

**Management to Facilitate Compliance with Global Conventions
During Hazardous and Toxic Waste Cleanup Projects in Asia**

by

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Management to Facilitate Compliance with
Global Conventions During Hazardous and
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A thesis
submitted in partial fulfilment
of the requirements for the Degree
of
PhD at the University of Waikato

By

Ron Laurence McDowall

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2004

Abstract

Abstract

The management of hazardous and toxic waste projects in Asia (especially that related to intractable chemicals) has had a less than acceptable performance profile during the last 20 years. There have been numerous documented cases of management and systems failures in intractable chemical recovery projects, despite the establishment of global conventions designed to avoid such problems.

A research programme was undertaken with the aim of producing a management model for companies to help prevent such failures in the future. The research began in the field with an exploration of management culture and its impact on project management. This involved multiple visits to five Asian countries and interviewing people involved in intractable waste management at both strategic and operational levels and reviewing project records. Personnel in government departments, particularly the “competent authority”, were interviewed to gain insights into the applied management culture within the five countries studied.

The various international conventions or regulations regarding hazardous waste and its management, were researched for their interdependence and effectiveness. The research concentrated on the “Management Plans” or “Environmental Management Systems” that reside within these conventions in order to establish a benchmark of expectation concerning standards of management and organisation that would be required of a member state to discharge its obligations under the conventions. This work involved the author attending several meetings and conferences of the parties to the UNEP Basel Convention, as well as attendance at many Technical Working Groups over several years.

Complexity theory and uncertainty theory, along with emergent theory and innovation adoption theory were researched. The outcome of this research clearly suggested that a multidimensional matrix-based approach could be successful in providing companies with a strategic management model that, if applied, could

enable them to manage large scale intractable projects effectively in compliance with the conventions. The hypothesis of this work is that Duncan's matrix model can be reverse applied to the external environmental elements and components, combined with the mutual adaptation model (i.e.: technology/organisational mutual adaptation), therefore establishing an integrated multidimensional model of adaptation.

The mutual adaptation approach was subsequently used to frame a series of questions that formed the basis of four field surveys. These surveys were applied at different times over a five year period, covering ten projects in China and Taiwan, and involving interviews with a total of 100 executives, who were asked a total of 96 questions across the four surveys, resulting in 9600 responses. The first two surveys were conducted close together in time with the third and fourth later in the process and thus could be considered retrospective. The respondents included project managers, engineers, technicians, company accountants, marketing managers and site leaders.

The data collected validated the hypothesis and established that complexity management was an element of those companies that successfully adopted external technology and systems and in fact were also engaged in reversing the technology back to the originators. The data also indicated that those companies not engaging in complexity management were not reversing technology adoption. An integrated mutual adaptation model was developed from the characterisation matrices and consequently a two-dimensional model of singularity. The final singularity model can be applied at an organisation's strategic level, so as to provide an organisational capacity for compliance with environmentally sound management practices as demanded by the international hazardous waste conventions.

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Contents

	List of Tables	viii
	List of Figures	x
	List of Acronyms	xii
Chapter		
1	Introduction	1
2	Management of Hazardous Wastes under International Conventions	9
	Introduction	9
	United Nations Environment Programme (UNEP) Basel Convention	10
	Organisation for Economic Co-operation and Development (OECD) Convention	28
	European Union (EU) Fifth Action Programme	33
	Summary	38
3	Emerging Global Waste Management Models	39
	Introduction	39
	Emergent Global Model	40
	Existing Management Models in Use	45
	UNCED Rio Declaration	46
	Weston International	58
	The International Institute of Sustainable Development (IISD)	63
	State Environmental Protection Agency (SEPA) China	74
	Summary	83

4	Organisational Characteristics	84
	Introduction	84
	Adaptation Issues	86
	Adaptation of the Organisation to the Technology	88
	Uncertainty	88
	Complexity	96
	Integration of Uncertainty and Complexity	102
	Adaptation of Technology to the Organisation	104
	Know-Why	104
	Inverse Transfer	111
	The Hypothesis	121
	Summary	122
5	The Field Surveys	124
	Introduction	124
	Projects and Contracts Observed and Surveyed	124
	Research Design and Methodology	126
	Survey A Uncertainty Characteristics	129
	Survey B Complexity Characteristics	144
	Survey C Know-Why Characteristics	161
	Survey D Inverse Transfer Characteristic	175
	Summary	190
6	Survey Analysis and Multidimensional Models	191
	Introduction	191
	Within Survey Analysis - Survey A	
	Total Uncertainty Scores	191
	Within Survey Analysis Survey B	
	Total Complexity Scores	192
	Project Groupings Surveys A & B	194
	Project Groupings Surveys C & D	200
	Within Survey Summary	206
	Between Survey Summary	206
	Formulation of Multidimensional Models	207

	Embedded Characteristics	209
	Mutual Adaptation Model	215
	Integrated Two Dimensional Model	217
	Model of Singularity	220
	Summary	221
7	Conclusion	222
	Introduction	222
	Additional Aspects of Complexity Theory Which Inform the Conclusion	222
	Theoretical Results and Implications	227
	Practical Implications for Waste Management in Asia	230
	Further Research	231
	Field Application Manuals (FAM)	234
	References	235
	Appendices	252
Appendix 1	United Nations Environment Programme Basel Convention	253
Appendix 2	Convention Organisation for Economic Co-operation and Development	280
Appendix 3	UNCED Rio Declaration	289
Appendix 4	UNEP Basel Declaration on Environmentally Sound Management	311
Appendix 5	UNEP Guide “Environmentally Sound Management of Hazardous Waste”	320

List of Tables

Table 5.1	Survey A Questionnaire
Table 5.2	Survey A Questions A1-6 Results, Frequencies and Means
Table 5.3	Survey A Questions A7-12 Results, Frequencies and Means
Table 5.4	Survey A Questions A13-18 Results, Frequencies and Means
Table 5.5	Survey A Questions A19-24 Results, Frequencies and Means
Table 5.6	Survey B Questionnaire
Table 5.7	Survey B Questions B1-6 Results, Frequencies and Means
Table 5.8	Survey B Questions B7-12 Results, Frequencies and Means
Table 5.9	Survey B Questions B13-18 Results, Frequencies and Means
Table 5.10	Survey B Questions B19-24 Results, Frequencies and Means
Table 5.11	Survey C Questionnaire
Table 5.12	Survey C Questions C1-6 Results, Frequencies and Means
Table 5.13	Survey C Questions C7-12 Results, Frequencies and Means
Table 5.14	Survey C Questions C13-18 Results, Frequencies and Means
Table 5.15	Survey C Questions C19-24 Results, Frequencies and Means
Table 5.16	Survey D Questionnaire
Table 5.17	Survey D Questions D1-6 Results, Frequencies and Means
Table 5.18	Survey D Questions D7-12 Results, Frequencies and Means
Table 5.19	Survey D Questions D13-18 Results, Frequencies and Means
Table 5.20	Survey D Questions D19-24 Results, Frequencies and Means
Table 6.1	Survey A - Summary of Means and Total Uncertainty Scores
Table 6.2	Survey B - Summary of Means and Total Complexity Scores
Table 6.3	Uncertainty and Complexity Rankings by Project
Table 6.4	Project Groupings in Uncertainty/Complexity Matrix

Segments

Table 6.5	Project and Question Groups and Difference of Means : Survey A
Table 6.6	Project and Question Groups and Difference of Means: Survey B
Table 6.7	Survey C - Summary of means
Table 6.8	Survey D - Summary of means
Table 6.9	Project and Question Groups and Difference of Means: Survey C
Table 6.10	Project and Question Groups and Difference of Means: Survey D
Table 6.11	Within Study Analysis Surveys A,B,C,D

List of Figures

- Figure 4.1 Mutual Adaptation model as adapted from Leonard-Barton
- Figure 4.2 Characteristics of Perceived Environments and Perceived Environmental Uncertainty by Robert B. Duncan and adapted by Richard L. Daft.
- Figure 4.3 Duncan's Table of Components Comprising the Organisation's Internal and External Environment.
- Figure 4.4 Blackman's Chinese Negotiating Norms
- Figure 4.5 Blackman's Norms integrated with Duncan's Components.
- Figure 4.6 Daft's Integrated Matrix
- Figure 4.7 The Complexity/Uncertainty Matrix
- Figure 4.8 Adaptation Model Pathway
- Figure 6.1 Uncertainty/Complexity Matrix based on Surveys A & B Results
- Figure 6.2 Arbitrary Scale for Matrix Element Comparison
- Figure 6.3 Complexity/Uncertainty Matrix with Survey A Elements
- Figure 6.4 Complexity/Uncertainty Matrix with Survey B Elements
- Figure 6.5 Complexity/Uncertainty Matrix with Survey C Elements
- Figure 6.6 Complexity/Uncertainty Matrix with Survey D Elements
- Figure 6.7 Complexity/Uncertainty Matrix with Survey A&B and C&D Elements
- Figure 6.8 Quadrant 1 of Figure 6.7 Re arranged for OL and KM
- Figure 6.9 Quadrant 2 of Figure 6.7 Rearranged for OL and KM
- Figure 6.10 Quadrant 3 of Figure 6.7 Rearranged for OL and KM
- Figure 6.11 Quadrant 4 of Figure 6.7 Rearranged for OL and KM

- Figure 6.12 Matrix of Quadrants and OL and KM Comparisons
- Figure 6.13 Quadrant Two Clusters
- Figure 6.14 Daft's Matrix with the Reverse Dynamic
- Figure 6.15 Mutual Adaptation Model with Stacey's Management Models
- Figure 6.16 Integration and Adaptation Elements of Daft's Matrix forming Integrated 2D Matrix.
- Figure 6.17 Multi Dimensional Matrix of Adaptation Forming Model of Singularity
- Figure 6.18 Model of Singularity from Daft's Matrix with Matrices A,B,C,D,E,F from Figure 6.17 on Quadrant Two Scale.

List of Acronyms

ACP	Africa Carribbean Pacific (Countries)
ANSI	American National Standards Institute
BS	British Standard
BSI	British Standards Institute
CNCCP	China National Centre for Cleaner Production
COP	Conference of the Parties
CP	Cleaner Production
DFE	Design for Environment
EARA	UK Environmental Auditors Registration Association
EEC	European Economic Commission
EFTA	European Free Trade Association
EMAS	Environmental Management Auditing Standard
EMS	Environmental Management Standard
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ESM	Environmentally Sound Management
EST	Environmentally Sound Technologies
EU	European Union
FAO	Food and Agriculture Organisation (UN)
ICC	International Chamber of Commerce
IETC	International Environment Technology Centre
IISD	International Institute of Sustainable Development
IMF	International Monetary Fund
IMNC	Mexican Institute of Standardisation and Certifications.
IMO	International Maritime Organisation
ISO	International Organisation for Standardisation
LCA	Life Cycle Analysis
MOU	Memorandum Of Understanding
NEPA	National Environmental Protection Agency (China)

NGO	Non Governmental Organisation
NTTTC	National Training and Technology Transfer Centre (China)
OECD	Organisation for Economic Co-operation and Development
PBRC	Pacific Basin Resource Centre
PCB	Polychlorobiphényles
PCT	Polychloroterphényles
PIC	Prior Informed Consent (Basel Convention)
PLA	Peoples Liberation Army
POPs	Persistent Organic Pollutants
RAB	Registrar Accreditation Board
SBC	Secretariat Basel Convention
SCC	Standards Council of Canada
SEPA	State Environmental Protection Agency (China)
SRP	Strategic Reference Point
TPC	Taiwan Power Company
TWG	Technical Working Groups
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organisation
USEPA	Environmental Protection Agency (USA)
WCED	World Commission on Environment and Development
WTO	World trade Organisation

1

Introduction

Waste, and hazardous and toxic waste in particular, is a growing¹ problem that is posing a serious threat to the “sustainability” of the global environment. Even with the advent of international conventions, few disposal options, and the high costs involved, drive an ever increasing demand for such wastes to be sent to inappropriate destinations with dangerous methods of management. The use, storage, handling, transportation, and disposal of hazardous waste, in both the developed and less-developed world, is characterised by inept, incompetent management that is continually compromising the biosecurity and biodiversity of the global environment.²

This thesis seeks to establish a multidimensional management model that deals with the issues of environmental protection demanded of Asian countries by global conventions. These countries have little experience or record of environmental protection capacity during hazardous or toxic waste projects, nor do they have an overt internal management structure that necessarily supports the principles of environmental protection.³

Objectives

This inquiry has two central objectives. The first is to examine the existing situation and background of hazardous waste management in Asia, and thus derive conclusions concerning how current management models address the global convention requirements. The second objective is to propose a multidimensional management model based on complexity theory and validated by field surveys.

¹ UN(FAO) Conference Baseline Study Paper, *Obsolete Pesticides Stocks*, M Davis, Pesticide Action Network, UK, Alexandria, Virginia, USA 13-15 September 2000.

² UNEP Sub Regional Workshop on Training and Management of Dioxins/Furans and PCBs, Seoul Korea 24-28 July 2000. See statement paper by Mr Heng Nareth Director, Department of Pollution Control Ministry of Environment, Cambodia.

³ UNEP Sub Regional Workshop on Training and Management of Dioxins/Furans and PCBs, Seoul Korea 24-28 July 2000, See country reports from Brunei, Philippines, Nepal, Thailand, Bangladesh, Myanmar, Indonesia and China.

Specific objectives are as follows;

Chapter two reviews relevant global conventions for purpose, intent and definitions of environmentally sound management of hazardous waste projects.

Chapter three reviews currently used management models that are applied in order to achieve environmentally sound management of hazardous waste projects.

Chapter four reviews organisational science literature with respect to complexity and uncertainty models to provide a basis for field surveys.

Chapter five describes four “Complexity and Uncertainty” surveys involving ten large scale hazardous waste projects in Asia.

Chapter six analyses the survey results placing the information into complexity/uncertainty matrices in order to characterise the projects and develops a two dimensional model using the characterisation information from the surveys and proposes a practical working model.

Finally chapter seven proposes a three dimensional model and suggests areas for further research.

Thus the thesis provides a marriage of theory and practical application validated through fieldwork.

The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal was adopted unanimously on 22 March 1989 by the 116 States participating in the conference of Plenipotentiaries, which was convened by the Executive Director of the United Nations Environmental Programme (UNEP) and held in Basel at the invitation of the Government of Switzerland.⁴

⁴ UNEP *Final Act of the Conference of Plenipotentiaries on the Global Convention on the Control of Transboundary Movements of Hazardous wastes*, 22 March 1989.

This convention was created in response to a growing recognition of the health and environmental risks associated with hazardous wastes. Various Governments brought into force a series of laws to control the generation, handling, storage, treatment, transport, disposal and recovery of these wastes.

The application of the Basel Convention uncovered a number of hazardous waste management problems that are still not well resolved. This is especially so with the trans frontier movements of intractable chemical waste.⁵ Such waste occurs in large quantities in many Asian countries. Many of these countries are now attempting to handle their intractable waste situation within the guidelines and rules of the Basel Convention.

The problem with agreements such as the Basel Convention is the application of the conventions' requirements in countries that may not care all that much about the methodology of recovery, packaging and transportation of intractable waste. This is especially so in Asian countries with a poor record of environmental protection and some other agenda for not removing vast quantities of intractable and toxic waste.⁶

During recent years, it has become apparent within many Asian countries provisions of the Basel Convention are in the main ignored, or circumvented by local managers who often do not have the skills to properly manage hazardous waste projects.⁷ It is also apparent that many shipments for disposal of hazardous wastes take place without notification, and involve movements between the developed world and the less-developed world, and do not comply with even basic international standards.⁸

Thus, the risk to the global environment from hazardous and toxic waste is not necessarily reduced by the ratification of the Basel Convention.

⁵ Tolba and El-Kholy (1992) ch. 10, provides an overview of likely intractable waste scenarios in developing countries.

⁶ Spitalink (1992), p.3, provides comparative studies of hazardous waste generation in Asian countries.

⁷ Tolba and El-Kholy (1992) , p. 264.

⁸ repetto (1994), p.4.

As with many “global” agreements, the Basel Convention, lacks specific detail concerning appropriate methods that should be applied so that the risk management of the hazardous waste is in compliance with the agreement.

There exists significant evidence (UNEP Basel Convention Conference - Stockholm, 1995) that the management culture of “environmentally emerging” countries can significantly reduce the intended effect of the management plans that are required by international conventions. There is a need for a strategic management plans to be developed that accommodate “local management culture” and strengthens its capacity when adopted within the host country infrastructure.⁹

Intractable waste contamination in Asia is a huge problem.¹⁰ Containing and managing the problem presents major issues of complexity in developing the logistical and management framework, and execution thereof. The potential risk to the global environment due to failure of the management plan is extreme. In countries where there is little in the way of substantive consideration for the environment, maintenance of security, and integrity of the management system desired by global conventions, during intractable clearance, are at constant risk of defaulting.¹¹

The scope of the global trade of hazardous wastes is difficult to ascertain. Estimates of the volume of hazardous wastes generated each year range from 300 to 500 million tonnes. It is generally accepted by the Basel Convention that about ten percent of this waste is shipped across international boundaries.¹²

The purpose of this thesis is to develop a management model that is more effective

⁹ See Greenpeace “*Waste Trade Update*” , Vol 2, Issue 2, 1 March 1989.

¹⁰ For discussion of the hazardous waste situation in Asia refer to a conference paper by Qiao Zhiqi (1999).

¹¹ The Food and Agriculture Organisation of the UN (FAO) in their 1996 report estimate that developing countries are holding stocks of more than 100,000 tonnes of obsolete pesticides. Many of these chemicals are so toxic that a few grams could poison thousands of people or contaminate a large area. Leakage, seepage and various accidents related; to pesticides are quite common and widespread. Storage conditions rarely meet internationally accepted standards. Many pesticide containers deteriorate and leak their contents into the soil, contaminating ground water and the environment.

¹² The ten percent figure is suggested and compiled in the country reports of imports and exports contained in *World Resources Report 1990-91* p.325.

than current management models used in the extraction, management, transportation and disposal of intractable, toxic, and hazardous waste. The model has specific relevance to Asian companies involved in toxic and hazardous waste and is focussed on ensuring the intentions of the global conventions are not subverted.

This work attempts to bridge the gap between ratification of international conventions and the application of such conventions by the utilisation of a management structure that is aimed at facilitating compliance.

During the last thirty years there have been many field studies of systems failure and resultant severe environmental pollution caused by completely inadequate systematised management procedures. These field studies show that while a management plan was in place with a quality system and an environmental plan, the pollution still occurred before any element of the management system was aware of the possibility. Many of the current management models are too global in their applications, and they suffer from a lack of specificity. When dealing with highly dangerous intractable material being recovered from dangerous locations, management techniques, even when applied under an ISO standard, in the author's experience, are often simply found to be inadequate.¹³

The study of management models that are designed to deal with the issues involved with hazardous waste must inherently involve the field of organisational science. By understanding industries as complex systems, model design can be arranged so as to improve chances of adoption by decision makers. This thesis, therefore, concerns the design of models drawn from what in organisational science is referred to as "Complexity".¹⁴

Complexity theory deals with systems that show complex structures in time or space, often hiding simple deterministic rules. Complexity refers to the condition of the universe, which is integrated and yet too rich and varied for us to understand in simple, mechanistic or linear ways. Complexity deals with the nature of

¹³ See McDowall project files 1987 - 1999. cf FAO reports 1996,1997,1998

¹⁴ See Casti (1995), Coveney and Highfield (1995), Gell-Mann (1994), Horgan (1995), Kauffman (1993), Kelly (1994), Reeves (1996), Stacey (1995), Waldrop (1992).

emergence, innovation, learning and adaptation.¹⁵ Traditional models for the management of hazardous waste projects tend to be linear or mechanistic in their response to the demands of global conventions such as the Basel Convention. Most traditional models are simplistic linear programmes of instructions that are not cognisant of the integrative elements that are a characteristic of such projects. Casti¹⁶ suggests that “learning and adaptation” are essential elements of an organisation’s management plan, yet these are not always part of the linear or mechanistic models that are applied today.

Without doubt, complexity research is not at the point of presenting an all embracing universal theory.¹⁷ Despite the lack of empirical data, bold claims are being made about complexity being the next major breakthrough in management.¹⁸ However, its norms are at a point where they can help to establish new models.¹⁹ While empirical data is strangely absent from the literature, especially that related to models involving extreme degrees of “issues of complexity”, there are those²⁰ that suggest with empirical studies such models can be described, and therefore that complexity theory adds much to organisational science. It is at this point that the thesis will begin its inquiry by attempting to provide the empirical data regarding issues of complexity and uncertainty that are involved with hazardous waste projects in Asia, and demonstrating how we may use the metaphors of complexity theory to shape management models.

If we define an organisation as "systems of co-ordinated actions among individuals and groups whose preferences, information, interests and knowledge differ"²¹, then a central task of an organisational manager is "the delicate conversion of conflict into co-operation." It is this convergence of conflicting elements that will form the basis for investigating the Asian management culture and will shape the survey questions.

If we can provide an understanding of organisations as complex systems, and

¹⁵ See Casti, 1995.

¹⁶ repetto (1995).

¹⁷ See Horgan (1995).

¹⁸ See Phelan (1995).

¹⁹ See Lissack (1996).

²⁰ See Begun (1994).

²¹ March and Simon (1993).

develop the methodology as to how their systems interact, managers can improve decision making, and search for innovative solutions. Complexity theory is a promising framework that accounts for the dynamic evolution of organisations, and complex internal and external interactions.

By conceptualising organisations as complex systems, a number of managerial implications can be developed. Complexity theory also points to the importance of developing guidelines and decision rules to cope with complexity, and of searching for non obvious and indirect means to achieving goals.²²

We have many instances in the organisational science literature where the application of complexity concepts is questioned. Johnson and Burden²³ have raised this question in their work. "Chaos theory and its close cousin, complexity theory, have recently made their appearance in the social science literature, including studies of organisations. The trend toward loosely applying non-linear dynamical theories to organisations troubles us...The essential problem remains: *How* should these concepts be applied?" The question 'how' is very important to this thesis. The answer will be crucial to the application of the models proposed.

James Begun²⁴ chides researchers for not looking at what confronts organisational science with respect to its practical application. Begun talks about the 95% of the organisational world, that complexity theory invites us to explore. It has been avoided because it is "too dark, murky, and intimidating, or, our theories and methods simply have not allowed us to see it". His suggestion is that we overcome the metaphors and approximate complex realities. On the other hand, Schein²⁵ is determined that "[t]he field of organisational science can only progress when we have a set of concepts that derive from concrete observations of real behaviours in real organisations, and therefore, provide some link to the concerns of practitioners who are solving problems here and now".

Within this thesis are four field surveys of companies engaged in ten large

²² Levy (1994).

²³ Johnson and Burton (1994), p. 322.

²⁴ Begun (1994), p. 331.

²⁵ Schein (1996), p. 231.

hazardous waste projects. These surveys provide empirical data so that concrete observations can be made and the model, while based on complexity theory, will have substantial validity based on real data from real companies. The research will be based upon direct observation and interviews of the managers within companies in Asia directly involved in hazardous waste work.

2

Management of Hazardous Wastes under International Conventions.

This chapter examines the various international conventions or regulations regarding hazardous waste and its management, and summarises their interdependence and effectiveness. The research concentrated on the “Management Plans” or “Environmental Management Systems” that reside within these conventions, or international agreements, in order to establish a benchmark of expectation concerning standards of management and organisation that would be required of a member State to discharge its obligations under the conventions.

Introduction

The research in this section concentrates on “Environmental Management Systems” methodologies as they affect the delivery of global convention requirements. Each of the three major conventions are examined here (UNEP Basel Convention, OECD Convention and EU Directives) from the point of view of what the Convention’s instruments demand in terms of “Environmental Management Systems”, and how that is to be delivered.

During the first stage of research into the international conventions, it became quickly apparent that the Basel Convention (UNEP) has been adopted as the pseudo standard for many of the countries within the Asian region. Indeed, many of the other international conventions such as OECD, EU directives and the French Driere have completely adopted the Basel Convention to the mutual exclusivity of their own regulations. Within Asia, which is the primary region for this research, the adoption of the Basel Convention is complete. The most interesting development is the fact that the countries of Asia, and many other regions, have not only adopted the “Basel” for transboundary movements, but have extended its influence into the national scene by also adopting its requirements for management practices outside of the actual transboundary movement.

Therefore, this thesis concentrates on the Basel Convention, and refers to the other conventions only where they provide additional management standards that are generally applied. The complete adoption of the Basel Convention by many Asian countries to the exclusion of others was surprising, as the Convention lacks the detail that would enable its use as domestic internal regulation.²⁶

Of note is the fact that the United States is not a signatory to the Basel Convention, and that the US EPA regulations regarding packaging and transportation do not figure in Asian projects involving hazardous waste management. The tendency is to use US Regulations such as the 40 CFR 760 series when nothing else is available. An example of this would be Korea asking for the 40CFR standards to apply for offshore incineration in France for PCBs.

It should also be noted that the Basel Convention Secretariat even though it is a subsection of the UNEP, is not funded by the United Nations. Its funding comes solely from the countries that are signatories to the convention. This is probably one of the main reasons for the convention's greater prominence than otherwise would be the case.

During the research period for this thesis, the Basel Convention secretariat held two Conference of the Parties (COP 4 & COP 5), several Technical Working Groups (TWG) and other meetings. These conferences were attended by representatives from 25 countries from the Asian region (including the author) and provided a valuable and relevant, insight into the current state of hazardous waste management and environmentally sound management practices in this region. The Basel Convention in the period 1995 to 1999, emerged as the truly global regulation for the management of hazardous wastes in an environmentally sound manner.

United Nations Environment Programme (UNEP) Basel Convention

The Montevideo Programme for Development and Periodic Review of Environmental Law identified the transport, handling, and disposal of toxic and dangerous wastes as one of the major areas that should be included in the

²⁶ See Lang, Nuehold and Zemanck (1991),p.150-152.