounding factors that dictate a preferred option rather than a BPEO assessment. The debates about the installation of incinerator are a good example, which reveal that political consideration is more than technique justification in the decision-making process.

In many cases the professional judgement of the inspector is used to assess the best method of minimising releases from a process, and the improvement programmes are ultimately matters of professional judgement.

5.4.4 The driver and problems in achieving IPC/IPPC

The inspector argued that most individuals wish to live in a lawful rather than lawless society so there is a natural tendency to accept the law and comply with it. Companies do not like the bad publicity, which goes with enforcement and prosecution whilst the penalties are less severe and less of a threat for a big company like Corus. The fine are only £2000 on summary conviction, whilst imprisonment is rare. In view of the inspector IPC was not introduced to provide benefits whilst it is often sold to business as a driver for improving the efficiency of the business.

The Environment Agency inspector stated that the main problems in

achieving the goal of IPC/IPPC might include:

- Too many irrelevant output performance measures;
- Too many time consuming administrative tasks;
- More time in the office filling in the form than on the beat;
- Inefficient use of professional resources;
- Lack of expertise to evaluate cleaner technology, more work done by consultants rather than by inspector; and
- There are industry sector groups but more time is spent talking about the interpretation of legislation than the technology to minimise pollution.

However, the inspector claimed that the guidance is becoming more detailed as it is based on BREF Notes, whereas the professional standard of inspectors is diminishing. At one time inspectors had to be members of a professional institution but not any more, more environmental scientist are being employed with limited industrial experience. The inspector implied that the assessment methodologies become more complicated as the level of inspector experience diminishes.

### 5.5 Summary

This case study is based on interviews with two representatives of Corus Engineering Steel, i.e. Environmental & Energy Section Manager N John Rockett, Environmental Engineer N Allen Gorringe, and the Environment Agency Inspector N Martin Barrett, and information collected from IPC/IPPC

Public Register.

It was supposed that the justification of the prescribed process would be in the beginning of IPC/IPPC application, but actually there are insufficient arguments referred to the BATNEEC/BAT at the very start. The process of justification was completed through a series of improvements.

According to the IPC/IPPC application documents of Corus Engineering Steels, the company involves many technical disputes. Firstly it argued that manufacturing process itself is the BAT, then it scrutinised every possible emissions from the process including air, water and waste. It focused on the process instead of emission checking. Each current abatement measure in the process was compared to the BATs quoted from some different guidance notes. In each comparison it gave a simple statement for each current release control measure against the quoted BAT. The central arguments are the air, water, and waste, whether they have been appropriately addressed. Additionally Corus Engineering Steels has justified that it has complied with the emissions limit, the environmental quality standards are met, and the environment impact is justified insignificant through a series of improvement requirements imposed by regulator. Nevertheless these arguments appear to be more defence about what it has already done before, rather than what it will be done in the future.

From the interview with two representatives of Corus Engineering Steels, it is impressive to see that they have strongly argued that the improvement conditions imposed on it are not BATNEEC, not cost-effective and lack

justification for requirements, and several examples are accompanied to underpin its arguments. It is interesting to find out that Corus Engineering Steels preferred the voluntary Environmental Management System, like ISO 14000, to the statutory IPC/IPPC. In its view IPC/IPPC are impractical and no help in environmental improvement, due to the fact that company policy has dictated better standards than the regulator.

From the information collected from interview with the Environment Agency Inspector and the IPC/IPPC application documents from the Public Register, the inspector has not directly responded to the strong claims from Corus Engineering Steels. The inspector stressed that the operator has the obligation to continue improving its process and the onus of justification of the regulated process is with the operator. But he admitted that too much time is consumed in administrative tasks and inefficient use of professional resources is a problem in achieving the objectives of IPC/IPPC.

It is believed that the sufficient reasons to justify harmlessness to the environment is necessary in IPC/IPPC application. It needs to convince the regulator, relevant authorities, local residents and the general public, instead of being self-evident. It needs sufficient evidence to persuade the stakeholders and make sure that the risk of environmental damage was reduced.

To what degree the environment risk been reduced is difficult to judge. Whilst the improvement programmes are the driving force in IPC/IPPC, the

BATNEEC/BAT are the tools used to lead to its goal and the EQSs are the basic benchmark to be complied.

For existing processes the improvement requirements appear to be inevitable, due to the fact that they always have some departures from BATNEEC/BAT. It is not difficult to pick out a flaw to require the operator to improve its operation.

However, the arguments from the operator and the inspector both reveal the IPC/IPPC are good in theory but the concept of integrated control is difficult to achieve in practice. It reveals that the objectives of IPC/IPPC have not yet been fulfilled.

# CHAPTER 6

## Castle Cement Ltd Ribblesdale Works

### 6.1 Introduction

Castle Cement Ltd (Castle Cement Ltd Ribblesdale Works) has been using alternative fuel since 1992 whereby the coal has been partially substituted for a solvent based fuel known as Cemfuel (Castle's own highly specified kiln fuel manufactured from liquid wastes). Its use is the focus issue in the IPC/PPC authorisation, due to the concerns and arguments were continuing and a number of Variation Notices have been imposed on its use since it was authorised in 1993.

According to the information collected from IPC/IPPC application documents in the Public Register, the major point source emissions of Castle Cement Ltd at Ribblesdale Works are the dry-process kiln 7, and the wet-process kiln 5 and 6 combined emissions to one stack. The trial burn started in 1992 with coal-Chemfuel mixtures containing 25% Chemfuel. The result indicated that releases of sulphur dioxide were reduced by 30%, releases of nitrogen oxides decreased by 50% and that releases of particulates, chlorides, dioxins and total organic compounds were not significantly changed. The Chemfuel use in IPC authorisation was then given that the kiln 5 and 6 using 50% Chemfuel replacement and kiln 7 using 25% replacement was granted by HMIP in 1993.

But since first authorisation the Agency has closely regulated the process to

ensure that BATNEEC/BPEO continues to be used. There have been numerous Variations Notice issued by the regulator, many of which have been designed to bring about improvements in the control of Chemfuel use on site and reductions in the impact of emissions from the kilns. Especially for kiln 7, Castle Cement Ltd voluntarily decided to stop using Chemfuel on kiln 7 and the permission to burn Cemfuel on kiln 7 was withdrawn in 1994 due to the continuing concerns over poor dispersion of releases from this kiln. Both kilns 5 and 6 have been imposed additional limits on releases to air when burning Chemfuel. However, in order to reduce the impact of plume grounding a wet scrubber on kiln 7 was installed and the velocity of releases of kilns 5 and 6 chimneys were modified to improve dispersion. After a number of trials and assessment of the environment consequences of the releases, finally the Environment Agency was satisfied that the use of 40% Chemfuel (energy replacement) on kiln 7 fulfils the requirements of BATNEEC and BPEO. A Variation Notice was issued in February 2001 to authorise its use and set tighter emission limits in order to ensure the ongoing performance of the kiln.

Subsequently, the IPPC new regime came into force, Castle Cement Ltd applied for a new permit in August 2001 for its kilns of 5/6 and 7 under PPC Regulation. Apart from the old issues kiln 5/6 and 7 have to be more carefully reviewed with a lot of the new issues, such as energy, noise, environmental management, and etc., these have been incorporated in the IPPC application. Meanwhile an independent application for use of shredded tyres as fuel at kiln 7 has also been issued separately.

At present, the authorisation process of kilns 5/6 and 7 under PPC Regulation

is still underway. The inspector, Paul Steven, said during the interview that the permit might be issued in September 2002.

In light of the review above, the hot issues appear to be the authorisation of kiln 7 in IPC and kiln 5/6 in IPPC. The following studies will focus on these two issues to discover the performances of them in practice. The information represented and reorganised here is from the interview with Safe, Health & Environment Adviser of Castle Cement Ltd N Chris Fish, and Environment Agency Inspector N Paul Stevens, and the IPC/IPPC application documents from the Public Register.

## 6.2 The authorisation of Kiln 7 in IPC

### 6.2.1 Scenario

This issue focuses on the use of Chemfuel in kiln 7 for the authorisation of application in IPC regime. Kiln 7 has been installed with wet scrubber, but before that the problem was the concern about the phenomenon of haze and odour associated with plume grounding. In 1996 HMIP issued a Variation Notice to limit the height of the chimney to its structure limit. The requirement focused on the improvement of plume dispersion. In order to comply with this requirement Castle Cement Ltd proposed the idea of the installation of a wet scrubber. Since then a number of discussions over the wet scrubber have taken place between the regulator and Castle Cement Ltd until the kiln was incorporated with a wet scrubber, and the use of

Chemfuel was authorised with some operation conditions in February 2001.

Apparently the main improvement in kiln 7 from 1994 to 2001 was the installation of the wet scrubber. Castle Cement Ltd proclaims it cost them £5 million. The wet scrubber was designed to remove 90 % of the sulphur dioxide produced in the kiln and about half of the already very small amounts of dust and ammonia. Ammonia can make the plume visibly persistent, so the scrubber is operating but it consists principally of steam that disperses quickly. Cleaned gases are returned to the chimney before being discharged into the atmosphere. The by-product Gypsum produced inside the scrubber is used in the cement-making process. Water is recycled and none finds its way into rivers, streams or underground aquifers. In order to get a better dispersion of air pollution, i.e. increasing the temperature of the plume, in the clinker cooler excess air is mixed with the scrubber exhaust gas.

The questions used to find out this issue were:

- How did Castle Cement Ltd justify that the use of Chemfuel in kiln 7 is BATNEEC/BPEO?
- What are the disagreements between Castle Cement Ltd and the regulators?
- What are the main considerations in compliance with IPC/IPPC authorisation?

- What are the viewpoints of IPC/IPPC performances from the regulator and operator?

6.2.2 Arguments from Castle Cement Ltd

The following information is collected from the IPC application document from Public Register and the interview with Safety, Health & Environment Adviser of Castle Cement Ltd - Chris Fish.

6.2.2.1 The use of Chemfuel is positive to environment

This application focuses on the use of Chemfuel, Castle Cement Ltd stated a few reasons to underpin its use, summarised as below:

- The use of Chemfuel helps reduce the disposal to landfill, the potential for illegal disposal, and thus a better national environmental performance.
- The use of Chemfuel in cement kiln for energy recovery promotes waste up the hierarchy.
- The use of Chemfuel has the added benefit of reducing carbon dioxide emissions assisting the government in achieving its recently agreed target of reducing greenhouse gas emission by 12% from 1990 to 2010.
- The use of alternative fuel in cement manufacture is commonplace in countries such as Belgium, France, and Sweden.

- Her Majesty's Governments 1995 strategy for sustainable waste management, *"Making Waste Work"* supports the use of cement kilns for energy recovery.

6.2.2.2 The kiln 7 is just about BAT

The dry process kiln 7 is a precalciner kiln and therefore the design represents BAT in terms of energy efficiency. The wet scrubber operates to the BAT levels for $SO_2$ due to the emissions below BAT-benchmark. The introduction of Chemfuel will reduce the $NO_x$ emissions by 20% of emissions from operation with coal alone, and it is further expected to meet the benchmark of 500mg/m$^3$ by use of the chipped tyres in the future at the calciner on this kiln, although currently the benchmark of $NO_x$ is not met.

6.2.2.3 The use of Chemfuel has insignificant environmental effects.

The results of trial burns of Chemfuel appear to show no statistical differences in the releases when using Chemfuel on kiln 7. Castle Cement Ltd argued that the introduction of 40% Chemfuel into the kiln is better than coal burning alone, and the impacts on environment is not statistically significant on the overall effect of the emissions from the kiln. The BPEO assessments using the EQs (Environmental

Quotients) and IEI (the Integrated Environmental Index) to integrate the air and land impacts together have proved insignificant environment effects in Chemfuel-coal fuel and coal fuel only, though they cannot be discriminated from each other within the error of the assessment.

6. 2.2.4 Too much paperwork is wasted in the justification of the use of Chemfuel

The main reasons put forward from Castle Cement Ltd are that they spend too much time and money to repeatedly maintain information, and indeed most of the information is not relevant. It took nearly 7 years from 1994 to 2001 to reintroduce Chemfuel on kiln 7 and lots of paper work to justify that there is an insignificant effect on environment from the burning of Chemfuel. In the interview the Safety, Health & Environment Adviser of Castle Cement Ltd argued that the authority's requirements are impractical and bureaucratic. On the contrary, he recommended that an Environment Management System, like ISO 14000 and EMAS, is a more cost-effective approach to environmental prevention.

The wet scrubber being incorporated into cement kiln is very unusual in the UK, even in the world, but it has reduced amount of sulphur dioxide yet cost a lot of money. Castle Cement Ltd stated that in order to offset the additional operating cost that the use of the wet

scrubbing system places on Castle Cement Ltd, it is necessary to increase the use of alternative fuels in kiln 7.

### 6.2.3 Arguments from regulator

The following information is from the interview with Environment Agency Inspector N Paul Stevens, and the IPC application documents from the Public Register.

Basically the Environment Agency inspector accepts the justification from Castle Cement Ltd. However, the inspector did not accept a financial link between the costs of the wet scrubbing system and alternative fuel usage as a reason for authorisation of use of Chemfuel. In other words, it might mean the costs of improvement environment cannot be used as "excess cost" for requiring alternative fuel. The process justification involving lots of paperwork is inevitable as it is used to ensure the environmental harmlessness has been secured.

It is surprising to find out that the inspector gave a transparent decision document in the Public Register document. The open document explicitly explains the EA's considerations in the IPC authorisation in 2001. Some of the key points are:

- No significant impact: There is no significant increase in environmental impact as a result of burning Chemfuel.

- Reducing the emission: The use of Chemfuel in place of coal leads to reductions of pollution emissions, *inter alia*, the reduction of nitrogen oxides and carbon dioxide (60%) which are consistent with the Agency's environmental strategy.

- Recovery of the waste: the use of waste materials in this way is consistent with the government strategy for sustainable waste management, as it will cause waste to move up the waste hierarchy from disposal to recovery.

- Reducing waste: there are potentially 32,000 tonnes per year of chemical waste could go to landfill if Chemfuel was not used as a fuel in kiln 7, whilst 1,500 tonnes per year of waste sent to landfill when Chemfuel was used on kiln 7.

### 6.2.4 Summary for kiln 7

In this case the permit application of kiln 7 only focused on the partial use of Chemfuel, therefore it is likely to be a comparison of impacts between coal fuel combined with Chemfuel and without Chemfuel, i.e. if it is not significant with the new fuel, then the authorisation likely to be issued. However, the justification is not only the insignificant impact on environment with regardless of the choice of fuel, but also to verify of the extent of BATNEEC/BAT has been closely approached.

In reality, the way of justification in this case implied a rule, which justified the process in principle first, then the arguments of BAT/BATNEEC, and then last but not least, the impacts on environment. Indeed this procedure is similar to the previous case study in chapter 5.

The requirement of providing information is the central complaint from the Castle Cement Ltd. It argued that similar answers were submitted to regulator again and again. Part of the reasons might be that the new IPPC regime has replaced the old IPC, but in essence most requirements are similar. In some case the new regime might require more information than the past regime.

However, the paperwork is inevitable as they are used to ensure that environmental harmlessness has been secured. Like in case of Corus Engineering Steels, Castle Cement Ltd also referred to the EMS, which is more cost-effective in environmental prevention approach than IPC/IPPC.

## 6.3 The authorisation of Kilns 5/6 in IPPC

### 6.3.1 Scenario

Another hot issue is the wet-process in kilns 5 and 6 in IPPC application. In the new IPPC regime the wet-process kilns 5 and 6 are re-examined due to the fact that both cannot meet the requirements

of all Benchmark and BAT. Anyway, Castle Cement Ltd has intended to close them following the successful commissioning of the new kiln at Padeswood, as the expected life of the wet kilns is around 4 years the shortened lifetime precludes significant capital expenditure to reduce kiln emissions. Given the limited operating life of these kilns, Castle Cement Ltd considers that the BATs are being employed to minimise emissions from these kilns rather than prevention. Yet the installation of the new kiln at Padeswood is slowly underway; the date of closing kiln 5 and 6 is undefined while pollution is continuing to be produced.

Lots of arguments have been issued through public and regulatory consultations. It is not likely to be acceptable to link the opening of a new kiln at Padeswood to the operating life of kilns 5 and 6 in terms of the BAT in the IPPC application. Where a significant difference between the benchmark limits for releases from these kilns indicated a BAT argument needed to be produced. This BAT argument included a full assessment considering the use of additional abatement equipment (e.g. a wet scrubber on kiln 5/6), the use of selective quarrying to reduce sulphur inputs to the kilns, and the use of an additive to reduce moisture. A time scale should be proposed for action on these kilns on the basis of the planning permission not being given at Padeswood and for planning permission being delayed.

The questions asked in further investigation were:

- How did the kiln 5/6 justify their departure from BAT and the benchmark?
- Is the situation acceptable to the regulator?
- What are the main considerations of the inspector?
- What are the arguments between the regulated company and the regulator?

6.3.2Arguments from Castle Cement Ltd

The following information is collected from the IPPC application document from Public Register and the interview with Safety, Health & Environment Adviser of Castle Cement Ltd - Chris Fish.

In order to underpin the argument of no cost-effectiveness in the upgrading of the old kilns 5/6, Castle Cement Ltd has quoted two statements from the S3.01 guidance note in its application documents. Firstly, it said that the timescales for the major cost improvements for the control of $NO_x$, $SO_x$ and particulate would depend on local factors and the results of the cost benefit assessments. Secondly, for an existing activity a less stricter standards may be acceptable due to the indicative requirements may imposing a disproportionate cost to replace the old one with the new techniques, for only a small decrease in emissions.

However, Castle Cement Ltd examined the potential pollutants, i.e. priorities for control, in the process of kilns 5/6. The current techniques

were compared to BAT, and the best options were justified. The key arguments based on emissions are shown below:

$NO_x$:

The benchmark given in the guidance for $NO_x$ is for a dry pre-calciner kiln utilising multistage combustion and selective non-catalytic reduction (SNCR). It is not suitable for wet-processes.

- Multistage combustion: These techniques cannot be applied to long wet-process kilns as they both require the introduction of fuel or ammonia in the calcining and preheating zones of the kiln system. There is the potential to introduce whole tyres by mid kiln firing as a form of staged combustion in the wet kiln. However, the investment costs of such a system is around £ 1M.

- SNCR: similar technical problems such as multistage combustion, where it is impossible to introduce ammonia water into the long wet kiln some 50 to 100m from either end.

- SCR: At present there is no proven full scale SCR plant operating on a cement kiln in Europe, it has not been considered as BAT for the kilns 5 and 6.

- Low $NO_x$ burner: While the replacement with low $NO_x$ burner would cost about £700k, there is no performance guarantee. This is due to the fact that the replacement burner would be

operational for a maximum of 2 years and the installation of low $NO_x$ burner is not considered as BAT.

- Flame cooling: The addition of water directly to the kiln flame has been used for $NO_x$ reduction, but there is no published information to guarantee. Therefore a trial programme would be required to establish the effectiveness of the technique.

- Alternative fuel: the use of Chemfuel has resulted in a significant reduction in emissions, and the continued use of Chemfuel will not reduce the amount of $NO_x$ emissions.

Dioxin

- The formation of dioxins and furans require the presence of suitable organic precursors, chlorine, temperatures between 250 and 400℃ and sufficient residence time. Basically, in cement kiln the emissions are not an inherent property of the raw materials but are a result of reformation reactions occurring in the gas cleaning section of the kiln system. The potential control techniques include: Active carbon filter, Remedia fabric filter, Activated carbon injection and Gas cooling.

- However, the only cost effective technique for reducing dioxin emissions from kilns 5/6 is the use of an in-duct-water cooling system. This technique is currently being assessed, but is not available yet. It is noted that the application of gas cooling

results in the deterioration of plume dispersion characteristics and the cost of returning the gas to the present emission temperature is excessively costly.

$SO_x$

- There are a number of potential abatement options available for sulphur dioxide, such as source of $SO_x$ - selective quarrying, low sulphur fuel, wet scrubber, dry scrubbing system, and process control.

- There is no opportunity for the application of selective quarrying as a technique to reduce $SO_x$ emissions. The way to change the sulphur content is to import limestone from other country, but it is too expensive to operate in this way. The other techniques are either not applicable to wet process kiln or are too costly.

- The current operation of the wet kilns has ensured that the emissions of $SO_x$ are minimised whilst at the same time clinker quality and fuel efficiency are optimised.

Particulate:

- While the present emissions are higher than the BAT benchmark level, the dispersion modelling work show that ground level concentrations of PM10 are less than 1% of the EQS (Environmental quality standard). Therefore reducing these emissions to the BAT level, whilst beneficial, would not be

measurable in terms of air quality.

- The other possible upgrading techniques including Upgrading Electrical system, Gas condition tower, Flow straightening, Optimisation of Rapping cycle, and Bag filter, However, these significant improvements in performance can only be achieved through major capital expenditure.

Additionally, Castle Cement Ltd demonstrated a study of risk assessment based on long-term average emissions of possible impacts on the human health rise from dioxins and furans and trace metals emitted from kilns 5/6 and 7. The results showed that even if the scenarios are considered in the worse case scenario the current levels of risk still meet the lifetime risk criterion, and the maximum conceivable intake of dioxins are also below the TDI (Tolerable Daily Intake) set by WHO. The report stresses that the long-term ground level concentrations of the potential pollutants are unlikely to lead to breaches of Air Quality Strategy Objective.

6.3.3Arguments from the regulator

The following information is from the interview with Environment Agency Inspector N Paul Stevens, and the IPPC application documents from the Public Register.

The inspector, Paul Stevens, agreed that upgrading of the old kilns 5/6 is not cost-effective. But he implied that the air quality modelling report from Castle Cement Ltd shows that the short-term impact on

the local air quality, especially the impacts to 15 minute mean ground level concentrations resulting from $SO_2$ emissions, might lead to the breach of relevant objective. Additionally the release to atmosphere from the fugitive and low level sources suggest that there may be an excess of the air quality strategy objectives for particulate matter at the boundary of the site and beyond out to a short distance from the edge of the site.

Whilst the Castle Cement Ltd has justified that its kilns 5/6 cannot meet the BATs and benchmark, they are continuing to produce pollution endlessly. In the interview, the inspector basically argued that he couldn't accept the two old kilns carrying on excess of the standards without any improvement or a clear deadline to close down. The reasons underpinning his arguments are that the kilns 5 and 6 are not BATs, therefore the Castle Cement Ltd has to spent money to upgrade. However, if the Castle Cement Ltd said that the expense is "excessive", and then the inspector's argument is that the "excess" related to the breach of short-term air quality is a danger, and because of that then the "excess" is overlooked. The inspector said that it is his stick to push Castle Cement Ltd to improve their installation or promise a specific date to stop the old Kilns.

### 6.3.4 Summary for kilns 5/6

Basically the kilns 5/6 are very old kilns in design. The serious improvement is believed to replace them with a new type kiln. In

IPPC application documents Castle Cement Ltd argued the old kilns are going to close down so it is not cost-effective to repair further. But they have examined the possible techniques and gave reasons why it cannot meet the benchmark for each pollutant release from the process. The cost-benefit analysis has been carried out for each emission to assess the advantages and disadvantages of the various techniques outlined in the guidance note. Its basic principle is that for an existing activity the cost in replacement of the new techniques might outweigh the benefits from a decrease in emissions.

Whilst a risk assessment report in IPPC application documents shows that the current levels of human health rise from dioxins and furans and trace metals emitted from kilns 5/6 and 7 still meet the lifetime risk criterion, a modelling report revealed that there is possible breach of ground level standards of $SO_x$ in terms of short-term impact on the local air quality. The old kilns 5/6 contribute to the emissions of $SO_x$ mostly because they have no $SO_x$ abatement equipment.

However, in the end it could be envisaged that there must be a compromise on the time of the old kilns to stop operation with certain operation conditions in order to ensure the risk has been rendered as harmless as possible.

# CHAPTER 7

## Findings and discussions

Based on the previous two case studies, this chapter aims to examine and discuss the findings from the disputes between the regulators and the regulated companies in order to reveal the influencing factors and essences in the performances of IPC/IPPC, and highlight the gap between theory and practice. The findings are classified into two portions with eight subdivisions as shown below.

*The crucial factors which influence the success of IPC/IPPC*

- *Improvement programmes are the meat of IPC/IPPC*
- *Burdens on paperwork*
- *The credits from IPC/IPPC are unclear*
- *Economic consideration interfere in the process of improvement*
- *Discretion of the regulator in making decisions*

The essential features of IPC/IPPC

- *Bargaining approach*
- *Precautionary approach*
- *BATs, EQSs and ELVs approach*

### 7.1 The crucial factors which influence the success of IPC/IPPC

#### 7.1.1 Improvement programmes are the meat of IPC/IPPC

In theory, BATNEEC/BPEO/BAT justification and environmental impact assessment should be incorporated during the preparation and assessment of an IPC/IPPC application. However, shortcomings in applications and in the

assessment procedure have meant that improvement programmes have frequently been used to obtain important information that was not supplied in the initial application.

For existing processes the real meat of an authorisation is contained in an improvement programme specifying the requirements for upgrading to new plant standards. These requirements are at the very heart of IPC/IPPC, and it will act as a driving force for environmental improvement. Its principal purpose is *to place a* legal duty on the operator to implement certain improvement set on timetable. It includes the actions that the operator had already proposed and that regulator required. For most of the improvements, further assessments are required on the environment impact and re-examination of abatement techniques. The regulated company has to carry out feasibility studies and implement the preferred option by a certain date.

Environmentalists, like FOE (Friend Of the Earth), might criticise IPC/IPPC for merely formalising existing procedures and failing to enhance the drive towards cleaner techniques. Improvement programme appears to be a defence for this criticism due to it acting as a driving pressure to encourage the operator in continuing improvement.

ENDS (1993 and 2001) have reported that the most of the applicants who fail to meet the objectives of IPC/IPPC in the initial application respectively were addressed through the implementation of improvement requirements. In the case study of Castle Cement Ltd, since the authorisation of kiln 7 in 1994 the regulator has continued to closely regulated the process to ensure that

BATNEEC and BPEO continue to be used through numerous variations, thereby encouraging Castle Cement Ltd to install the wet scrubber in the kiln 7 eventually. However, it takes a long time to finish its task. For the Castle Cement Ltd kiln 7 the time period of IPC application spending on completing its improvement requirements was from 1996 to 2001, whilst Corus was from August 1995 to October 2000. The performance of the improvement programme appears to be the main scenario of IPC/IPPC, and also it presents a driving force in approaching the goal of IPC/IPPC.

### 7.1.2 Burdens on paper works

Castle Cement Ltd strongly reasoned that they spent too much time and money in providing irrelevant information for the regulator. However, simply from the mountainous volumes of files associated with Castle Cement Ltd's IPC/IPPC application in the Public Register, it could be envisaged that the huge loadings on the Castle Cement Ltd for dealing with IPC/IPPC authorisation. In case study of Corus, the Environmental & energy section manager straightforwardly said that the benefit from IPC is by far little, whilst the burdens are huge. It is noticeable that in the eyes of the company that IPPC is just an extension of IPC in practice, but more focus on an environment effect, i.e. more loadings of assessment works imposed on the operator.

Admiring the merit of IPC/IPPC led to one-stop-shop, and there existed the arguments of heavy paperwork load. It is similar to what ENDS (1993) has reported that many companies expect IPC to bring them benefits, but overall,

respondents view IPC as burdensome and unlikely to lead to significant environmental improvements. In the two cases studies, it is noteworthy that burdens are not only imposed on the regulated companies but also on the regulators. The similar viewpoint comes from the inspector who also argues that more time was spent talking about the interpretation of legislation than the technology to minimise pollution.

Generally, in order to justify the prevention and reduction of emissions and rendering them harmless to the environment, extensive assessments were required. Nevertheless too many complicate assessment works lead to volumes of paper work that might cost lots of time and money. It incurs complaints of bureaucracy and then fails in enforcement. An inspector pointed out that the main cause might be that professional experiences are diminishing whilst the guidance notes and methodologies are increasing and complicated. Therefore it leads to more time in the office filling in the form than on the beat, and more time is spent talking about the interpretation of legislation rather than the technology to minimise pollution. It is arguable that the cost of paper work in IPC/IPPC application might overweigh the benefits they have created.

### 7.1.3 The credits from IPC/IPPC are unclear

Corus Engineering Steels argued that the Environment Agency only give the priority of regulations rather than how to improve the environment in IPC/IPPC authorisation. The large company might have their own upgrading agenda. In case studies of Corus the manager directly stated that company policy

dictates better standards than the regulator, and the driving force of improvement is public image instead of IPC/IPPC.

In the case studies the two companies, Corus and Castle Cement Ltd, both argued that EMS (Environment Management System) helped IPC/IPPC. Whilst the IPC/IPPC encourage the operators to improve their process continually, the similar concept of continual improvement is emphasised in ISO 14001 system. By comparing both systems it is easy to find that whilst the requirements are considered to be BAT in IPPC, they appear to be the same techniques as required in EMS. The IPPC sector guidance also stated that within IPPC, an effective system of management is a key technique for ensuring that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis.

However, it must be remembered that EMS is voluntary, therefore, there is no statutory obligation imposed on the operator. It is believed an effective EMS will help operators to maintain compliance with regulatory requirements and to manage other significant environmental impacts but their motive for approaching environmental protection might be totally different. It is arguable that company voluntarily adopt ISO 14001 for a variety of reasons. Many of the reasons have nothing to do with the environment, such as marketing advantages, peer pressure, or good image (Cunningham 2000).

The above argument discloses that there might have other similar policies that encouraged the regulated companies to develop their own improvement programmes in environmental protection. It is not easy to find out the credit of

individual policy. To what extent the contribution of environmental protection in the performance of IPC/IPPC was unclear.

### 7.1.4 Economic consideration interferes in the process improvement

Addressing a problem before it might emerge is always the best policy. So as the reduction of releases to the environment through design and redesign of the process plant can usually be achieved more cost-effectively, like major investment in plant modernisation than that can be achieved by retrofitted end-off-pipe abatement techniques.

However, in practice, economic considerations usually appear to be a big issue. Major investment usually involves long term strategic decisions, which cannot easily be revised when the BAT decision are made or the perception of BAT changes. Therefore a close liaison between the operator and regulator is always encouraged in order to develop an on-going sustainable strategy for environmental improvement.

In the case study of Castle Cement Ltd the improvement of the old kilns 5/6 is not cost-effective, for further operation some compromises will be met. Local factors could be taken into account and the less stringent standards are allowed for existing processes in authorisation if there is no significant increase in environmental effect. The inspector tends to use BAT to challenge kilns 5/6 in IPPC application, therefore a promise of the closure deadline of

kilns 5/6 rather than another new kiln's implicitly installed seems to convince the inspector and the public easier. However, it might be envisaged that Castle Cement Ltd is taking into account economic considerations, i.e. the total sufficient capacity of cement to supply its customers. If the new kiln has not yet been authorised to be built first, then the old kilns 5/6 seem unlikely to be closed.

It is believable that for existing processes/installations in practice the first consideration in the mind of manufacturing companies is always economic situation although the environmental protection is still important. It seems to be self-evident common sense. The industry's capacity to pay for improvements is an important backdrop in its attitude towards IPPC (ENDS 2001). To the extreme mindset it could be as the Environmental & Energy Section Manager of Corus Engineering Steels argued, that at the end of day the IPC/IPPC couldn't produce steel for them. Whilst the IPPC guidance says the lack of profitability of a particular business should not affect their determination of BATs, it might still be a consideration on the ground of business benefits.

The above discussions reveal that the company's economic situation is a necessary consideration in process upgrading in practice. The financial position of the companies is a key point to determine their decision on serious improvement programmes.

### 7.1.5 Discretion of regulator in making decisions

In case study of Corus the central argument from the company is that improvement requirements and conditions issued by the regulator were not justified, impractical, and no reasons were given. It implied the rules and guidance are unclear so they gave regulators the power and freedom to decide what is appropriate in their viewpoints. The inadequate requirements may cost lots of time and money but benefits are unforeseeable. If they are determined by one expert's judgement and not given any reason to the regulated company and public, there seems to be a risk of bias in the decision. If the conditions were justified nonsense after lots of time and money has been spent by the regulated, would it be fair to the operator? Is there anyone who can judge it fairly? However, there is no solution in the regulation and guidance note, therefore it might turn to appeal to the Secretary of State. The solution might be subject to another expert judgement in Court, case by case.

Allott (1994) stated that the inspectors produce an internal report describing the reasoning used in determining authorization conditions and BATNEEC for a particular process, but this information is used for checking the consistency in authorization standard. In his survey there were very few cases of inspection reports being entered into the public register. In the Corus Engineering Steels case indeed neither has the regulated company received an explanation of regulator's decisions, nor has any reasoning been found in the public register document, even though lots of application and authorization documents have been open to the public. Whilst it is arguable that whether the decision documents in authorization have to be put in the public register or not, it is believable that if the transparency of decision-making has been lost,

then the intention of improvement from the operator would decrease and the public confidence in the regulator enforcement might diminish.

On the contrary, in the case study of Castle Cement Ltd the decision documents in authorization are shown in the public register. It is interesting to see that the EA has given clear reasons of its decision, but Castle Cement Ltd still argued that the requirements from regulator are not cost-effective and overloading. Therefore the problems might be insufficient participants in the making decision, which cause the more discretion of the regulator.

## 7.2 The essential features of IPC/IPPC

### 7.2.1 Bargaining approach

Owing to the fact that most of BAT-based benchmarks are derived for new processes or installations, for many cases in practice the existing process/installation always depart from the BAT. The final options are allowed to deviate from BATs under local environmental considerations if the operator could justify its departure.

According to the PPC Regulation 12 (6) technical characteristics of the particular installation, its local conditions have to be taken into account in the determination of ELVs. However, PPC Regulation and the guidance only give principle descriptions in determining the BAT and setting ELVs. The principle of determining BAT involves identifying options, assessing environmental effects and considering economics. The lowest impact on the environment

appears to be the BAT. It involves the assessment of the relative significance of different environmental effects in different media. These comparisons of different effects might include several assumptions and expert judgments. Therefore it could be envisaged that the conclusion might be more subjective than objective.

Additionally, the guidance also stated that the decision has to take account of several factors, but in the end it says that at best the operators could find better ways of operating installations rather than relying solely on BAT-benchmark standards in guidance. Therefore it appears to be a flexible benchmark.

The view that there is an obscure game rule has been reflected in the report of IPPC performance by CTCE (2001), which stated that the majority of applicants found the guidance to be less than satisfactory, and called for better guidance on a sector basis. It is noteworthy that the guidance is not mandatory. They might be used as a basis for dialogue between industry and the authorities. This reveals that IPC/IPPC might be a kind of bargaining approach.

### 7.2.2 Precautionary approach

In case study of Corus the inspector implied a kind of precautionary mind to set the stricter operation conditions in authorising the IPC permit, notwithstanding the fact that scientific investigations and environment impacts have been proved insignificant. In the view of the inspector there seems to be

uncertain risk in the background, which have not been discovered. Similarly, in case study of Castle Cement Ltd kilns 5/6, it also shows the compromise between precautionary mind and the cost-effectiveness in its upgrading.

Schedule 2 to PPC Regulations states:

> *"In determining best available techniques special consideration shall be given to . bearing in mind the likely costs and benefits of a measure and the principles of precaution and prevention".*

It reveals that precautionary principle is one of the central considerations in IPC/IPPC. The precautionary principle generally describes an approach to the protection of the environment or human health based around precaution even where there is no clear evidence of harm or risk. It is often associated with areas of high public controversy and concern where there are unknown risks to the environment or human health.

The Sustainable Development White Paper set out the Government's commitment to use the precautionary principle by reference to the 1992 Rio Declaration on Environment and Development (UNCED 1992). The Principle 15 stated that

> *. where there are threats of serious or irreversible environmental damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation."*

The definition makes clear that where there is scientific uncertainty the precautionary principle establishes an impetus to make a decision that seeks to avoid serious damage if things go wrong. It is interesting to see two different views of precaution principle from Nature Conservancy Council and RCEP. The former states that the precautionary principle is not so much a practical guide to decision-making, whilst the latter argues that the principle is a rational response to uncertainties in the scientific evidence relevant to environmental issues and uncertainties about the consequences of action or inaction (Ball and Bell 2000). The inconsistent views underline the fact that the principle is subject to interpretations of concepts such as the significance of risks, and the acceptability of scientific evidence. Ball and Bell (2000) argued that the precautionary principle provides the decision-maker with a flexible principle that assists with the balance or trade-off between different options.

However, in practice there are problems in the application of this principle. Under a weak interpretation of precautionary there are difficulties in assessing the costs and benefit of uncertain risks that may need to be extrapolated over a long period of time. On the contrary, a strong interpretation of the principle could result in a prohibition on beneficial activities, since science cannot provide one hundred percent certainty on any risk, with the result that all activities would be proscribed.

### 7.2.3 BATs, EQSs and ELVs approach

In the two case studies the regulators tend to use BATs (Best available techniques) to set the ELVs (emission limit values) in order to require the regulated companies to further improve, but they argued that the pressure exerted by the regulator depends on whether the process has a significant local effect on health derived from EQSs (Environment Quality Standards). If the EQSs are the final checkpoint, why are not the EQSs used directly to induce improvement and set the permit conditions? Are the BATs and the EQSs under the same considerations of acquiring improvements? As Doppelhammer (2000) argued ELVs, BATs and EQSs might be the most important pillar of IPC/IPPC. Therefore, it is worthwhile to study their relationship and thereby highlight the orientation of an integrated approach in pollution control.

Firstly, PPC Regulation 12 (6) and (7) states that the ELVs should be based on the BATs but must also take account of local environmental conditions and there is a general requirement to ensure a high level of protection for environment as a whole. Furthermore, the definition of BATs in the Regulation stated that the BATs have to take account of economically and technically viable conditions, costs and advantages in the universal concept that provides for indicative standards.

The mission of BATs imposed by PPC Regulation 2000 is to fulfill the objectives of IPPC. That is to achieve a high level of protection of the environment taken as a whole. Therefore, the BATs will be used rather than EQSs to set ELVs and operation conditions in authorization, which includes

several numerical standards that specify maximum concentrations of named pollutants for air and water, and technical operation conditions as well.

However, Regulation 12 (7) goes on to state that where an EQS as set out in community legislation requires stricter ELVs than those achievable under BATs, the regulator must impose those stricter limits. It is believable that the security of EQSs associated with the environment impact is an important approach as it involves healthy and environmental effects. In some cases, the best option might be based on the EQSs requirements through environment impact assessment. This argument seems to imply that the final determinant of ELVs appears to be the EQSs rather than BATs.

However, it is arguable that whilst the determination of BATs has taken account of all local environment conditions, Regulation 12 (7) states that sometimes where an EQS as set out in community legislation might require stricter ELVs than those achievable under BATs. It might reveal that EQS set out in community legislation have not been taken into account in determination of BATs for a specific case, therefore sometimes the final ELVs are determined by EQS set out in community legislation. The BATs are not the only guides to set ELVs, but the Regulation states that ELVs are set from BATs. There appears to be a certain conflict in words of the Regulation itself.

Notwithstanding whether there is an arguable contradiction in the Regulations or not, it should be remembered that permit conditions are not only emission limit values. They include technical operation conditions as well, which are used to anticipate the emissions below ELVs. Whilst the quantitative EQSs

might be possibly used to set the ELVs, the qualitative operation conditions are difficult to be determined by EQSs. Even when the stricter ELVs determined by EQSs have to replace that BATs have imposed, the ELVs must be supplemented or replaced by equivalent parameters or technical measures developed by BATs. Only the BATs approach can provide the technical improvement conditions in practice.

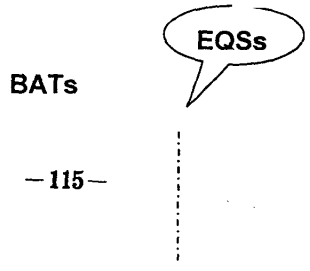
The above analysis reveals that the BATs approach will be considered first, and EQSs have to be checked later. Therefore ELVs and technical operation conditions will be appropriately set under IPC/IPPC authorization.

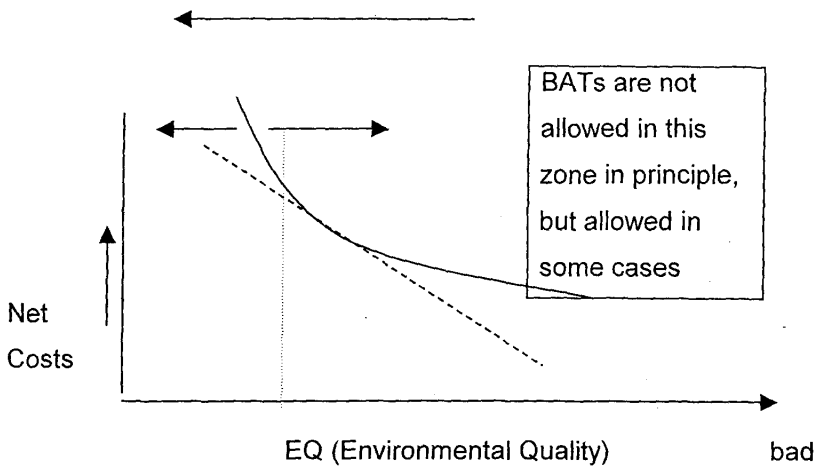
Whilst there is an allowance for departure from BATs, if it is justified, there is a concession in compliance with EQSs. The guidance stated that basically EQSs cannot be breached, but sometimes it depends on the significance of on environment impacts the installation has caused, the proportion of pollution contribution from the installation, and the regulator's action plans to reduce the emissions from area sources (DEFRA 2000). In the interview with the Environment Agency Regional Manager, Ian Haskell, he states that only in some cases ambient air concentration is allowed to exceed the environmental standard level, like the breach of $NO_x$ where most of the contribution of emissions comes from transportation. In the case study of Castle Cement Ltd a report in IPC/IPPC application documents revealed that there is a possible breach of short-term ground level standards of $SO_x$. This breach is obviously attributed to the old kilns 5/6, which are going to be closed down. It appears that in some cases the temporary departure from EQSs might also be

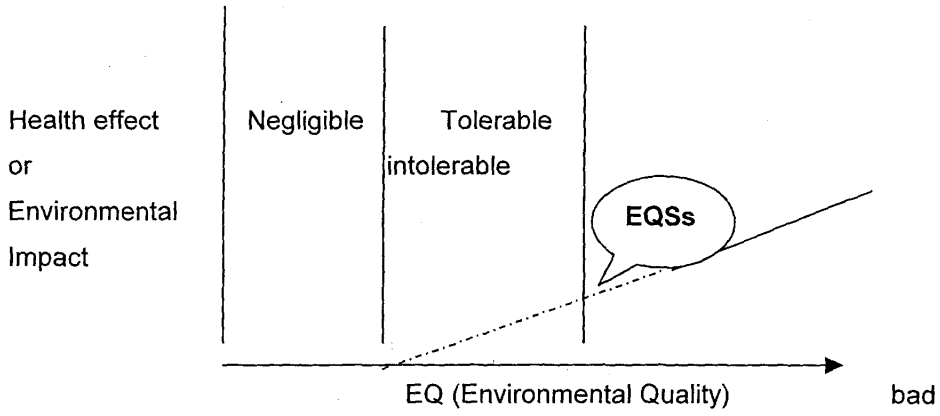
allowable. The relationship between EQSs and BATs is interpreted in the Figure 7.1.

However, in case studies the inspectors argued that the options identified in a theoretical way to achieve BAT might not be practical. Sometimes political considerations will make the final decision, such as the installation of an incinerator, and in many cases professional judgment of the inspector is used to assess the best method of minimising release from a process.

**Figure 7.1 The relationship between EQSs and BATs**




BATs are not allowed in this zone in principle, but allowed in some cases
Net Costs
EQ (Environmental Quality)
bad


Health effect or Environmental Impact
Negligible
Tolerable
intolerable
EQSs
EQ (Environmental Quality)
bad

# CHAPTER 8

## Is An Integrated Approach to Pollution Control a Myth?

It is noteworthy to remember that the original intention of IPC/IPPC is to protect the environment taken as a whole using the precaution and prevention principles. There are two vital elements which underpin its goal. The first one is the principle of prevention and precaution, which has been embodied by the concepts of cost-benefit in BATNEEC/BAT. The other one is the integration of pollution control measures in the three media.

Notwithstanding there are the potential difficulties in integrating overall effects from different media, the integrated approach is the initial intention of the development of integrated pollution control policy. This chapter aims to examine the myth of integrated approach in pollution control and see how the integrated concept has been achieved in practice in the UK.

### 8.1 The interpretation of integrated approach

The regulated processes in IPC have been expanded to a wider range of installations in IPPC since 2000. Whilst it is argued that the wider IPPC is expected to lead to a high level of environment protection, another broader concept of integration is found in a recommendation adopted by OECD (1991). The recommendation advises OECD countries to practice integrated pollution prevention and control, taking into account the effects of activities and substances on the environment as a whole and the whole commercial and environmental life cycles of substances when assessing the risks they pose and when developing and implementing controls to limit their release (OECD

1991).

It revealed that the important aspect of the integrated approach include the consideration of the whole life cycle of substances and products; anticipation of effects in all environmental media of substances and activities; and the minimization of the quantity and harmfulness of waste.

An appendix to the recommendation sets out guidance on implementation of the IPPC concept. The guidance identified certain policy aspect as essential to an effective integrated approach, such as sustainable development, energy conservation, application of clean technologies and replacement of harmful substances with safer alternatives. Apparently, IPPC is not the only integrated approach policy in environment protection.

The guidance implies there are three approaches in IPPC. Firstly, substance-based approaches may be appropriate in respect of particularly hazardous, persistent or otherwise problematic pollutants. Secondly the region-based approach to IPPC aims to achieve a desired environmental standard in a defined area by controlling inputs via all media. The third one is the source-based approaches which apply controls to industrial process, products or economic sectors which are responsible for pollution. However, a broad integrated approach in decision making of substances, sources and region might either be considered in isolation, or may be interrelated due to substances being used in processes and manufactured into products. Nevertheless, obviously both IPC and IPPC are source-based control through the regulation of industrial processes.

Emmott (1997) argued that a broad integrated approach is through the use of mass balances and life cycle approaches. It is noteworthy that life cycle approaches are concerned with assessing the environmental impacts of products not only related to the production process but also the supply of inputs and the use of final disposal of the product. This approach might take account of all external and internal impacts. It surpasses traditional environmental impact assessments by quantifying the cumulative impacts of a product from where materials and energy are extracted from the earth, to either a point in the life cycle of product, or the disposal of waste back to earth. In reality, it is a cradle to grave study. However, whilst the life cycle approach is an increasingly used tool in environmental management control, it is still in its infancy and much remains to be done in developing databases and more open information.

Whilst the integrated approaches in the IPC regime concerns mainly on release from processes, and IPPC goes further requiring more considerations of environmental impacts, energy efficiency, waste reduction, accidence, conservation of resource, and decommissioning apart from emissions control, they both do not take any significant steps towards a life cycle approach. As the IPPC H1 horizontal Guidance Note (2001) states that the scope of the assessment is limited to the requirements of the IPPC Directive and does not incorporate full Life Cycle Analysis (LCA) aspects; and the costs of controlling polluting emissions are based on the private costs of implementation of techniques to the Operator and do not include wider social costs. Both IPC/IPPC have embraced the concept of integration but are still a narrow

approach.

## 8.2 The achievement of an integrated approach in the UK

### 8.2.1 The integration of regulations and regulators

A classic problem with a non-integrated pollution control system is that it does not take into account the possible interchangeability of emissions. One can often see shifting of the pollution to other less controlled or regulated sectors. The integrated approach therefore, is that all possible emissions, whether in the air, liquid or solid, can be integrated into one decision-making procedure, as a result of which ELVs are set. That industry then has no incentives to shift its emissions from one medium to the other. The integrated concept could also provide the reduction of administrative costs. A separate licensing procedure for every possible emission from a large plant obviously leads to high costs, both for industry and bureaucracies involved. It is an advantage for industry to address itself to one-stop-shop rather than applying for three or more licences.

It is believed that a comprehensive reformation of legal structures is a necessity in achieving a true integrated assessment of industrial emissions and if it combines with institutional restructuring, it would make the integrated system more effective. As Majone (1976) pointed out the performance of policy instruments depends more on the institutional framework within which they are used than on their technical characteristics.

The integration of legislation is very straightforward. The enactment of the Environment Protection Act 1990 was a milestone to step into an integrated legislative regime. The purpose of Part I of the Act is described in the Preamble as 'to make provision for the improved control of pollution arising from certain industrial and control processes." Another integration of legislation was initiated from EC IPPC Directive. In order to comply with EC Directive the PPC Act (Pollution Prevention and Control Act) 1999 in the UK was enacted, then the following PPC (Pollution Prevention and Control) Regulation 2000 flesh the detail criteria out, which came into force on 1 August 2000.

The first integration of authorities was the HMIP (Her Majesty Inspectorate of Pollution) in 1987 (DoE 1986). It was an amalgamation of the HWI (Hazardous Waste Inspectorate) the IAPI (Industrial Air Pollution Inspectorate), the RCI (Radiochemical Inspectorate) and water pollution staff. The initial task for HMIP was to alloy itself into a single, unified Inspectorate. However, HMIP pursued separate, inherited regulatory functions until the phased introduction of IPC beginning in 1991. Since then a legislative basis for an integrated approach to pollution control was given to HMIP.

The second integration of authorities was the EA (Environmental Agency). The creation of EA echoes that of HMIP, which is an amalgam of pre-existing regulators. The NRA (National Rivers Authotity), HMIP and the WRAs (Waste Regulatory Authorities) have been brought together in the EA. In 1995 the Environmental Act formally create the EA. Its creation was driven by multiple motives including a more integrated approach; improved technical

effectiveness; and similar deregulatory desires (Gallagher 1996; Carter and Lowe 1994).

From the UK's experiences in developing an integrated control system it showed that the regulations have been integrated and the different regulatory agencies have been combined into one-stop-shop. It is believed that the UK has achieved the basic requirements of integration. However, it is interesting to find out that the IPPC Directive does not necessarily demand the creation of a unified or integrated regulatory agency in each member state (Gouldson 1998).

Whilst it was a great achievement in forming a one-stop-shop and single PPG Regulation, it might be argued that the regulations and regulatory agencies integration are only superficial. The real benefit to the environment might be their performances in real integrated pollution control measures.

### 8.2.2 Bundling rather than integrating

Apart from the one-stop-shop presenting an integrated single regulator the arguments from Corus showed that there is not really integration in the current IPC/IPPC performance, but putting all prescribed issues together, then examining them independently and submitting them together. The manager of Corus stated that whilst the IPPC incorporated broader issues together than IPC, those added issues have been addressed by the company under other regulations before and now put together in one application, and submitted to one reception.

It might be true that the integration of impact of three media is not highlighted in practical performances. In the case study of Corus Engineering Steels, the inspector admitted that it is difficult to compare impacts from three different media, and it is difficult to assess the environmental impact in terms of cost. It reveals that so far the concept of protection environment taken as a whole may be theory more than practice in performance.

The concept of integrated control has been shown in the case study of Castle Cement Ltd by using the methodology of BPEO assessment. In its variation application in August 2000 the long/short term environmental effects of releases from kiln 7 with Cemfuel-coal burning and with coal only have been assessed respectively in term of IEI. The IEI number integrated with the impact of emissions to air and land, and shown that using Cemfuel is less harmful than without Cemfuel. However, it also identified Castle Cement Ltd's emissions were not significant regardless of the choice of fuel.

Whilst there are some criticisms on the IEI method (ENDS 1994), it might be a good demonstration of integrated approach, as at least it showed a combined consideration for different media. One should be aware that in Castle Cement Ltd case study, it only confined to the emission to air and land. In some cases related to off-site consumption, there might have been other factors which should be considered. Furthermore the waste recycling and minimisation arguments have to be incorporated in the considerations as well. Its benefit is to represent a quantitative approach to integration concept taken the environment as a whole.

However, the CIA (Chemical Industries Association) argued that in practice the BPEO has a meaning only applicable in the context of new processes or major changes to an existing plant. It said that for existing processes the brief comparison with new plant standards and an assessment of local environmental quality should determine the need for improvement (ENDS 1994). Nevertheless the BPEO methodology seems to be the EA's preferred approach for operators to justify their choice of BAT, where more than one option exists or where they plan to deviate from BAT. The EA appears to have accepted the criticism that the derivation of IEI is like adding apples and oranges. But the EA stressed that it is not possible or desirable to give universal guidance on how to judge the relative importance of different environmental effects (ENDS 1997). The environmental quotients simply provide an indicative overall potential of effect, and the IEI might only be appropriate in certain circumstances.

The two case studies have justified that in the UK at present, the integrated pollution control is not real integration, but bundled pollution control.

# CHAPTER 9

## Conclusions and Recommendations

The process of using regulation to control or manage the environmental impacts of industry begins by establishing principles and setting standards, which govern the operations of regulated companies (Gouldson 1998). In terms of IPC/IPPC the standards might be ELVs and EQSs whilst the principles might be BATNEEC/BPEO/BAT. The regulations based on standards are specific emissions limits and not flexible to interpret, whilst the principle regulations are qualitative operating conditions and highly elastic to explaination.

Owing to the fact that pollution emissions are controlled by operation conditions, the principle regulations that focus on conditions setting are better in managing than those that rely on emissions limit values. Therefore the regulations based on the application of principles appear to be an anticipatory approach.

The IPC/IPPC are based on the BATNEEC/BPEO/BAT but also involve the emissions limit values, which are set from the BATNEEC/BAT. Therefore IPC/IPPC seem to be anticipatory approach. They are expected to address the problems that have not yet emerged and to reduce the possible risk of environmental deterioration in the future. However, it is noteworthy that if the regulation just set the principle requirements, then the rules are interpretable

and the decisions are arguable. In such considerations the arguments seem to be a normal phenomenon in the performances of IPC/IPPC.

Whilst IPC/IPPC are regarded as good approaches in theory, they incurred a lot of disputes in practical performances. The disagreements cover bureaucracy, no cost-effectiveness, discretion of regulator and so on, which have been pointed out before. Accompanying the problems, the essential features of the integrated approach are discovered. There are three recommendations.

More efficient use of information is the first recommendation. According to section 39 Part I Chapter III Environment Act 1995 the duty placed on the EA is to take into account the likely cost and benefits when deciding whether or not to exercise its authority. Whilst the Act formalizes the concept of cost-benefit criteria in BATNEEC, the PPC Regulation 2000 gave the costs and advantages consideration in BAT. The cost-effectiveness appears to be a statutorily necessity in an integrated approach, although the extent of its approach sometimes depends on the affordability of industry's information resources.

In the two cases studies, most of the requirements imposed on the operators were to provide more and more background data for justifying the reduced impacts on the environment. The companies not only complained that they suffered too much loading in providing information, but also argued that improvement requirements are impractical and not cost-effective at all. This argument implied that the integrated approach in IPC/IPPC an improvement in

the view of the regulated companies is not easy to see. Nevertheless, the information the companies have provided is used to justify that the pollution has been prevented or minimised as far as possible by the regulated company. The relative effectiveness from the costs appears on the security of environmental risk, and they are not measurable and not perceived by the regulated companies.

Nevertheless, no one will accept that the resources spent on environment assessment is greater than that could be justified by any environment improvement. Consequently, the arguments of non cost-effectiveness appear to be inefficient use of information resources.

An inspector stated that inefficient use of professional resources is one of the main problems in achieving the goal of IPC/IPPC. It should bear in mind that the extensive information used in an integrated approach assessment is a burden on both the regulated companies and regulators. Whilst it might secure the uncertain risk of environment damage, it cost a lot of time and money.

The effectiveness of implementation is likely to depend on the efficiency of using information resources on the task. An excellent regulation is essentially useless without information to administer its implementation. Gouldson (1998) argued that the extent to which resources are made available would have an important bearing on the impact of any regulatory regime.

In a precautionary approach regime it needs sufficient information is needed

to justify that the environment impacts have been prevented, minimized or render harmless. The broader factors have been considered in an integrated approach, and the more information has to be investigated and analyzed. The tasks might include the inventorying the emissions, balancing the material and energy input and output, classifying and evaluating the different environmental effects and quantify their contributions. The concerns are not just the environmental impacts associated with the operation of a process, but also to consider such impacts all the way from the design of a process, through operation to decommissioning. Unfortunately, many background data are usually not wide-open and inaccessible. Some might need a long time to verify, whilst some solution depend on the uncertain extrapolated results.

It is believed that the more advanced integrated approach needs more information and more complicated methodologies, and hence more costs should be paid. It might be envisaged that the implementation of a full integration of pollution control would be an expensive game, therefore the cost-effective use of information is a key factor in an extensive integrated approach.

Secondly, there is a necessity to put incentive credits in setting statutory operation conditions in order to enhance the function of anticipatory pollution control. Before the emissions limit values and operation conditions have been imposed on the operator, the BATNEEC/BPEO/BAT for a specific process/installation are arguably flexible. Nevertheless once the conditions are set on the authorization, they become statutory obligations. Any departure from the conditions appears to be a breach. There is no credit for the operator

to comply with the statutory standards, and also no incentive to encourage the operator to reduce their emissions further. Therefore at the stage of authorizing the permit, the key point to argue is the degree of operator's obligations. The stricter conditions mean more compulsory onuses on pollution protection. Consequently, the arguments of BATNEEC/BPEO/BAT might become a defensive approach rather than an anticipatory approach due to no incentive credit given to the operators. As Corus argued that why should the company strive to continually improve its environment performance if it is then going to be penalised by imposition of stricter environment standard without justification. Therefore the second recommendation is that there must be certain incentive credits along with the setting of anticipatory permit conditions on the operators, such as tax reduction or public image enhancing programme etc.

The last recommendation is to gain more emphasis on integration of resources used in order to take more advantages of one-stop-shop. From the view of the resources used, the integrated approach on environmental protection must be more efficient than a separate approach. Unfortunately, the benefits seem not to be perceived by the regulated companies. In view of the regulated companies, even the more integrated control, IPPC, is similar to IPC. The only difference is that the issues have been addressed under other regulations before, but now put together in one permit document.

Due to the technical difficulty in integrating different effects in different media, the sophisticated environmental impacts cannot be compared appropriately. Sometimes the qualitative comparison with professional judgment presents an

efficient way to represent an integrated approach. Therefore the focus then divert to the deep prevention rather than cross-media prevention. In the case studies there are less emphasis on the integrated topic, but instead precaution and prevention are the main actors in IPC/IPPC performance scenario. As Ball and Bell (2000) argued, IPPC places an emphasis on the preventive nature of control mechanism rather than the integration of the permit system.

The original intention of an integrated approach N protecting the environment taken as a whole N has not been exhibited in the practical case performance. So far the performance of IPC/IPPC appear to be a bundled approach, which put all issues together and collate their environment effects under individual regulations independently. It is arguable that if there is no specific detail on what "protecting environment taken as a whole" really means, or how different options for environmental protection may be compared, there is a danger that integrated pollution control will remain theoretical. Emmott (1997) argued that in practice, IPC or IPPC might become disparate, medium-specific controls bundled together in a show of apparent integration.

However, the concept of an integrated approach is still good in theory. In practice, it also has provided one window for industry to communicate with one regulator only. Nevertheless, integrated one-stop-shop is not simply to combine the different issues together on one reception. Instead it contains deep concerns about the interaction of a variety of environment issues together with anticipatory approach. It is a complicated control concept and it cannot be fulfilled over night. In an interview with the Regional Manager of the

EA, Ian Haskell, he argued that an integrated pollution control should be executed step by step, and it is too fast for the UK to jump from IPC to IPPC even though they are very similar. It is believed that many industries have not known well the obligations of the regulated companies in the integrated pollution control regime. The potential benefits in pursuing an integrated pollution control should place on a long-term basis. A true integrated approach cannot be reached over night and it is inevitable to cost time and money. Whilst the regulated companies welcome the one-stop-shop and agree to the theory of integrated approach, the obligations should also be fully understood by the regulated companies.

In the case studies, the two factories are big companies, and what they have revealed might not precisely represent the whole picture for all industrial companies. However, it could be envisaged that small companies might have more complaints about the assessment works and providing information if the same level of requirements are imposed on them.

The findings in this dissertation also provide a lesson for other countries outside Europe to learn what might be a good way to approach an effective integrated pollution control.

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