No.

タイ国環境研究能力向上プロジェクト
実施協議調査報告書

平成 16 年 10 月

（2004 年）

独立行政法人　国際協力機構

地球環境部

環　境
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序　　文

タイ王国では、工業化や都市化、モータリゼーションの進行を背景に深刻な大気汚染問題を抱えている。

かかる状況の下、タイ王国天然資源環境省においては、一酸化炭素、二酸化窒素、二酸化硫黄、総浮遊粒子、PM-10、オゾン、鉛等の伝統的な大気汚染物質について環境基準値を設け、バンコク首都圏を中心にモニタリングを行い大気汚染対策に取り組んでおり着実に改善の傾向を見せている。しかしながら、浮遊粒子（PM-10）やオキシダント（オゾン）の原因物質の１つとして知られている大気中揮発性有機化合物（Volatile Organic Compounds：VOCs）については、環境基準、排出基準が設定されておらず体系的なモニタリングも実施されていない。また、VOCs 汚染の実態把握についても十分には行われていない状況にある。VOCs は、吸入による頭痛やめまい、腎障害などの有害性や発ガン性などの可能性が指摘されていることから、タイ王国においてもその対策の重要性が認識されていた。このような状況から、大気中 VOC の環境基準策定に資する調査研究の実施を目的にタイ王国政府から日本国政府に対し要請が出された。

これを受け JICA は、協力内容の協議のために 2004 年 10 月 11 日から 10 月 16 日まで実施協議調査団を派遣し（団長：地球環境部第２グループ公害対策第１チームチーム長 岩崎英二)、2005 年 10 月 15 日に協議議事録（Minutes of Meeting:M/M）を署名した。

本報告書は、実施協議調査の調査・協議結果を取りまとめたものであり、本案件の円滑な実施のための基礎資料としてのみならず、今後の類似案件における計画立案等のために広く活用されることを願うものである。

ここに、本調査にご協力頂いた関係機関の方々に深く謝意を表するとともに、引き続きご支援を賜りますようお願いする次第である。

2004 年 10 月

独立行政法人　国際協力機構
理事　　北原　悦男

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第１章　事前調査団派遣の概要

１－１　経緯と目的

タイ王国〔以下、「タイ」と記す。（面積 51.1km^2、人口 6,346 万人（2002 年）、１人当たり GDP2,236 ドル（2003 年)〕は、工業化や都市化、モータリゼーションの進行を背景に深刻な大気汚染問題を抱えている。

これまでのところ、一酸化炭素、二酸化窒素、二酸化硫黄、浮遊粒子状物質（SPM)、オキシダント等に関して大気環境基準を制定し、バンコク首都圏を中心に主要な県においてモニタリングを行っている。しかし、浮遊粒子状物質や光化学オキシダントの原因物質の１つとして知られる揮発性有機化合物（Volatile Organic Compounds：VOCs）については、環境基準が設定されておらず、また具体的な対策を立案するための調査は行われていない。VOCs は、吸入による頭痛やめまい、腎障害などの有害性や発ガン性など可能性が指摘されていることから、タイにおいてもその対策の重要性が認識されているところである。

このような状況から、大気中 VOCs の環境基準策定に資する調査研究（健康リスクアセスメント）の実施を目的にタイ政府から日本政府に対し要請が出された。これを受け、事前評価調査団を派遣するものである。

なお本案件は、要請段階では４分野（VOCs 健康リスクアセスメント、環境関連データの QA/QC システムの構築、エビ養殖における汚染の評価と水質管理モデルの開発、酸性雨モニタリング技術）の協力にわたっていた。しかし、案件採択段階における検討により、タイ側の優先度が最も高い VOCs 健康リスクアセスメントに絞って採択されたものである。

１－２　調査実施方針

（１）プロジェクトの活動計画及び適切な投入計画について先方関係者と協議を行いプロジェクトの詳細を明確にする。なおその際、VOCs 環境基準策定等 VOCs 対策を視野に入れた協力となることを十分考慮するとともに、平成 17 年度新規案件として環境研究・研修センター（Environmental Research and Training Center：ERTC）及び公害防止局（Pollution Control Department：PCD）から要請があがっている以下の２案件との関係を明らかにしたうえで、適切なプロジェクト計画を作成する。

- Receptor Model for Evaluation of VOCs Sources Apportionment in Bangkok Metropolitan Region（ERTC より要請）
- The Development of Environmental and Emission Standards of VOCs（PCD より要請）

（２）プロジェクト計画を５項目（妥当性、有効性、効率性、インパクト、自立発展性）の観点で評価する。

（３）事前評価調査の成果として以下の事項を取りまとめる。

１）案件の基本計画（成果、活動計画、投入計画、期間、実施機関・体制）
２）Plan of Operation（活動計画のスケジュール）
３）事前評価表（案）

（４）タイ側の負担事項（人員配置、予算措置、免税措置）の確認を行う。

（５）協議内容については Minutes of Meeting（M/M）に取りまとめ、署名・交換を行う。

１－３　調査内容

（１）プロジェクト実施の妥当性

１）国家計画における本プロジェクトの位置づけの確認

２）大気汚染対策における VOCs 対策の優先度の確認

３）VOCs 対策の現状と課題

４）大気中 VOCs 対策及び環境基準策定の主管官庁・関係機関の確認と ERTC の役割の明確化

５）大気中 VOCs 対策及び環境基準策定のための取り組み状況、計画の確認

６）ERTC の VOCs に関する調査研究計画の確認及び調査研究体制の能力評価

７）他ドナー援助との関係整理

（２）プロジェクトの全体計画

１）プロジェクトの基本計画（目標、成果、活動、投入）

２）プロジェクト期間

３）プロジェクトの実施体制

４）プロジェクトの投入の詳細計画の検討（投入の妥当性が確認された場合）

ａ）専門家（TOR、派遣時期等）

ｂ）本邦研修（研修カリキュラムの検討、実施時期）

ｃ）機　材

①　機材の基本設計（品目、数量、グレードの適正確認）

②　機材調達方法の検討

③　機材メンテナンス計画の検討、作成

④　タイ側負担事項（据え付け、メンテナンス等）及び経費の調査、検討

（３）タイ側の負担事項（人員配置、予算措置、免税措置）の確認

１－４　調査団構成

（１）総　　括　岩崎　英二（JICA 地球環境部第２グループ公害対策第１チーム　チーム長）

（２）VOCs 対策　渡辺　靖二（環境省環境調査研修所　教官）

（３）協力企画　　土畑　いづみ（JICA 地球環境部第２グループ公害対策第１チーム）

１－５　調査日程

日順	月日	時刻	調査内容
1	10 月 11 日（月）	11:00	成田 -------→ バンコク
2	10 月 12 日（火）	08:40-09:15	JICA タイ事務所打合せ
		09:30-10:00	日本大使館表敬
		10:45-11:10	DEQP 局長表敬
		11:15 -12:00	DEQP 副局長表敬
		12:15	Welcome Lunch
		14:00-16:45	PCD 及び ERTC との合同協議
3	10 月 13 日（水）	09:45-12:45	ERTC との打合せ
		14:00-14:30	PCD ラボラトリー見学
		14:30-16:45	PCD との打合せ
4	10 月 14 日（木）	09:30-15:00	ERTC との打合せ
		15:00-16:00	PCD 自動車排気ガス試験用ラボラトリー見学
		16:00-23:00	ERTC との打合せ
5	10 月 15 日（金）	09:30-11:30	ERTC にて M/M 署名
		14:00-15:15	DTEC への調査報告
		16:00-17:00	JICA タイ事務所への調査報告
		17:30-18:30	常時モニタリングステーション見学
6	10 月 16 日（土）	11:20	バンコク----------→ 成田

DEQP: 天然資源環境省 環境質向上局（Department of Environmental Quality Promotion）

PCD: 公害防止局（Pollution Control Department）

ERTC: 環境研究・研修センター（Environmental Research and Training Center）

DTEC: Department of Technical and Economic Cooperation

第２章　タイにおける VOCs 対策概要

２－１　VOCs による大気汚染の概要

世界保健機構（WHO）は、VOCs〔高揮発性有機化合物（Very Volatile Organic Compounds, VVOCs を含む)〕を、沸点が 240～260 度以下の有機物質と定義している。VOCs は、沸点が低い性質のために使用場所から大気へ放出されやすく、大気を汚染しやすい。大気汚染物質としての VOCs は、直接吸引することが問題になる有害大気汚染物質と、大気中で光化学反応を受けて、浮遊粒子、あるいは光化学オキシダントを生成する前駆物質に着目する必要がある（両方の性質を有する VOCs が存在する)。ここでは、この２点に着目してタイの大気汚染について概観する。

（１）有害大気汚染物質（Hazardous Air Pollutants：HAPs）

タイでは、VOCs の大気環境基準値は設定されておらず、これまで体系的な大気モニタリングは実施されていない[1]。単発の調査としては、新エネルギー・産業技術総合開発機構（NEDO）が行った 1997 年の化学工場周辺の調査、ERTC が 2002 年にバンコクで行った沿道調査、PCD が 2004 年４月と６月にバンコク市内及び郊外で行った調査がある。ERTC は、固相吸着加熱脱着-GC/MS 法により 21 種の VOCs を測定し、PCD は２種のアルデヒド類、アクロレインと４種の VOCs を測定している。共通して測定された VOCs の濃度を比較すると、ERTC の報告値が１桁以上高い値を報告している。

表－１　Concentrations (μg/m^3) of Benzene, Toluene, Xylene and Ethylbenzene in ambient air in Bangkok

Sampling site	Benzene	Toluene	Xylene	Ethylbenzene
Yaowarach(Roadside)[a]	180	745	242[c]	83.2
Silom(Roadside)[a]	245	613	197[c]	60.5
Victory Monument(Roadside)[a]	85.3	307	72.1[c]	22.1
Rachayotin(Roadside)[a]	73.9	307	26.4[c]	16.0
Din Daeng (Roadside)[b]	0.278～4.56	0.367～20.3	5.53～6.18	ND～5.57
Ban Somdet (Residential)[b]	0.537～2.30	1.57～55.5	1.27～3.46	0.890～1.83
Vachiralongkom Dam (Background)[b]	1.50～2.95	3.71～9.97	ND～3.07	ND～2.37

a: After Report of ERTC (2002 Aug.); b: After Report of PCD (2004 Apr., June); c: Data includes concentration of styrene

ERTC のデータが VOCs 汚染の実情を反映しているとすると、ベンゼン、ジクロロメタンが日本の環境基準値の約 50 倍、トリクロロエチレンが環境基準値と同レベル、キシレンとトルエンが室内環境基準値の数倍の濃度に相当し、バンコク市内の VOCs の汚染は、健康被害が心配されるほど深刻であることがうかがえる。一方、PCD のデータは、ベンゼン濃度がおおむね基準値レベルで、それ以外の VOCs 濃度が基準値以下であった。このことは、サンプリング地点の選定・方法の検討の必要性と VOCs 汚染実態調査の必要性を示唆している。

[1] 日本では、毒性が強く、環境汚染濃度が比較的高い VOCs４種類を基準物質、５種類を優先取り組み物質に選定し、基準値及び指針値を設定し、環境大気モニタリングを行っている。2003 年度の調査結果では基準項目のうちベンゼンが８％の調査地点で基準値を超えたものの、他の基準項目は環境基準値を満たした。ベンゼンを含め、濃度は 1998 年以降減少傾向を示している。

（２）工場・事業所の状況

タイでは、VOCs が原因と考えられる悪臭を伴う事故が影響して、有害大気汚染物質に対する関心が年々高まってきている。1997 年には、マタプットの石油化学工場から放出された VOCs が原因と考えられる健康被害が発生し、３つの学校がコンビナート地区から移転する事故があった。2004 年９月には、パクチョンにおいて VOCs を含む産業廃棄物が違法投棄され、周辺環境が汚染された（現在、PCD と ERTC が協力して汚染調査を行っている)。また、環境汚染にかかわる住民からの苦情の 40%が悪臭に関するもので、そのなかのかなりの部分は溶剤等の VOCs が原因していると PCD は認識している（10 月 12 日ジョイントミーティングにおける PCD の配布資料説明)。

VOCs の年間使用量（輸入量・生産量）は、固定発生源（工場など）からの VOCs の環境への放出量を推定する手がかりになる。本調査の質問表のなかで使用統計について尋ねたところ、ERTC から 2000 年のデータが回答された。しかしこのデータのなかに 1998 年の報告書「タイ国揮発性有機化合物汚染に関する研究」に記載されている VOCs と比較できる同種類 VOCs がなく、潜在的な大気汚染の危険性が増えているかどうかを推測することはできなかった。

（３）移動発生源の状況

車両などの移動発生源からの VOCs の放出に関しては、車の販売台数が年々増加しており、ベンゼン等の放出量の増加が懸念される。

タイ政府は、車排ガスの基準を現行の EURO２から、近い将来に EURO３に移行する計画があり、これに対応して、PCD は、シャーシダイナモ施設を建設して、車両排ガスの測定を行っている。こうした目的のためと考えられるが、測定は、気温 20 度、相対湿度 50%という EURO 基準に従って行われている。

（４）前駆物質としての VOCs

前駆物質としての VOCs による大気汚染の程度は、浮遊粒子（PM-10）とオキシダント（オゾン）を指標としてある程度推測することができる。2000 年までの環境モニタリングデータと 2003 年のデータからは、PM-10 濃度（基準値 0.12 mg/m^3）が 2000 年までは確実に減少したが、その後増加していること、一方オゾン（基準値 0.1ppm）は、濃度の増減があるものの、減少傾向を示している[2]。

PM-10 とオキシダントの年平均濃度をバンコクと日本で比較すると、PM-10 についてはバンコクの方が２倍程度高く、オキシダントは同レベルである。したがって、日本と同様にタイでも、前駆物質としての VOCs による大気汚染対策に取り組む必要があろう。ただし、タイでは、乾期に PM-10 の濃度が上昇する傾向が認められており、自然由来の浮遊粒子の寄与に注意して VOCs の寄与を評価する必要がある。

今回の調査では、10 月 12 日のジョイントミーティングにおいて、PCD からタイにおいても前駆物質としての VOCs が PM-10 とオゾンの汚染に対してどの程度寄与しているのかを推定する研究が必要であるとのコメントがあった。

[2] 日本では、PM-10の環境基準値（0.1mg/m^3）に対する達成率が約50%に下がったあと、近年はほぼ横ばい(2001年平均値33μg/m^3)で推移している。オキシダント（環境基準値0.06ppm、2001年平均値0.044ppm）についても汚染が改善される傾向が認められず、先駆物質としてのVOCsの単位面積当たりの排出量が世界的にみても高いことが原因していると考えられている。〔環境省、揮発性有機化合物（VOCs）排出抑制検討会報告書、揮発性有機化合物（VOCs）の排出抑制について、平成16年２月〕

表－２　PM-10 concentration (μg/m^3) and O_3 concentration (ppb) in Bangkok in 2003

Category	Range	95 Percentile	Annual average	Numbers of samples exceeding STD (%)
PM-10 (24 hr) Ambient	20.5～189.0	101.0	54.5	36/1,680 (2.1)*
PM-10 (24 hr) Roadside	12.7～208.9	119.8	61.4	108/2,152 (5.0)*
O_3 (1 hr) Ambient	0～169.0	55	15.7	155/61,789 (0.25)**
O_3 (1 hr) Roadside	0～145.0	42	11.8	13/24,905 (0.05)**

* STD value: 120 μg/m^3; ** STD value: 100 ppb
After PCD provided data in the Joint Meeting on 12, Oct. '04

２－２　大気汚染対策における VOCs 対策の位置づけ

タイでは、一酸化炭素、二酸化窒素、二酸化硫黄、総浮遊粒子、PM-10、オゾン、鉛について環境基準値を設け、大気汚染対策に取り組んでいる。その結果、いずれの項目についても年々濃度が下がってきている。PM-2.5 については、環境基準値の設定が汚染対策委員会（Pollution Control Board）で議論されたが、基準値設定には至っていない。世界銀行の報告書「Thailand Country Development Partnership-Environment (2003)」によれば、タイの大気環境対策の課題は、浮遊粒子濃度を低減させることであり、その一環として PCD が、2007 年までに浮遊粒子の排出インベントリーを作成し、浮遊粒子暴露によるヒトの健康影響を評価する計画である。

有害大気汚染物質としての VOCs については、今のところ対策の対象になっていない[3]。しかしながら、上述のようにタイでは、VOCs 汚染に対する社会的関心が高まっていることから、速やかにベースラインサーベイを実施し、対策を検討する時期にきているといえる。

2004 年度の JICA に対する技術移転協力要請案件として、ERTC から環境基準値策定のための VOCs のヒトに対する健康影響の量作用関係を導く手法、2005 年度案件として VOCs 排出のインベントリー作成にかかわる技術、PCD から VOCs の排ガス及び一般環境基準値策定手法の技術移転要請が提出された。これらのことは、有害大気汚染物質としての VOCs 対策がタイ政府のなかで注目され始めてきた証左と考えられる。

２－３　VOCs 対策・研究の現状と計画（含む体制）

（１）カウンターパート

ERTC の研究・開発課の大気部は、チーフを含め分析担当の３名とサンプリング担当の４名で構成されている。課長と２名のスタッフは、「タイ環境研究研修センタープロジェクト（1990～1997 年）」による技術移転を受けており、プロジェクト終了後は、NEDO の協力を得て VOCs の分析、さらにスウェーデンの協力を得て酸性雨の分析を行った。2004、2005 年タイ会計年度には、上述の VOCs 暴露と健康影響との関係に関する研究、気温の垂直分布モデルの検証に取り組んでいる（10 月 13 日、ERTC との協議における説明）。これらのことから、大気部の研究員は、基礎的な分析手法、研究手法を既に習得していると考えられる。しかしながら VOCs 対策に係わる研究、すなわち VOCs 汚染のベースラインサーベイ及び排出インベントリー作成を行うにあたっては、未習得の技術が必要になるので、日本が技術協力を行い、カウンターパートの研究能力を強化することが望ましい。

[3] 地下水中の VOCs 基準値策定が検討されている。

（2）分析装置

現在、ERTC には、大気分析用にマニュアルの加熱脱着装置（ACEM、Supelco 社製）/GC/MS（GC/17A-QP5000、島津製作所製）が設置されている。VOCs による大気汚染のベースラインサーベイ及び VOCs 排出インベントリー作成のためのデータ整備を行うには、多数の試料を測定する必要がある。これらの調査を行うには、測定可能な最低濃度（下限値）を、日本を含めて諸外国で設定されている VOCs の環境基準値の 1/10 以下まで下げる必要がある。ERTC の現有の機材は、こうした条件を満たさないので、自動試料導入装置と十分な検出感度をもった分析装置[4]の供与が不可欠である。

PCD は、連続観測ステーションを全国に 52 か所に設置しており、基準項目の自動測定を行っている。PCD のラボには、VOCs 測定用の容器（キャニスター）低温試料導入装置/GC/MS（測定感度等の性能を備えている）が設置されており、VOCs 分析体制が一応整っている。分析技術の指導は、現在のところ（2004 年 10 月）元シニアボランティアの久留宮氏が行っている。

（3）技術協力の内容と方法

技術移転が必要になると考えられる主な項目を以下に列記する。

① VOCs のアクティブ及びパッシブサンプリング法をタイの気象条件に適した方法に開発し、検証する技術
② GC/MS のメンテナンス法
③ VOCs モニタリングにおける精度管理手法
④ ベースライン調査計画策定手法
⑤ VOCs の排出インベントリー作成（モデリングを含む）
⑥ VOCs データ解析手法

これらのプロジェクトに要する全期間は、分析法の確立に１年間、ベースラインサーベイに２年間、排出インベントリー作成に１年間、並行して展開するので合計３年が必要と考える。この間の技術移転方法としては、上述のようにカウンターパートが基礎的な研究遂行能力を備えていると考えられるので、①～⑥の項目を短期専門家の派遣及びカウンターパートの日本研修で行うことが可能と思われる[5]。

1990～1997 年に実施された ERTC プロジェクト方式技術協力では、環境施策にかかわる環境分析を基にした研究体制の構築が目標のひとつとされていた。そのプロジェクトが終了し、一定期間をおいたこの時点に、かつての目標と合致するような技術協力を行うことは、カウンターパートに ERTC における研究の方向性について再考を促す意味でも意義があると考えられる。

[4] 現在、日本で環境大気中の VOCs のコンプライアンスモニタリングで使用されている測定装置は完成型に近いと考えられるので、それと同等の性能を満たす装置を供与すれば、少なくとも今後 10 年間は装置が古くてデータに信頼性がないというような評価を受けることはないだろう。機種選定にあたっては、テキストに記述した２つの性能に加えて、装置メーカーがタイにおいてメンテナンス体制を整備していること、パッシブサンプラーで採取した試料も測定可能であること、VOCs を固相吸着・溶媒抽出法で処理して得られる液体試料を GC/MS 測定するのに必要なスプリット／スプリットレス注入口を備えていることを条件に加える必要がある。

[5] 実施時期については、“Plan of Operation”参照。移転が必要と考えられる技術を１人の短期専門家でカバーすることは難しいので、複数の短期専門家を派遣することになる。このような様式の計画を実行する際に問題になるのは、短期専門家派遣及びカウンターパート日本研修による技術移転の時期の適正を、プロジェクト全体を俯瞰し、進捗を確かめながら判断して対応することである。プロジェクト開始にあたっては、これらを可能にする日本側の体制をつくりあげておく必要がある。

（4）VOCs 汚染対策における ERTC と PCD との役割分担

VOCs 汚染対策にかかわるモニタリングにおいて、ERTC は分析法の研究・開発が、PCD はモニタリングの実施が職掌になる。タイの事情に適したサンプリング手法の開発を ERTC が行い、その成果をベースラインモニタリングに活用して、PCD と ERTC がエリアを分担してモニタリングを実施し、その後に VOCs の排出インベントリーを作成する際にも PCD と ERTC が協力してデータを蓄積・整備することが、VOCs 汚染対策において ERTC と PCD がとるべき対応と考えられる。

VOCs の測定を、ERTC は加熱脱着法で、PCD はキャニスター法で進めようと考えている。ERTC が、サンプリングコストが比較的廉価な加熱脱着法を使って多数の試料を採取し、サンプリング場所、曜日、頻度などの条件検討を行うことは、研究の進め方として適当といえる。また、日本では、両法が有害大気汚染物質の標準分析法になっていることから、２つの分析法がそれぞれ開発されることは、将来タイにおいてコンプライアンスモニタリングを実施するうえでも有益である[6]。

この役割分担については、今回の調査で ERTC と PCD と個別に行った意見交換のなかで確認しあっている。

（5）VOCs 汚染対策

上記の研究活動及び PCD との共同調査によって得られるベースラインサーベイ結果と VOCs 排出インベントリーデータを基に、PCD が、環境基準値策定を含む VOCs 汚染対策案を作成し、汚染対策委員会（Pollution Control Board）へ提案することが期待される。

２－４　他ドナーの動き

現在 ERTC は、他国からの援助を受けておらず、VOCs 汚染対策のための研究能力を向上させる技術協力は、他ドナーと重複しない。

PCD は、世界銀行 Trust Fund（1,300 万米ドル）他の援助[7]を受けて、バンコクの PM-10 濃度を低減するためのプロジェクトを、2004～2007 年で実施している。このプロジェクトは、国土交通省（LTD）、バンコク首都県庁（BMA）、タイ警察（TRP）が交通量のデータベースを提供する計画になっている。

今回の調査で、PCD がドイツの援助を受けてラボを整備したという情報を得たが、確認することはできなかった。

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[6] 事前調査におけるタイ側との協議では、技術移転対象として個体吸着/加熱脱着/GC/MS 法を採用することで合意した。この方法を採用した理由は、PCD と分析法を重複させないことによって、タイ国内に普及させる分析法を多様化させること（将来、他分析機関において選択の幅を広げることで、モニタリングを推進することが期待できる）、キャニスター法に比べて経費を節約できるメリットを考慮したからである。しかしながら、その後の有害大気汚染物質モニタリング従事者（渡辺調査団員の個人的なネットワーク）とサンプリング手法の移転技術としての適正を検討した結果、キャニスター法に変更することにし、ERTC もそれを了承した。変更した具体的な理由は、個体吸着/加熱脱着法を採用した場合、気温や湿度と VOCs の捕集効率との関係を調べて、サンプリング手法を確立するのにかなりの時間を要すること、一方キャニスター法はそのままでタイの大気環境に適用できること、また必要経費を見積もったところ、24 時間連続サンプリングを個体吸着/加熱脱着法で行うのに必要な低速で吸引するポンプが予想以上に高価であったため、キャニスター法に必要なパッシブキャニスターサンプラーと差がないことが判明したからである。

[7] タイ政府は 25 万米ドルを支出し、その他から 95 万米ドルを集める計画になっている。

第３章調査結果概要

３－１　現地調査総括

調査団は、10 月 12 日（火）から 15 日（金）までの 4 日間のタイ国天然資源環境省環境質向上局（DEQP）環境研究・研修センター（ERTC）、公害防止局（PCD）及び DEQP との協議を行い、実施機関である ERTC のプラディット所長とプロジェクト・マスタープラン案や活動計画（PO）案を含む協議概要を M/M に取りまとめ、15 日午前中に署名交換を行った。短期間の滞在であったものの、長年の協力実績もあり、協議を建設的かつ円滑に行うことができた。

今回の調査では、その要請内容が揮発性有機化合物（VOCs）による大気汚染対策のための研究能力支援という限定的な協力テーマが設定されていたことから、この妥当性について、環境行政とタイの大気汚染対策の現状という２つの観点から調査した。環境行政からの観点では、実際に汚染対策を担当する PCD とも協議を有し、VOCs 対策が環境行政上も優先度が与えられている課題であることを確認した。PCD としては、2004 年 1 月における国家環境委員会からの要求もあり、VOCs のモニタリングの開始、環境基準及び排出基準の作成に着手したいとしており、そのための研究として本要請が妥当性をもつことが確認できた。また、大気汚染対策の現状からみての妥当性としては、酸化物等の典型的な大気汚染物質については環境基準を満たしつつある現状がある一方、SPM やオゾンについてはいまだ環境基準を満たせず[8]、光化学ダイオキシダント対策の一環としても VOCs 対策に必要な研究に着手する時期にきていることはおおむね妥当であろうと考えられる。また、工業地帯からの溶剤等の VOCs が原因とみられる住民からの苦情も発生しており、PCD、ERTC としては対応を迫られている状況であり、それぞれ財源を確保し独自の取り組みを開始していることからもその必要性は見てとれた。

以上、調査の妥当性を確認したうえで、1997 年に終了した ERTC に対するプロジェクト方式技術協力期間中に強調されていた、「環境行政を支援する ERTC」という点に留意し、協力内容について ERTC と協議を行った。その結果、当初要請にあった「健康リスクアセスメントモデルの開発」に特化したものでなく、VOCs の汚染状況の把握、VOCs をモニタリングするための測定法の検討等といった、今後、PCD が環境基準の作成を検討していくうえで必要不可欠な成果に重点を置いた協力内容とすることでタイ側の理解を得た（付属資料 M/M 中のマスタープラン参照）。協議にあたっては、日本の環境行政の例を用い（付属資料参照）、調査団側の考えの背景を伝え、タイ側との意見のすりあわせを行った。また、研究の成果を行政に生かすためのシステムとしては、ERTC の成果は汚染対策委員会（Pollution Control Board）に提出されるようになっており、タイの現行システム上から見ても今回協力結果が行政を支援することにつながっていくことに無理がないことを確認した[9]。また、今回プロジェクトの主要なカウンターパート３名は前回協力から継続して ERTC に勤務している者であり、その他４名も既に指名され ERTC 側の基礎的な体制が整っていることから、短期専門家、研修、機材供与のみを日本側の投入とし、プロジェクトの実施は ERTC が適宜日本人専門家からアドバイスを受けながら自主的に取り組むことを前提にした計画とした。

最後に、2005 年度要請として ERTC と PCD から共に VOCs をテーマにした要請が提出されていることから、本プロジェクト要請背景調査の一環として、今回要請との関係も調査した。発生源プロファイル作成を目的とした ERTC からの要請については、汚染の現状を把握するとの観点から今回作成

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[8] PCD からの情報及び世界銀行「Country Development Partnership-Environment」による。実際の対策がどの程度硫黄酸化物（SOx）の削減に貢献しているか等については詳細な検討が必要。

[9] タイにおいては、政策決定にあったて、科学的証拠、社会的インパクト、経済的インパクト、技術水準の４点を考慮することになっており、今回協力は、科学的証拠、社会的インパクト（健康リスク）、技術水準（モニタリング技術）に寄与する。

したマスタープランで十分先方のニーズを満たすことができることを確認した。一方、基準作成をテーマにしているPCDからの要請については、いまだ具体的に基準作成には着手していない状況のなか、協議の際に調査団側が行った日本の行政経験に対して強い関心を示し、今後どのように取り組んでいけばよいかについて、日本人専門家からアドバイスを得たいとのことであった。要請内容は、基準作成のための技術的な部分と行政的な部分に分けられ、前者については今回協力にて実施するような訓練活動が、コンプライアンス・モニタリングを担当することとになるPCDのスタッフにとっても重要であるとのことであった。本プロジェクトの活動にある汚染状況の把握のための調査については、全国に52の常時大気観測局を有するPCDと共に実施することができればより有効な調査が可能になる。また、本プロジェクトのインパクトとしては、PCDが主管局となる基準作成が促進されることを予期しているため、PCD側の基準作成のための行政的な知見を高めることは本プロジェクトのインパクトを高めるうえでも重要である。

３－２　プロジェクトの概要

（１）協力概要

本プロジェクトは、タイ国天然資源環境省環境質向上局環境研究・研修センター（ERTC）をカウンターパート機関とし、短期専門家派遣、本邦研修の実施、機材供与の３つの協力を組み合わせて実施することにより、①タイにおける適切なVOCs大気環境モニタリング方法の開発、②VOCs大気汚染の現状把握、③VOCs大気汚染とヘルスリスク分析に関するERTCの調査研究能力強化、という３つの成果を主要コンポーネントとする。これにより、タイ天然資源環境省におけるVOCs大気汚染対策を講じるためのキャパシティー（環境基準、排出基準の策定を含む）が強化されることを目的とする。

プロジェクトのマスタープラン案は表－３のとおり。

（２）協力期間：３年

（３）協力総額（日本側）：約7,500万円

（４）協力相手先機関：タイ国天然資源環境省環境質向上局環境研究・研修センター（ERTC）

（５）国内協力機関：環境省環境調査研修所、自治体

（６）裨益対象者及び規模、等

対象地域：バンコク市を中心にタイ全土

ターゲット：ERTCスタッフ７名に加え、プロジェクトの活動で行う研修を通じて、地方自治体の環境管理に携わる職員等も裨益対象者となる。

（７）マスタープラン：本プロジェクトのマスタープランは表－３のとおり。

表－３マスタープラン

１．上位目標

VOCs 大気汚染に対する具体的対策がとられる。

（指標）汚染対策委員会が VOCs 大気環境基準を策定するための具体的活動を行う際に、本プロジェクトの成果が活用される。

２．プロジェクト目標

天然資源環境省において VOCs 大気汚染対策を講じるためのキャパシティー（環境基準、排出基準の策定を含む）が強化される。

（指標）

- ERTC が汚染対策委員会に対し、信頼性のある VOCs 大気汚染モニタリング手法を提案する。
- 天然資源環境省が、健康影響の観点から優先的に監視、管理すべき VOCs を認識する。
- ERTC が VOCs 大気汚染モニタリング手法に関する研修を実施できるだけの技術的能力を習得する。
- タイ国民が ERTC の研究を通して VOCs 大気汚染に関する認識を深める。

３．成果

(1)タイにおける適切な VOCs 大気環境モニタリング方法が開発される。
（指標）タイにおける適切な VOCs 大気モニタリング手法が汚染対策委員会に提出される。

(2)VOCs 大気汚染の現状が明らかにされる。
（指標）

- VOCs 大気汚染のベースラインサーベイが実施される。
- VOCs 大気汚染の地理分布が解明される。
- VOCs 大気汚染の時系列解析が行われる。
- VOCs 排出インベントリーが作成される。
- 健康影響の観点から VOCs 大気汚染が評価される。
- VOCs 大気汚染の現状に関する技術報告書が作成される。

(3)VOCs 大気汚染とヘルスリスク分析に関する ERTC の調査研究能力が強化される。
（指標）

- ７名の ERTC スタッフ（サンプリング：３名、分析：４名）が、プロジェクトの２年目終了時までに、VOCs 大気汚染モニタリングを計画し実行できるようになる。
- ４名の ERTC スタッフが、パッシブサンプリング手法を用いて、室内・室外の VOCs 大気汚染レベルを調査できるようになる。
- ７名の ERTC スタッフがタイにおける VOCs 大気汚染の状況を明らかにするためのデータ解析技術を習得する。

４．活動

成果１に対応	(1-1) ガスクロマトグラフ-質量分析装置（GC/MS)、過熱脱着装置（TDU）等の機材の準備
	(1-2) 分析方法の予備試験の実施
	(1-3) 精度管理・精度保証（QA/QC）診断フローチャートの作成
	(1-4) 機材のメンテナンス
	(1-5) 他の分析方法との比較検討
	(1-6) 大気中 VOCs のサンプリング及び TDU- GC/MS を用いた分析標準作業手順（SOP）の作成
	(1-7) １年次プログレスレポートの作成
成果２に対応	(2-1) 調査、サンプリングサイトの選定（少なくとも９か所以上）
	(2-2) 24 時間サンプリングに基づいたベースライン調査
	(2-3) VOCs 排出インベントリーの作成
	(2-4) 屋内及び屋外におけるパッシブサンプリング方法の確立及び測定の実施
	(2-5) TDU- GC/MS を用いたパッシブサンプルの分析標準作業手順（SOP）の作成
	(2-6) データ解析（地理分布、時系列分析）
	(2-7) ２年次プログレスレポートの作成
成果３に対応	(3-1) VOCs 大気汚染モニタリング研修の実施
	(3-2) パッシブサンプリング手法に関する研修の実施
	(3-3) データ解析とモデル化に関する研修の実施
	(3-4) VOCs 排出インベントリー研修の実施
	(3-5) ワークショップ、セミナーの開催
	(3-6) VOCs 大気汚染の現状に関するテクニカルレポートの作成

３－３　投入計画（PO）案

タイ側との協議の結果、マスタープラン案に沿った Plan of Operation（PO）案について、表－４のとおり合意した。

この PO については、プロジェクトの実施が決定されたあとに、必要に応じて改良することとした。

表－４　Tentative Plan of Operation

Expected Outputs	Activities	Schedule				Duration of Activities(Month)
		1st year	2nd year	3rd year	4th year	
1.Development of appropriate methodologies for VOC ambient monitoring in Thailand	(1.1) Preparation of equipment and materials (GC/MS, thermal desorption sampling, pumps, solid adsorbent tubes)					2
	(1.2) Preliminary test of the methods*					4
	(1.3) QA/QC diagnosis flow chart*					2
	(1.4) Maintenance of equipment					continuous
	(1.5) Comparative study with other methods*					3
	(1.6) Preparation of SOPs (sampling/analysis) for TDU-GC/MS method*					12
	(1.7) Progress report*					1
2.Elucidation of the VOC contamination status in Thailand	(2.1) Survey and sampling site selection (at least 9 sampling sites)*					2
	(2.2) Baseline survey (based on 24hrs sampling) *					24
	(2.3) Emission inventory for prevailing VOCs*, **					8
	(2.4) Establishment of passive sampling method (indoor/outdoor) and measurement*, **					6
	(2.5) Preparation of SOPs (sampling/analysis) for TDU-GC/MS method for passive samples*					6
	(2.6) Data interpretation with respect to spatial distribution and time series analysis*, **					3 (1.5x2)
	(2.7) Progress report*					1
3. Strengthening of the ERTC's capability to research on VOC air contamination and health risk	(3.1) Training on VOC ambient monitoring method (in Thailand)					12
	(3.2) Training on establishment of passive sampling method (in Japan)					2
	(3.3) Training on data interpretation and modeling (in Japan)					1
	(3.4) Training on emission inventory for VOCs* (in Japan)					2
	(3.5) Workshop/Seminar*					5 days
	(3.6) Technical Report on state of VOC air pollution in Thailand*					2

* Need technical assistance from the expert for the capacity building of ERTC staffs (activities in Thailand).

** Capaity building of ERTC staffs through technical training in Japan.

３－４　確認事項（マスタープラン以外の M/M 確認事項）

（１）日本側投入案（詳細については M/M の ANNEX III 参照）

１）短期専門家

ａ）TOR（１年目）

- 大気中 VOCs に関する分析方法の予備試験の実施
- QA/QC 診断フローチャートの作成
- 大気中 VOCs に関する分析方法の比較検討
- TDU-GC/MS を用いた大気中 VOCs 分析 SOP の作成
- １年次プログレスレポートの作成監理

ｂ）TOR（２年目）

- VOCs 排出インベントリーの作成
- 屋内及び屋外におけるパッシブサンプリング方法の確立及び測定の実施
- TDU-GC/MS を用いたパッシブサンプル分析 SOP の作成
- データ解析（地理分布、時系列分析）
- ２年次プログレスレポートの作成監理

ｃ）TOR（３年目）

- ワークショップ、セミナーの開催
- VOCs 大気汚染の現状に関するテクニカルレポート作成監理

２）機材供与

大気中 VOCs サンプリング及び分析に必要な機材一式

３）本邦研修

以下のテーマに関し、カウンターパートに対する本邦研修を実施する。

１）VOCs 排出インベントリー

２）屋内及び屋外におけるパッシブサンプリング方法の確立及びサンプリングの実施

３）データ解析及びモデリング

（２）終了時評価

プロジェクト終了前３ヶ月以内に、プロジェクトの達成状況に関し JICA 及びタイ側とで合同評価を実施することで合意した。

（３）平成 17 年度案件について

平成 17 年度要請案件に関し、PCD 及び ERTC と協議を行い以下のとおり確認した。

１）PCD からの要請案件 “The Development of Environmental and Emission Standards of VOCs” については、基準作成のための取り組みに関し、技術的、行政的な側面からの協力が必要である。前者に関しては、今回プロジェクトにて実施するような研修及び VOCs 汚染状況の調査が、実際に汚染対策を担当する PCD にとっても重要な課題であることを確認した。後者に関しては、VOCs 基準作成に向けて、今回プロジェクトと補完関係にあるものである。

２）平成 17 年度案件として ERTC から要請が出されている“Receptor Model for Evaluation of VOCs Sources Apportionment in Bangkok Metropolitan Region”に関しては、ERTC との協議の結果、今回のプロジェクトの活動のなかで十分タイ側のニーズを満たすものである。

３－５　事前評価案

評価５項目により、本プロジェクトを以下のとおり評価する。

（１）妥当性

以下の点から、本プロジェクト実施の妥当性が高いことを確認した。

１）環境行政

実際に汚染対策を担当する PCD は、2004 年１月における国家環境委員会からの要求を受け、VOCs 大気環境モニタリング、環境基準及び排出基準の作成に着手したいとしている。本プロジェクトは、そのための調査研究として妥当性をもつ。

２）大気汚染対策の現状

タイにおいては、SOx、窒素酸化物（Nox）等の典型的な大気汚染物質については環境基準を満たしつつある現状がある一方、SPM やオゾンについてはいまだ完全には環境基準を満たしていない。光化学ダイオキシダント対策の一環としても VOCs 対策に必要な調査研究に着手する時期にきていることはおおむね妥当であると考えられる。

３）住民からのニーズ

工業地帯からの溶剤等の VOCs が原因とみられる住民からの苦情が発生しており、PCD、ERTC としては対応を迫られている状況である。これに対し、それぞれ財源を確保し独自の取り組みを開始していることからも、VOCs 対策に取り組む必要性は高い。

（２）有効性

以下の点から、本プロジェクトの有効性が高いことを確認した。

１）ERTC は調査研究機関であることから、本プロジェクトにおいては VOCs 大気汚染に関する分析法の研究・開発を成果１とし、成果２としてベースラインサーベイの実施をあげている。既存システム上、これらの成果が環境行政に生かされることを確認しており、タイの環境行政における ERTC の役割に合致した協力内容となっている。

２）ERTC は 1997 年の協力終了後も積極的に研修を実施しており、現在では 3,000m^2 もの研修棟を独自に建設し研修の拡充に努めている。本プロジェクトにおいて、ERTC の VOCs 大気汚染モニタリング技術の向上を図ることは、ERTC の新たな研修能力の向上につながる。

（３）効率性

以下の点から、本プロジェクトの効率性が高いことを確認した。

１）本プロジェクトの主要なカウンターパート２名は、1990 年から 1997 年にかけて実施された JICA のプロジェクト方式技術協力から継続して ERTC に勤務している者であり、また、その後もスウェーデンの協力を得て酸性雨の分析を行う等、基礎的な分析手法、研究手法については修得済みであると考えられる。また、その他のカウンターパート５名も既に指名され、ERTC 側の基礎的な体制が整っていることから、日本側の投入は短期専門家、研修、機材供与（現地調達）のみで可能であり、効率的な協力が実施できる。

2）タイ側からの投入として、機材のメンテナンスコスト、ランニングコスト、ローカルコスト、タイ国内での研修コスト等が確認されている。

（4）インパクト

以下の点から、本プロジェクトのインパクトが高いことを確認した。

1）上位目標である「VOCs 大気汚染に対する具体的施策がとられる」に関しては、実際に汚染対策を担当する PCD も VOCs 対策に意欲的であることから、VOCs 汚染リスクが高いことが科学的に確認できれば、十分に発現が見込まれるものである。

2）本プロジェクトにより、タイの事情（気象条件、社会条件等）に適したサンプリング手法が開発され、汚染対策委員会に提出されることをめざしており、VOCs 環境基準、排出基準策定に資する協力となることが期待できる。

（5）自立発展性

以下の点から、本プロジェクトの自立発展性が高いことを確認した。

1）本プロジェクトでは、ERTC の既存キャパシティーを十分に活用し、日本側の投入は短期専門家、研修、機材供与（現地調達）のみであり、プロジェクトの実施は ERTC が適宜日本人専門家からアドバイスを受けながら自主的に取り組むことを前提に計画しており、協力終了後も独自の研究・研修活動が継続される可能性は高い。

３－６　実施に向けてのスケジュールと留意事項

（1）スケジュール

今後、日本人専門家の分野や人数等の積み上げを行ったのち、事前評価表の作成を行い実施のための決裁を行う。決裁終了後、必要であれば討議議事録（R/D）を締結し正式に協力を開始する予定。

（2）留意事項

- 本プロジェクトは、長期専門家を派遣しない協力計画となっており、ERTC 側の進捗について適宜確認する必要がある。このため PO のなかでは、１年に１度プログレスレポートを作成し進捗を確認するようにした。
- PCD からの要請が日本政府により採択された際は、再度、本計画との役割分担について協議をもつ必要ある。
- ERTC が属する環境質向上局（DEQP）と PCD は、今後統合の可能性が協議されているとの情報をモンチップ氏等から得た。プロジェクトの運営にも影響を与える組織改革の動向については十分留意する必要がある。

３－７　平成 17 年案件に対する調査団の提案

PCD からの要請案件 “The Development of Environmental and Emission Standards of VOCs” については、今回プロジェクトを単なる研究協力にとどまらせることなく、環境行政に資する協力とするためにも重要な役割を果たすと考えられる。この要請案件が採択された際には、協力内容について再度タイ側関係者と協議をもち、今回プロジェクトの成果を活用した効率的な協力が実施できるよう、プロジェ

クト計画を立てる必要がある。

３－８　ERTC 関連補足情報

- プロジェクト方式技術協力終了後の ERTC の自立発展性については、今回十分協議・調査する時間はなかったものの、その後 3,000 ㎡の延べ床面積を有する研修棟を独自に建設し研修部分の拡張を行っており、かつ 2004 年度の予算も 9,700 万バーツを確保する（1997 年 : 5,381 万バーツ）等、十分自立発展的に活動を行っている様子がうかがえた。なお、ERTC の独立行政法人化の動きがかつてあったと側聞していたので、この件を DEQP に確認したところ、当分その可能性は低いとのことであった。
- 一方で、PCD との関係においては、「ERTC の研究結果は PCD 等の環境行政に役立つべき」との発言がモンチップ氏、ERTC 及び PCD 等の関係者からあるなどおおむね良好であると推察できるものの、PCD は、モニタリング用のラボや自動車の排気ガスを試験するための施設を有する等、独自のラボ活動を実施してきており、両機関の役割は必ずしも明確でない部分が生じてきている。

第４章　事業事前評価表（技術協力プロジェクト）

作成日：平成 16 年 11 月 8 日
担当部：地球環境部第二Ｇ公害対策第一Ｔ

１．案件名

タイ国環境研究能力向上プロジェクト

２．協力概要

（１）プロジェクト目標とアウトプットを中心とした概要の記述

本プロジェクトは、タイ天然資源環境省環境質向上局環境研究・研修センター（ERTC）をカウンターパート機関とし、①タイにおける適切な VOCs 大気環境モニタリング方法の開発、②VOCs 大気汚染の現状把握、③VOCs 大気汚染とヘルスリスク分析に関する ERTC の調査研究能力強化、という３つの成果を主要コンポーネントとする。これにより、タイ天然資源環境省における VOCs 大気汚染対策を講じるためのキャパシティー（環境基準、排出基準の策定を含む）が強化されることを目的とする。

（２）協力期間　３年

（３）協力総額（日本側）　7,500 万円

（４）協力相手先機関　タイ国天然資源環境省環境質向上局　環境研究・研修センター（ERTC）

（５）国内協力機関　環境省環境調査研修所、自治体

（６）裨益対象者及び規模、等

対象地域：バンコク市を中心にタイ全土

ターゲット：ERTC スタッフ７名に加え、プロジェクトの活動で行う研修を通じて、地方自治体の環境管理に携わる職員等も裨益対象者となる。

３．協力の必要性・位置づけ

（１）現状及び問題点

タイでは、工業化や都市化、モータリゼーションの進行を背景に深刻な大気汚染問題を抱えている。これまでのところ、一酸化炭素、二酸化窒素、二酸化硫黄、総浮遊粒子、PM-10、オゾン、鉛に関して大気環境基準を制定し、バンコク首都圏を中心に主要な県においてモニタリングを行っている。その結果、典型的な大気汚染物質については環境基準を満たしつつある一方、浮遊粒子やオゾンについてはいまだ完全には環境基準を満たしていない。2003 年に作成された世界銀行の報告書「Thailand Country Development Partnership-Environment」においても、タイの大気環境対策の重要課題として浮遊粒子対策があげられている。

この浮遊粒子は、工場や車両等から発生する揮発性有機化合物（Volatile Organic Compounds：VOCs）が原因物質の一つとして考えられていることから、タイ政府は、浮遊粒子対策としての VOCs 対策に注目し始めている。

さらに VOCs は、直接吸引することで、頭痛やめまい、腎障害などの有害性や発ガン性などの可能性が指摘されていることから、有害大気汚染物質対策としての VOCs 対策も重要視されている。また近年 VOCs が原因と考えられる悪臭を伴う事故が工場周辺で発生し、住民からの苦情が多く寄せられていることから、早急に対策をとる必要性が出てきている。

これらを受け、2004 年１月に首相が議長を務めるタイ国家環境委員会より汚染対策局に対し VOCs 対策に着手するよう要求が出されている。しかし、タイにおいては VOCs 大気環境基準値が設定されておらず、具体的な対策を立案するための体系的な大気モニタリングが実施されていない。また、モニタリング手法のノウハウも不足している状況である。

（2）相手国政府国家政策上の位置づけ

2004 年 1 月に首相が議長を務める国家環境委員会において、実際に汚染対策を担当する公害管理局に対し、VOCs モニタリングの開始、環境基準及び排出基準作成を要求しており、タイの環境行政上 VOCs 対策が優先度の高い課題として位置づけられている。

（3）我が国援助政策との関連、JICA 国別事業実施計画上の位置づけ（プログラムにおける位置付け）

国別事業実施計画において、協力重点 5 分野の 1 つに環境保全セクターがあげられており、本プロジェクトはそのなかの開発課題「公害管理対策」に位置づけられる。

4．協力の枠組み

〔主な項目〕

（1）協力の目標（アウトカム）

1）協力終了時の達成目標（プロジェクト目標）と指標・目標値

＜目標＞

天然資源環境省において VOCs 大気汚染対策を講じるためのキャパシティー（環境基準、排出基準の策定を含む）が強化される。

＜指標＞

・ERTC が汚染対策委員会に対し、信頼性のある VOCs 大気汚染モニタリング手法を提案する。

・天然資源環境省が、健康影響の観点から優先的に監視、管理すべき VOCs を認識する。

・ERTC が VOCs 大気汚染モニタリング手法に関する研修を実施できるだけの技術的能力を習得する。

・タイ国民が ERTC の研究を通して VOCs 大気汚染に関する認識を深める。

2）協力終了後に達成が期待される目標（上位目標）と指標・目標値

＜上位目標＞

VOCs 大気汚染に対する具体的対策がとられる。

＜指標＞

汚染対策委員会が VOCs 大気環境基準を策定するための具体的活動を行う際に、本プロジェクトの成果が活用される。

（2）成果（アウトプット）と活動

＜成果 1 ＞

タイにおける適切な VOCs 大気環境モニタリング方法が開発される。

＜指標＞

タイにおける適切な VOCs 大気モニタリング手法が汚染対策委員会に提出される。

＜活動＞

（1-1）ガスクロマトグラフー質量分析装置（GC/MS）、加熱脱着装置（TDU）等の機材の準備

（1-2）分析方法の予備試験の実施

（1-3）精度管理・精度保証（QA/QC）診断フローチャートの作成

（1-4）機材のメンテナンス
（1-5）他の分析方法との比較検討
（1-6）大気中 VOCs のサンプリング及び TDU- GC/MS を用いた分析標準作業手順（SOP）の作成
（1-7）１年次プログレスレポートの作成

＜成果２＞
VOCs 大気汚染の現状が明らかにされる。
＜指標＞
・VOCs 大気汚染のベースラインサーベイが実施される。
・VOCs 大気汚染の地理分布が解明される。
・VOCs 大気汚染の時系列解析が行われる。
・VOCs 排出インベントリーが作成される。
・健康影響の観点から VOCs 大気汚染が評価される。
・VOCs 大気汚染の現状に関する技術報告書が作成される。
＜活動＞
（2-1）調査、サンプリングサイトの選定（少なくとも９箇所以上）
（2-2）24 時間サンプリングに基づいたベースライン調査
（2-3）VOCs 排出インベントリーの作成
（2-4）屋内および屋外におけるパッシブサンプリング方法の確立およびサンプリングの実施
（2-5）TDU- GC/MS を用いたパッシブサンプルの分析標準作業手順（SOP）の作成
（2-6）データ解析（地理分布、時系列分析）
（2-7）２年次プログレスレポートの作成

＜成果３＞
VOCs 大気汚染とヘルスリスク分析に関する ERTC の調査研究能力が強化される。
＜指標＞
・７名の ERTC スタッフ（サンプリング：３名、分析：４名）が、プロジェクトの２年目終了時までに、VOCs 大気汚染モニタリングを計画し実行できるようになる。
・４名の ERTC スタッフが、パッシブサンプリング手法を用いて、室内・室外の VOCs 大気汚染レベルを調査できるようになる。
・７名の ERTC スタッフがタイにおける VOCs 大気汚染の状況を明らかにするためのデータ解析技術を習得する。
＜活動＞
（3-1）VOCs 大気汚染モニタリング研修の実施
（3-2）パッシブサンプリング手法に関する研修の実施
（3-3）データ解析とモデル化に関する研修の実施
（3-4）VOCs 排出インベントリー研修の実施
（3-5）ワークショップ、セミナーの開催

（3-6）VOCs 大気汚染の現状に関するテクニカルレポートの作成

（3）投入（インプット）

① 日本側（総額 7,500 万円）

短期専門家派遣　20M/M 程度（約 5,000 万円）

供与機材（約 1,500 万円）

研修員受入れ　10M/M（約 1,000 万円）

② タイ国側（総額 835 万円）

機材メンテナンスコスト（68 万円）

ランニングコスト（340 万円）

ローカルコスト（337 万円）

タイにおける研修コスト（90 万円）

（4）外部要因（満たされるべき外部条件）

・カウンターパートが ERTC に勤務を続ける。

・タイ側の投入（メンテナンスコスト、ランニングコスト等）が適切に投入される。

・タイの環境行政における VOCs 対策の優先度に変更が生じない。

5．評価 5 項目による評価結果

（1）妥当性

以下の点から、本プロジェクト実施の妥当性が高いことを確認した。

1）環境行政

汚染対策を担当する公害防止局は、2004 年 1 月における国家環境委員会等からの要求を受け、VOCs 大気環境モニタリング、環境基準及び排出基準の作成を優先的課題としている。本プロジェクトは、そのための調査研究として妥当性をもつ。

2）大気汚染対策の現状

タイにおいては、SOx、NOx 等の典型的な大気汚染物質については環境基準を満たしつつある一方、SPM やオゾンについてはいまだ完全には環境基準を満たしていない。光化学ダイオキシダント対策の一環としても VOCs 対策に必要な調査研究に着手する時期にきていることはおおむね妥当であると考えられる。

3）住民からのニーズ

工業地帯からの溶剤等の VOCs が原因と見られる住民からの苦情が発生しており、公害防止局、ERTC としては対応を迫られている状況である。これに対し、それぞれ財源を確保し独自の取り組みを開始していることからも、VOCs 対策に取り組む必要性は高い。

（2）有効性

以下の点から、本プロジェクトの有効性が高いことを確認した。

1）ERTC は調査研究機関であることから、本プロジェクトにおいては VOCs 大気汚染に関する分析法の研究・開発を成果 1 とし、成果 2 としてベースラインサーベイの実施をあげている。既存システム上、これらの成果が環境行政に生かされることを確認しており、タイの環境行政における ERTC の役割に合致した協力内容となっている。

2）ERTC は 1997 年の協力終了後も積極的に研修を実施しており、現在では 3,000m^2 もの 研修棟を独自に建設し研修の拡充に努めている。本プロジェクトにおいて、ERTC の VOCs 大気汚染モニタリング技術の向上を図ることは、ERTC の新たな研修能力の向上につながる。

（3）効率性

以下の点から、本プロジェクトの効率性が高いことを確認した。

1）本プロジェクトの主要なカウンターパート３名は、1990 年から 1997 年にかけて実施された JICA のプロジェクト方式技術協力から継続して ERTC に勤務している者であり、また、その後もスウェーデンの協力を得て酸性雨の分析を行う等、基礎的な分析手法、研究手法については修得済みであると考えられる。また、その他のカウンターパート４名も既に指名され、ERTC 側の基礎的な体制が整っていることから、日本側の投入は短期専門家、研修、機材供与（現地調達）のみで可能であり、効率的な協力が実施できる。

2）タイ側からの投入として、機材のメンテナンスコスト、ランニングコスト、ローカルコスト、タイ国内での研修コスト等が確認されている。

（4）インパクト

以下の点から、本プロジェクトのインパクトが高いことを確認した。

1）上位目標である「VOCs 大気汚染に対する具体的施策がとられる」に関しては、実際に汚染対策を担当する公害防止局も VOCs 対策を優先課題としていることから、VOCs 汚染リスクが高いことが科学的に確認できれば、十分に発現が見込まれるものである。

2）本プロジェクトにより、タイの事情（気象条件、社会条件等）に適したサンプリング手法が開発され、汚染対策委員会に提出されることをめざしており、VOCs 環境基準、排出基準策定に資する協力となることが期待できる。

（5）自立発展性

以下の点から、本プロジェクトの自立発展性が高いことを確認した。

1）本プロジェクトでは、ERTC の既存キャパシティーを十分に活用し、日本側の投入は短期専門家、研修、機材供与（現地調達）のみであり、プロジェクトの実施は ERTC が適宜日本人専門家からアドバイスを受けながら自主的に取り組むことを前提に計画しており、協力終了後も独自の研究・研修活動が継続される可能性は高い。

６．貧困・ジェンダー・環境等への配慮

本プロジェクトは公害対策を目的としており環境に対しネガティブなインパクトは生じない。

７．過去の類似案件からの教訓の活用

研究機関に対する協力においては、いかに環境行政に資する協力とするかが課題と考えられるが、今回事前評価調査において、タイのもつ既存システムを確認し、ERTC の研究成果が環境行政に生かされることを確認した。

８．今後の評価計画

2008 年２月ごろ　終了時評価

付　属　資　料

１．Minutes of Meeting（2004年10月16日付け）
２．Amendment of Minutes of Meeting（2005年３月４日付け）
３．質問票
４．ERTCの概要（2004年10月12日付けERTC作成資料）
５．ERTCに係る経緯
６．組織図（MoNRE、PCD、ERTC）
７．世界銀行国別開発パートナーシップ（タイ）環境分野の取り組み（2004～2007年）
８．タイにおける環境をめぐる動向及び環境管理の現状〔"Environmental Sector Priority in Thailand"（Draft Report）より抜粋（JICAタイ事務所／Social Research Institute, Chiang Mai University）〕

MINUTES OF MEETING BETWEEN JAPANESE PREPARATORY STUDY TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF KINGDOM OF THAILAND ON JAPANESE TECHNICAL COOPERATION FOR THE CAPACITY BUILDING FOR ENVIRONMENTAL RESEARCH IN THAILAND

The Japanese Preparatory Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), visited the Kingdom of Thailand from October 11th, 2004 to October 16th, 2004 for the purpose of working out the details of the technical cooperation project for "Capacity Building for Environmental Research in Thailand" (hereinafter referred to as "the Project").

During its stay in the Kingdom of Thailand, the Team exchanged views and had a series of discussions with the Thai authorities concerned with respect to desirable measures to be taken by JICA and the Government of Thailand for the successful implementation of the Project.

As a result of the discussions, and in accordance with the provisions of the Agreement on Technical Cooperation between the Government of Japan and the Government of Thailand signed on November 5, 1981 (hereinafter referred to as "the Agreement") and the Embassy of Japan's Note No.149/16 dated May 19, 2004 and the Ministry of Foreign Affairs of Thailand's Note No.0607/6791 dated June 4, 2004, the Team and the Thai authorities concerned came to the understanding concerning the matters referred to in the document hereto, and agreed to recommend this to their respective Governments.

Bangkok, October 15, 2004

岩崎 英二

Mr. Eiji IWASAKI
Leader of the Preparatory Study Team,
Japan International Cooperation Agency
(JICA)

Mr. Pradit Boontantrapiwat
Director,
Environmental Research and Training Center (ERTC),
Department of Environmental Quality Promotion (DEQP),
Ministry of Natural Resources and Environment (MoNRE)

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN JICA AND GOVERNMENT OF THAILAND

1. The Government of Thailand will implement the Project in cooperation with JICA.
2. The Project will be implemented in accordance with the Master Plan which is given in Annex I. The Plan of Operation is also shown in Annex II.

II. MEASURES TO BE TAKEN BY JICA

In accordance with the laws and regulations in force in Japan and the provisions of Article III of the Agreement, JICA as the executing agency for technical cooperation by the Government of Japan, will take, at its own expense, the following measures according to the normal procedures of its technical cooperation scheme.

1. DISPATCH OF JAPANESE EXPERTS

JICA will provide the services of the Japanese experts as listed in Annex III. The provision of Article IV of the Agreement will be applied to the above-mentioned experts.

Both sides confirmed that the official request form to assign Japanese experts for the term of technical cooperation will be submitted by DEQP.

2. PROVISION OF MACHINERY AND EQUIPMENT

JICA will provide such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex III. The provision of Article VIII of the Agreement will be applied to the Equipment.

Both sides confirmed that the official request form for provision of equipment will be submitted by DEQP.

3. TRAINING OF COUNTERPART PERSONNEL IN JAPAN

JICA will receive Thai counterpart personnel connected with the Project for technical training in Japan.

Both sides confirmed that the official request form for training in Japan will be submitted by the Government of Thailand.

III. MESURES TO BE TAKEN BY THE GOVERNMENT OF THAILAND

1. The Government of Thailand will take necessary measures to ensure that self-reliant operation of the Project will be sustained during and after the period of Japanese technical cooperation, through full and active involvement in the Project by all related authorities, beneficiary groups and institutions.
2. The Government of Thailand will ensure that the technologies and knowledge acquired by the Thai nationals as a result of Japanese technical cooperation will contribute to the economic and social development of the Kingdom of Thailand.
3. In accordance with the provisions of Article IV, V, VI of the Agreement, the Government of Thailand will grant in Thailand privileges, exemptions and benefits to the Japanese experts referred to in II-1 above and their families.
4. The Government of Thailand will take necessary measures to ensure that the knowledge and experience acquired by the Thai counterpart personnel from technical training in Japan will be utilized effectively in the implementation of the Project.
5. In accordance with the provisions of Article IV- (b) of the Agreement, the Government of

Thailand will provide the services of Thai counterpart personnel and administrative personnel as listed in Annex IV.

6. In accordance with the provisions of Article IV- (a) of the Agreement, the Government of Thailand will provide the office space and facilities mutually agreed upon as necessary.
7. In accordance with the laws and regulations in force in the Kingdom of Thailand, the Government of Thailand will take necessary measures to meet the running expenses necessary for the implementation of the Project.

IV. Administration of the Project

1. The Team requested to Environmental Research and Training Center (hereinafter referred to as "ERTC") that DEQP will take overall responsibility for the Project. ERTC will consult this matter with DEQP and reply the result to the JICA Thailand Office.
2. The Team requested to ERTC that Director General, DEQP as the Project Director, will bear overall responsibility for the administration and implementation of the Project. ERTC will consult this matter with DEQP and reply the result to the JICA Thailand Office.
3. Director of ERTC, as the Project Manager, will be responsible for the managerial and technical matters of the Project.
4. The Japanese experts will give necessary technical guidance and advice to the Thai counterpart personnel on technical matters pertaining to the implementation of the Project.
5. The Meeting will be held at least once a year between Thai side and Japanese side authorities concerned for the purpose of as follows;

(1) To review the overall progress and achievements of the Project,
(2) To exchange views on major issues arising from or in connection with the Project, and
(3) To work out the modification of activities depending on the necessity

6. DEQP will nominate the counterparts of the Project for training in Japan and the counterparts trained in Japan should present the results to DEQP.

V. DURATION OF COOPERATION

The duration of technical cooperation for the Project under this Attached Document will be thirty-six (36) months starting from the date when equipment is delivered in 2005.

VI. JOINT EVALUATION

Evaluation of the Project will be conducted jointly by JICA and the Thai authorities concerned, during the last three (3) months of the cooperation in order to examine the level of achievement.

VII. MUTUAL CONSULTATION

There will be mutual consultation between JICA and the Thai authorities concerned on any major issues arising from, or in connection with this Attached Document.

VIII. MEASURES TO PROMOTE UNDERSTANDING OF AND SUPPORT FOR THE PROJECT

For the purpose of promoting support for the Project among the people of the Kingdom of Thailand, DEQP will take appropriate measures to make the Project widely known to the people of the Kingdom of Thailand.

IX. OTHERS

1. New two proposals over VOCs

The Team has discussed with staff of PCD and ERTC over new proposals for Japanese

FY2005 to find out background information and relationships with the Project.

Regarding the proposal from PCD namely, "The Development of Environmental and Emission Standards of VOC", PCD explained that the request contains two fields of the expertise i.e. environmental administration and environmental technique. Furthermore, two following items are recognized by both sides; i) such activities as training and investigating the situation of contamination in the Project are useful to PCD in terms of the environmental technique, ii) the administrative part of the proposal and the Project are mutually complementary since they have the same direction of developing environmental and emission standards of VOCs.

Regarding the proposal from ERTC, namely "Receptor Model for Evaluation of VOC Source Apportionment in Bangkok Metropolitan Region", both sides agree that it is possible to address the problem practically through the Project.

2. List of Participants

List of Participants in the series of discussions during the Team visit in Thailand is shown in Annex V.

LIST OF ANNEXES

ANNEX I	MASTER PLAN
ANNEX II	TENTATIVE PLAN OF OPERATION
ANNEX III	LIST OF INPUTS FROM JAPANESE SIDE
ANNEX IV	TENTATIVE LIST OF THAI COUNTERPART AND ADMINISTRATIVE PERSONNEL
ANNEX V	LIST OF PARTICIPANTS

ANNEX I MASTER PLAN

PROJECT TITLE: Capacity Building for Environmental Research in Thailand

1. Overall goal: Concrete actions on air pollution by VOC will be taken

Indicator: Output of the study will support the Pollution Control Board to take a concrete action for setting up air quality standards for VOC in Thailand

2. Project purpose: MoNRE's capacity to take countermeasures against VOC air pollution including development of environmental and emission standards in Thailand is enhanced.

Indicators:

1) ERTC can propose reliable measurement methodologies for ambient VOC monitoring to the Pollution Control Board
2) Priority compounds of VOC in terms of human health risk to be monitored and controlled in Thailand are recognized in MoNRE
3) ERTC has a technical capability to conduct training courses on air quality monitoring method of VOCs
4) Awareness of VOC air pollution is enhanced through ERTC research

3. Project outputs:

1) Development of appropriate methodologies for VOC ambient monitoring in Thailand

Indicator: Submission of appropriate methodologies for ambient VOC monitoring to the Pollution Control Board

2) Elucidation of the VOC contamination status in Thailand

Indicators:

a. Baseline survey
b. Spatial distribution of ambient VOCs
c. Time series analysis of ambient VOCs
d. Emission inventories for prevailing VOCs
e. Evaluate VOC air pollution from the view point of human health risk
f. Technical report

3) Strengthening of the ERTC's capability to research on VOC air contamination and health risk

Indicators:

a. 7 ERTC personnel (3 persons for sampling, 4 persons for analysis) can design and conduct VOC monitoring in ambient air by the end of the second year.

b. 4 ERTC personnel can investigate the indoor/outdoor exposure levels using passive sampling method.

c. 7 ERTC personnel acquire data interpretation for clarifying severity of VOC air pollution in Thailand.

4. Project activities

4.1 Activities under Output 1

(1) Preparation of equipment and materials i.e., Gas Chromatograph Mass Spectrometer (GC/MS), thermal desorption unit (TDU), pumps, solid adsorbent tubes

(2) Preliminary test of the methods

(3) Quality Assurance and Quality Control (QA/QC) diagnosis flow chart

(4) Maintenance of equipment

(5) Comparative study with other methods

(6) Preparation of Standardized Operation Procedures (SOPs) for sampling and analysis using TDU-GC/MS method

(7) 1st year progress report

4.2 Activities under Output 2

(1) Survey and sampling site selection (at least 9 sampling sites)

(2) Baseline survey (based on 24hrs sampling)

(3) Emission inventory for prevailing VOCs

(4) Establishment of passive sampling method (indoor/outdoor) and measurement

(5) Preparation of SOPs (sampling/analysis) for TDU-GC/MS method for passive samples

(6) Data interpretation with respect to spatial distribution and time series analysis

(7) 2nd year progress report

4.3 Activities under Output 3

(1) Training on VOC ambient monitoring method (in Thailand)

(2) Training on establishment of passive sampling method (in Japan)

(3) Training on data interpretation and modeling (in Japan)

(4) Training on emission inventory for VOCs (in Japan)

(5) Workshop and/or seminar (in Thailand)

(6) Technical report on state of VOC air pollution in Thailand

ANNEX II TENTATIVE PLAN OF OPERATION

The both sides confirmed the Plan of Operation (hereinafter referred to as "P/O") of the Project. This P/O has been formulated for the purpose of realizing the detailed schedule of the activities in the Master Plan as shown in the next page. This P/O is subject to budget approval. When necessity arises, both sides will consult to modify P/O.

Tentative Plan of Operation

Expected Outputs	Activities	Schedule				Duration of Activities(Month)
		1st year	2nd year	3rd year	4th year	
1.Development of appropriate methodologies for VOC ambient monitoring in Thailand	(1.1) Preparation of equipment and materials (GC/MS, thermal desorption sampling, pumps, solid adsorbent					2
	(1.2) Preliminary test of the methods*					4
	(1.3) QA/QC diagnosis flow chart*					2
	(1.4) Maintenance of equipment					continuous
	(1.5) Comparative study with other methods*					3
	(1.6) Preparation of SOPs (sampling/analysis) for TDU-GC/MS method*					12
	(1.7) Progress report*					1
2.Elucidation of the VOC contamination status in Thailand	(2.1) Survey and sampling site selection (at least 9 sampling sites)*					2
	(2.2) Baseline survey (based on 24hrs sampling) *					24
	(2.3) Emission inventory for prevailing VOCs* **					8
	(2.4) Establishment of passive sampling method (indoor/outdoor) and measurement* **					6
	(2.5) Preparation of SOPs (sampling/analysis) for TDU-GC/MS method for passive samples*					6
	(2.6) Data interpretation with respect to spatial distribution and time series analysis* **					3 (1.5x2)
	(2.7) Progress report*					1
3. Strengthening of the ERTC's capability to research on VOC air contamination and health risk	(3.1) Training on VOC ambient monitoring method (in Thailand)					12
	(3.2) Training on establishment of passive sampling method (in Japan)					2
	(3.3) Training on data interpretation and modeling (in Japan)					1
	(3.4) Training on emission inventory for VOCs* (in					2
	(3.5) Workshop/Seminar*					5 days
	(3.6) Technical Report on state of VOC air pollution in Thailand*					2

* Need technical assistance from the expert for the capacity building of ERTC staffs (activities in Thailand).

** Capaity building of ERTC staffs through technical training in Japan.

Ed. Poothit.

ANNEX III LIST OF INPUTS FROM JAPANESE SIDE

1. Short-term Expert
The short-term experts who will fulfill the following subjects, will be dispatched.

(1) TOR of 1st year
a. Preliminary test of the methods
b. QA/QC diagnosis flow chart
c. Comparative study with other methods
d. Preparation of SOPs (sampling/analysis) for TDU-GC/MS method
e. Supervision of making 1st year progress report

(2) TOR of 2nd year
a. Emission inventory for prevailing VOCs
b. Establishment of passive sampling method (indoor/outdoor) and measurement
c. Preparation of SOPs (sampling/analysis) for TDU-GC/MS method for passive samples
d. Data interpretation with respect to spatial distribution and time series analysis
e. Supervision of making 2nd year progress report

(3) TOR of 3rd year
a. Workshop and/or seminar
b. Supervision of making the technical report

2. List of Equipment
The following equipment, if necessary for the implementation of the Project, will be provided.

- Volatile organic compounds sampling and analytical instrument with its accessories, 1 set

Both sides confirmed the following points:
(1) The equipment should be utilized to achieve the Project purpose.
(2) The Thai side will take necessary measures for the installation of the equipment.
(3) The Thai side will provide the running cost expenses and consumable supplies for the equipment.

3. Theme of the Training of counterpart personnel in Japan
The Training of counterpart personnel in Japan will be conducted for enhancing the capability for following points.

(1) Emission inventory for VOCs
(2) Establishment of passive sampling method (indoor/outdoor) and measurement
(3) Data interpretation and modeling

ANNEX IV TENTATIVE LIST OF COUNTERPART AND ADMINISTRATIVE PERSONNEL

1. Project administrative management counterpart

(1) Project Director

Mr. Suvat Singhapant	Director General, DEQP

(2) Deputy Director

Ms. Pornthip Puncharoen	Deputy Director General, DEQP

(3) Project Manager

Mr. Pradit Boontantrapiwat	Director, ERTC

2. Technical Counterpart

Air Quality Research and Technology Development Section, ERTC

(1) Dr. Hathairatana Garivait	Director
(2) Ms. Wanna Laowagul	Environmental Officer 7
(3) Mr. Weraptep Greeratithadaniyom	Environmental Officer 6
(4) Mr. Sirapong Sooktawee	Environmental Officer
(5) Mr. Supachai Lamool	Environmental Officer
(6) Ms. Saranya Prapatsornpinyo	Environmental Officer
(7) Mr. Nirun Piemyai	Technician

3. Other personnel will be assigned if necessary

ANNEX V LIST OF PARTICIPANTS

THAI SIDE

MoNRE

Dr. Monthip Sriratana Tabucanon	Inspector General

DEQP

Mr. Suvat Singhapant	Director General
Ms. Pornthip Puncharoen	Deputy Director General

ERTC

Mr. Pradit Boontantrapiwat	Director, ERTC

Air Quality Research and Technology Development Section, ERTC

Dr. Hathairatana Garivait	Director
Ms. Wanna Laowagul	Environmental Officer 7
Mr. Sirapong Sooktawee	Environmental Officer
Mr. Supachai Lamool	Environmental Officer
Ms. Saranya Prapatsompinyo	Environmental Officer
Mr. Nirun Piemyai	Technician

Toxic Substances Research and Technology Development Section, ERTC

Ms. Sukanya Boonchalermkit	Director
Mr. Sutiab Srilachai	Environmental Officer 6
Mr. Prachuap Kuna-ake	Environmental Officer

Water Quality Research and Technology Development Section, ERTC

Dr. Fairda Malem	Environmental Officer 5

Noise and Vibration Research and Technology Development Section, ERTC

Mr. Thanaphan Suksaad	Environmental Officer 7

Air Quality & Noise Management Bureau, PCD

Ms. Mingquan Wichayarangsaridh	Director
Mr. Hiroyuki Kurumiya	Volunteer

Ambient Air Quality Division, Air Quality & Noise Management Bureau, PCD

Mr. Phunsak Thiramongkol	Director
Dr. Sarawut Thepanondh	Environmental Officer 5
Ms. Nittaya Chaisa-at	Environmental Officer 5

Automotive Air Pollution Section, Air Quality & Noise Management Bureau, PCD

Mr. Panya Warapetcharayut	Director

Industrial Air pollution section, Air Quality & Noise Management Bureau, PCD

Mr. Thalearngsak Petchsuwan	Director
Ms. Pilai Thiandat	Environmental Officer 7
Dr. Jariya Sukhapan	Environmental Officer 5

JAPANESE SIDE

Japanese Embassy Mr. Kenichi KAMAE	First Secretary
JICA Expert Dr. Jin SATO	JICA Expert, Office of Natural Resources and Environmental Policy and Planning, MoNRE
JICA Thailand Office Mr. Shoichi OKUMURA Mr. Mikiya SAITO	Deputy, Resident Representative Assistant Resident Representative
JICA Preparatory Study Team Mr. Eiji IWASAKI Dr. Seiji WATANABE Ms. Izumi TSUCHIHATA	Leader Technical Expert Cooperation Planning

AMENDMENT OF MINUTES OF MEETING BETWEEN JAPANESE PREPARATORY STUDY TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF KINGDOM OF THAILAND ON JAPANESE TECHNICAL COOPERATION FOR THE CAPACITY BUILDING FOR ENVIRONMENTAL RESEARCH IN THAILAND

Based on the Minutes of Meeting signed on October 15, 2004 of the successive Preparatory Study conducted by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA Thailand Office had a series of discussions with Thai authorities concerned on desirable measures to be taken by both JICA and Thai authorities concerned for the successful implementation of the Project on "Capacity Building for Environmental Research in Thailand" (hereinafter referred to as "the Project").

As a result of discussions, and in accordance with the provisions of the Agreement on Technical Cooperation between the Government of Japan and the Government of Thailand signed on November 5, 1981 (hereinafter referred to as "the Agreement") and the Embassy of Japan's Note No.149/16 dated May 19, 2004 and the Ministry of Foreign Affairs of Thailand's Note No.0607/6791 dated June 4, 2004, JICA and the Department of Environmental Quality Promotion came to the understanding concerning the matters referred to in the document hereto, and agreed to recommend this to their respective Governments.

Bangkok, March 4, 2005

Mr.Mikiharu SATO
Resident Representative,
Japan International Cooperation Agency
(JICA)

Mr.Chartree Chueyprasit
Director General,
Department of Environmental Quality
Promotion (DEQP),
Ministry of Natural Resources and
Environment (MoNRE)

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN JICA AND GOVERNMENT OF THAILAND

The Project will be implemented in accordance with the Master Plan which is given in Annex I. The Plan of Operation is also shown in Annex II.

II. MEASURES TO BE TAKEN BY JICA

In accordance with the laws and regulations in force in Japan and the provisions of Article III of the Agreement, JICA as the executing agency for technical cooperation by the Government of Japan, will take, at its own expense, the following measures according to the normal procedures of its technical cooperation scheme.

1. DISPATCH OF JAPANESE EXPERTS

JICA will provide the services of the Japanese experts as listed in Annex III. The provision of Article IV of the Agreement will be applied to the above-mentioned experts.

Both sides confirmed that the official request form to assign Japanese experts for the term of technical cooperation will be submitted by DEQP.

2. PROVISION OF MACHINERY AND EQUIPMENT

JICA will provide such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex III. The provision of Article VIII of the Agreement will be applied to the Equipment.

Both sides confirmed that the official request form for provision of equipment will be submitted by DEQP.

III. Administration of the Project

The Director General, DEQP as the Project Director, will bear overall responsibility for the administration and implementation of the Project.

LIST OF ANNEXES

ANNEX I MASTER PLAN

ANNEX II TENTATIVE PLAN OF OPERATION

ANNEX III LIST OF INPUTS FROM JAPANESE SIDE

ANNEX I MASTER PLAN

PROJECT TITLE: Capacity Building for Environmental Research in Thailand

1. **Overall goal:** Concrete actions on air pollution by VOC will be taken

Indicator: Output of the study will support the Pollution Control Board to take a concrete action for setting up air quality standards for VOC in Thailand

2. **Project purpose:** MoNRE's capacity to take countermeasures against VOC air pollution including development of environmental and emission standards in Thailand is enhanced.

Indicators:

1) ERTC can propose reliable measurement methodologies for ambient VOC monitoring to the Pollution Control Board
2) Priority compounds of VOC in terms of human health risk to be monitored and controlled in Thailand are recognized in MoNRE
3) ERTC has a technical capability to conduct training courses on air quality monitoring method of VOCs
4) Awareness of VOC air pollution is enhanced through ERTC research

3. Project outputs:

1) Development of appropriate methodologies for VOC ambient monitoring in Thailand

Indicator: Submission of appropriate methodologies for ambient VOC monitoring to the Pollution Control Board

2) Elucidation of the VOC contamination status in Thailand

Indicators:

a. Baseline survey
b. Spatial distribution of ambient VOCs
c. Time series analysis of ambient VOCs
d. Emission inventories for prevailing VOCs
e. Evaluate VOC air pollution from the view point of human health risk
f. Technical report

3) Strengthening of the ERTC's capability to research on VOC air contamination and health risk

Indicators:

a. 7 ERTC personnel (3 persons for sampling, 4 persons for analysis) can design and conduct VOC monitoring in ambient air by the end of the second year,
b. 4 ERTC personnel can investigate the indoor/outdoor exposure levels using passive sampling method.

c. 7 ERTC personnel acquire data interpretation for clarifying severity of VOC air pollution in Thailand.

4. Project activities

4.1 Activities under Output 1

(1) Preparation of equipment and materials i.e., Gas Chromatograph Mass Spectrometer (GC/MS), preconcentrator system, canister, passive canister sampler

(2) Preliminary test of the methods

(3) Quality Assurance and Quality Control (QA/QC) diagnosis flow chart

(4) Maintenance of equipment

(5) Comparative study with other methods

(6) Preparation of Standardized Operation Procedures (SOPs) for sampling and analysis using Canister-GC/MS method

(7) 1st year progress report

4.2 Activities under Output 2

(1) Survey and sampling site selection (at least 9 sampling sites)

(2) Baseline survey (based on 24hrs sampling)

(3) Emission inventory for prevailing VOCs

(4) Establishment of passive sampling method (indoor/outdoor) and measurement

(5) Preparation of SOPs (sampling/analysis) for TDU-GC/MS method for passive samples

(6) Data interpretation with respect to spatial distribution and time series analysis

(7) 2nd year progress report

4.3 Activities under Output 3

(1) Training on VOC ambient monitoring method (in Thailand)

(2) Training on establishment of passive sampling method (in Japan)

(3) Training on data interpretation and modeling (in Japan)

(4) Training on emission inventory for VOCs (in Japan)

(5) Workshop and/or seminar (in Thailand)

(6) Technical report on state of VOC air pollution in Thailand

Tentative Plan of Operation

Expected Outputs	Activities	Schedule				Duration of Activities(Month)
		1st year	2nd year	3rd year	4th year	
1.Development of appropriate methodologies for VOC ambient monitoring in Thailand	(1.1) Preparation of equipment and materials (GC/MS, preconcentrator system, canister, passive canister sampler)					2
	(1.2) Preliminary test of the methods*					4
	(1.3) QA/QC diagnosis flow chart*					2
	(1.4) Maintenance of equipment					continuous
	(1.5) Comparative study with other methods*					3
	(1.6) Preparation of SOPs (sampling/analysis) for Canister-GC/MS method*					12
	(1.7) Progress report*					1
2.Elucidation of the VOC contamination status in Thailand	(2.1) Survey and sampling site selection (at least 9 sampling sites)*					2
	(2.2) Baseline survey (based on 24hrs sampling) *					24
	(2.3) Emission inventory for prevailing VOCs* **					8
	(2.4) Establishment of passive sampling method (indoor/outdoor) and measurement* **					6
	(2.5) Preparation of SOPs (sampling/analysis) for TDU-GC/MS method for passive samples*					6
	(2.6) Data interpretation with respect to spatial distribution and time series analysis* **					3 (1.5x2)
	(2.7) Progress report*					1
3. Strengthening of the ERTC's capability to research on VOC air contamination and health risk	(3.1) Training on VOC ambient monitoring method (in Thailand)					12
	(3.2) Training on establishment of passive sampling method (in Japan)					2
	(3.3) Training on data interpretation and modeling (in Japan)					1
	(3.4) Training on emission inventory for VOCs* (in Japan)					2
	(3.5) Workshop/Seminar*					5 days
	(3.6) Technical Report on state of VOC air pollution in Thailand*					2

* Need technical assistance from the expert for the capacity building of ERTC staffs (activities in Thailand).

** Capacity building of ERTC staffs through technical training in Japan.

ANNEX III LIST OF INPUTS FROM JAPANESE SIDE

1. Short-term Expert

The short-term experts who will fulfill the following subjects, will be dispatched.

(1) TOR of 1st year

a. Preliminary test of the methods
b. QA/QC diagnosis flow chart
c. Comparative study with other methods
d. Preparation of SOPs (sampling/analysis) for Canister-GC/MS method
e. Supervision of making 1st year progress report

(2) TOR of 2nd year

a. Emission inventory for prevailing VOCs
b. Establishment of passive sampling method (indoor/outdoor) and measurement
c. Preparation of SOPs (sampling/analysis) for TDU-GC/MS method for passive samples
d. Data interpretation with respect to spatial distribution and time series analysis
e. Supervision of making 2nd year progress report

(3) TOR of 3rd year

a. Workshop and/or seminar
b. Supervision of making the technical report

2. List of Equipment

The following equipment, if necessary for the implementation of the Project, will be provided.

- Volatile organic compounds sampling and analytical instrument with its accessories, 1 set

Both sides confirmed the following points:

(1) The equipment should be utilized to achieve the Project purpose.
(2) The Thai side will take necessary measures for the installation of the equipment.
(3) The Thai side will provide the running cost expenses and consumable supplies for the equipment.

3. Theme of the Training of counterpart personnel in Japan

The Training of counterpart personnel in Japan will be conducted for enhancing the capability for following points.

(1) Emission inventory for VOCs
(2) Establishment of passive sampling method (indoor/outdoor) and measurement
(3) Data interpretation and modeling

QUESTIONNAIRES ON THE PROJECT OF CAPACITY BUILDING FOR ENVIRONMENTAL RESEARCH IN THE KINGDOM OF THAILAND

This questionnaire is for the purpose of collecting information needed for designing of the project on the Capacity Building for Environmental Research in Thailand, which is requested by ERTC.

The Preparatory Study Team is going to be dispatched from October 12 to 15, 2004 to discuss the framework of the project with Thai authorities concerned.

We expect that some of the questions might be difficult to answer, but we would appreciate it if you could prepare for the information as much as possible.

Thank you very much for your kind cooperation.

October 4, 2004

Sincerely yours,

Eiji IWASAKI

Leader of the Preparatory Study Team

Japan International Cooperation Agency (JICA)

QUESTIONNAIRES TO ERTC/PCD

To formulate an effective and efficient project for Thailand, please kindly provide us with information by answering the questions below. For better understanding we appreciate the answers in writing or with photocopied documents from existing papers.

I. Issues related to air pollution management

1-1 What kinds of pollutants are covered by the existing air quality standard and emission standards for air pollution?

1-2 Outline of existing vehicle emission standards

1-3 How do you monitor the ambient air standards which have already established?

1-4 Compliance of air pollutants with the air quality standards

1-5 What is the priority issue which should be managed among the air pollutants?

1-6 Procedures of establishing (developing) ambient air quality standard and emission standard

1-7 Outline of fuel switching program

II. Issues related to VOCs' countermeasures

2-1 Pollution level of VOCs or severity of VOCs pollution

2-2 What is a priority of VOCs pollution control among the air pollution management?

2-3 Program and measures taken for VOCs controls, if any, problems and constrains for VOCs polltion control

2-4 In the procedures of program and measures taken for VOCs controls, what kinds of research and studies are needed?

2-5 Expertise needed from Japan for setting up standards and VOCs' countermeasures

2-6 Coordination or relationship with CDP which has the focus on reducing fine particulate matter in Bangkok

2-7 Which department is in charge of VOCs pollution control and setting up standards and VOCs' countermeasures?

2-8 What kind of authorities should be involved in setting up standards and VOCs' countermeasures?

III. Technical issues on VOCs' countermeasures

3-1 How many tons of VOCs are imported, exported, and used in Thailand? Could you review their recent statistical data?
These data together with individual toxicity data and actual concentration in Thai environment are on the basis of selecting target VOC items for the project.
In addition, we think that comparison of these statistical data between Thailand and Japan may give us a clue to the understanding of VOCs pollution.
"Study on Utilization and Management Situation of Volatile Organic Compounds in Thailand" by Thailand Environment Institute (TEI) referred statistical data on VOC import in 1996. In Japan, air emission of VOCs in 2001 and 2002 was estimated by our PRTR system. Assuming that all of the imported VOCs had been emitted to the air, of course this is very rough assumption, the emission of trichloroethylene and tetrachloroethylene was almost equal to those in Japan in the early 2000s. As to methylene chloride, its emission was about one sixth of Japan. Then, it seems meaningful that to find how such difference in mission amounts of VOCs is reflected in difference of ambient air concentrations.

3-2 Do you have any data on traffic in main roads by which total amounts of car exhaust gas per day, per week or per month can be estimated?

3-3 In Japan, we conduct airborne VOCs monitoring once a month at the representative sites from traffic area, industrial area and residential area. If you select at least three sampling sites from the respective areas, where do you recommend and what is the basis of your recommendation?
According to the TEI's study, landfill sites were pointed out as one of the significant VOC emission sources, although they did not indicate whether VOCs might be emitted to the air, groundwater and/or both. Do you think that some landfill sites are needed to be monitored for VOCs?

3-4 We would like to ask ERTC to propose a monitoring methodology (solid-adsorption/thermal desorption/GC/MS) as a candidate of authorized one to PCD. In the process of establishing a VOC monitoring methodology, it is needed to set up a target detection limit (or quantitation limit) value (ng/m^3) and uncertainty range (%) for a target VOC.
What are your target concentration levels of VOCs for ambient air monitoring?
What criteria on analytical quality control have you introduced so far for analytical methods using GC/MS? For example, what is the QC procedures established for analyzing pesticide residues in water by using GC/MS?

3-5 What kinds of trouble have you ever experienced in analyzing airborne VOCs? How about, for example, purity of gases, insufficient blank level, electricity failure?

3-6 We think you are going to start compliance monitoring when you establish the environmental quality standards of VOCs. What is your plan on this matter? In details,
Who will do monitoring works?
How often and from where will you collect samples?
What is the methodology you employ?
How will you publish the results?
How will you allocate the budget of the expenditure for the compliance monitoring?

3-7 According to “Regulatory measures against air pollutants emitted from factories and business sites”, Air Pollution Control Law, Japan, EQS items other than benzene, trichloroethylene, tetrachloroethylene, and dioxins have been established the emission standard values. All designated corporations are responsible for measuring VOCs in exhaust gases and submitting the results to local governments. Local governments have the right to inspect corporations when there are any problems such as data reliability.
As to benzene, trichloroethylene, tetrachloroethylene, there are the restriction standards for some classes of facilities. The restriction standard is something like guideline by which any penalty is not caused. Designated facilities have no obligation of analyzing these compounds in exhaust gases and submitting the concentrations to the local government. The local government can not inspect the facilities with this matter.
Other specific substances including other 8 VOC compounds have no regulations relating to emission. Specific substances are Acrylonitrile, Vinyl chloride monomer, Chloroform, Chloromethyl methyl ether, Ethylene oxide, 1,2-dichloroethane, Dichloromethane, Tetrachloroethylene, Trichloroethylene, 1,3-butadiene, Benzene.

However, the concentrations of VOCs listed as specific substances in ambient air have shown declining trends according to the report of the national monitoring survey. Why?
It is said that this is due to effort of corporations to decrease usage of VOCs. In 1998, MOE proposed some industrial associations to make voluntarily three-year plans to reduce usage of the specific substances including VOCs and, then, 77 associations corresponded. For example, Association of chemical industry planed to reduce 30 % of the usage of 9 substances compared to those in 1995 (reference year) during 1997 to 2000. This voluntarily reducing plan had been achieved and renewed for the next three years.
On the top of this, PRTR system has promoted reduction of VOC usage. In this system, all

designated corporations have to submit amount of releasing and transferring substances belonging to Class 1 chemical substances, in which most of specific substances are included, to local governments. As the result, people notice how much of substances are emitted by a corporation. Then, most of corporations concerning public reputation have been trying to reduce emission amount.
Accordingly, MOE is not going to set up any restrictive regulations with respect to VOC emission until the effort of associations becomes not-effective in decreasing VOC concentrations in the ambient.

How do you think about introducing approach like above to Thailand?
To set up emission standard you have to understand quantitatively how emission of VOCs from a factory affects or increases their concentrations in the ambient air. Then, you have to find analyzing methodology of VOCs in emission gases from each factory, which should be practically applicable to Thai factories. How are you going to clear these matters?

IV. Activities of ERTC (Only for ERTC)

4-1 Authorized role and function of ERTC

4-2 What kind of role might be expected ERTC to control VOCs?

4-3 Do you have any priority study and research plans for VOCs emission control or reduction?

4-4 Preparedness for VOCs' study and research i.e.staff, budget, equipment

4-5 Organizational Structure of ERTC

- Functions and number of staffs of each section
- ERTC activities in 2003, 2004
- List of existing equipment which can be used for VOCs monitoring
- List of technical cooperation projects or equipment provisions by other donor countries to ERTC
- Budget which is allocated to ERTC in the past 5years

END

Environmental Research and Training Centre (ERTC)

Department of Environmental Quality Promotion

Ministry of Natural Resources and Environment

BACKGROUND

- ✓ **The government of Japan supported the establishment 2,314 m.Yen**
- ✓ **Technopolis, Klong 5, Klong Luang, Pathumthani**
- ✓ **Area 11.68 hectare**

- **HRH Princess Maha Chakri Sirindhorn presided over the opening ceremony on March 20, 1992**

ERTC in 1991

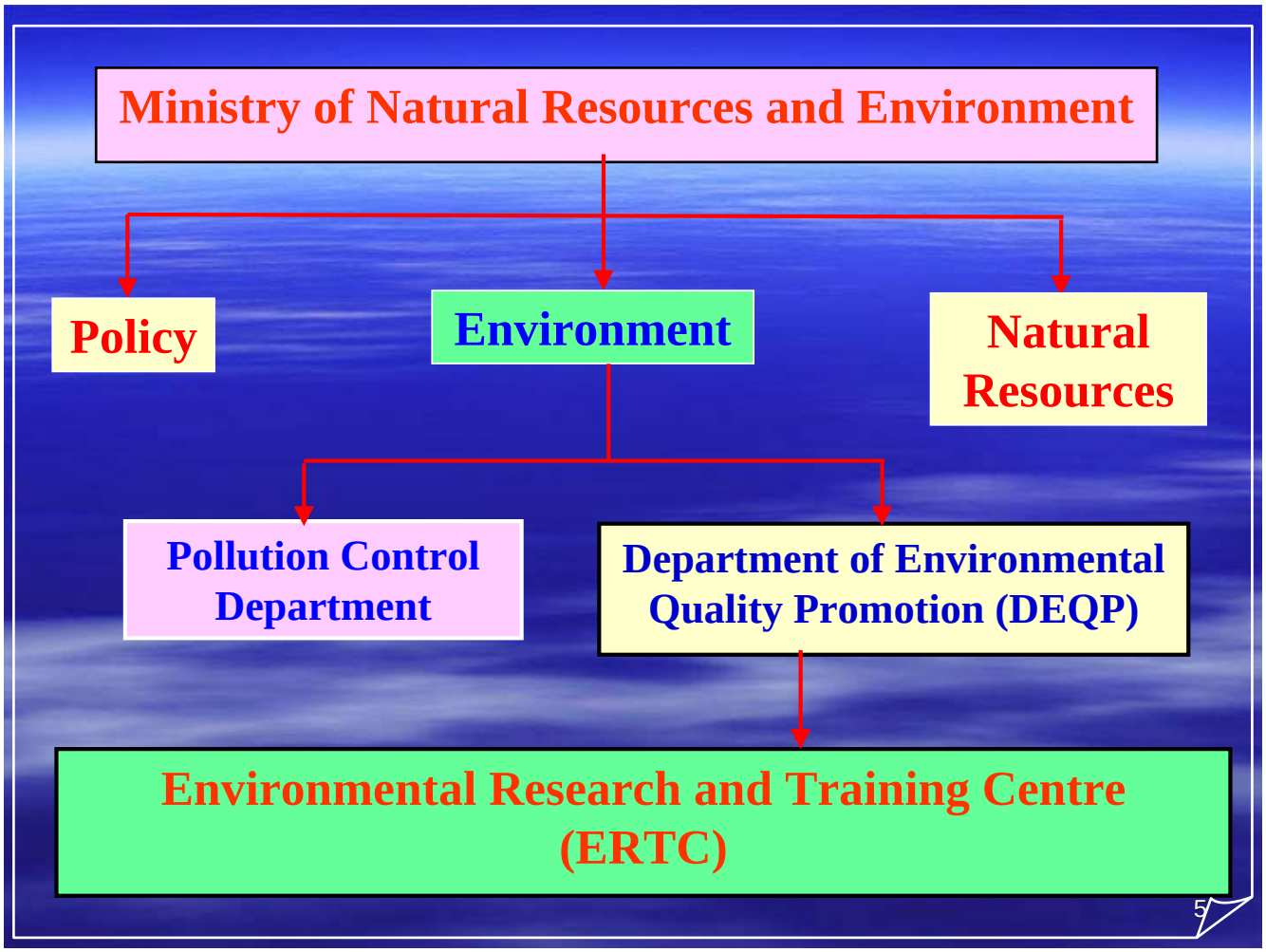
Facilitiy

Training Building (3,000 m^2)

Main Building (8,156 m^2)

Multi Purpose Building

Dormitory Buildings



5

VISIONS

"TO BE THE CENTER OF EXCELLENCE IN CONDUCTING RESEARCH, DEVELOPMENT AND TRANSFER OF TECHNOLOGY FOR THE SUSTAINABLE DEVELOPMENT IN ORDER TO ENFORCE THE BETTER QUALITY OF LIFE OF THE THAI SOCEITY"

6

MISSIONS

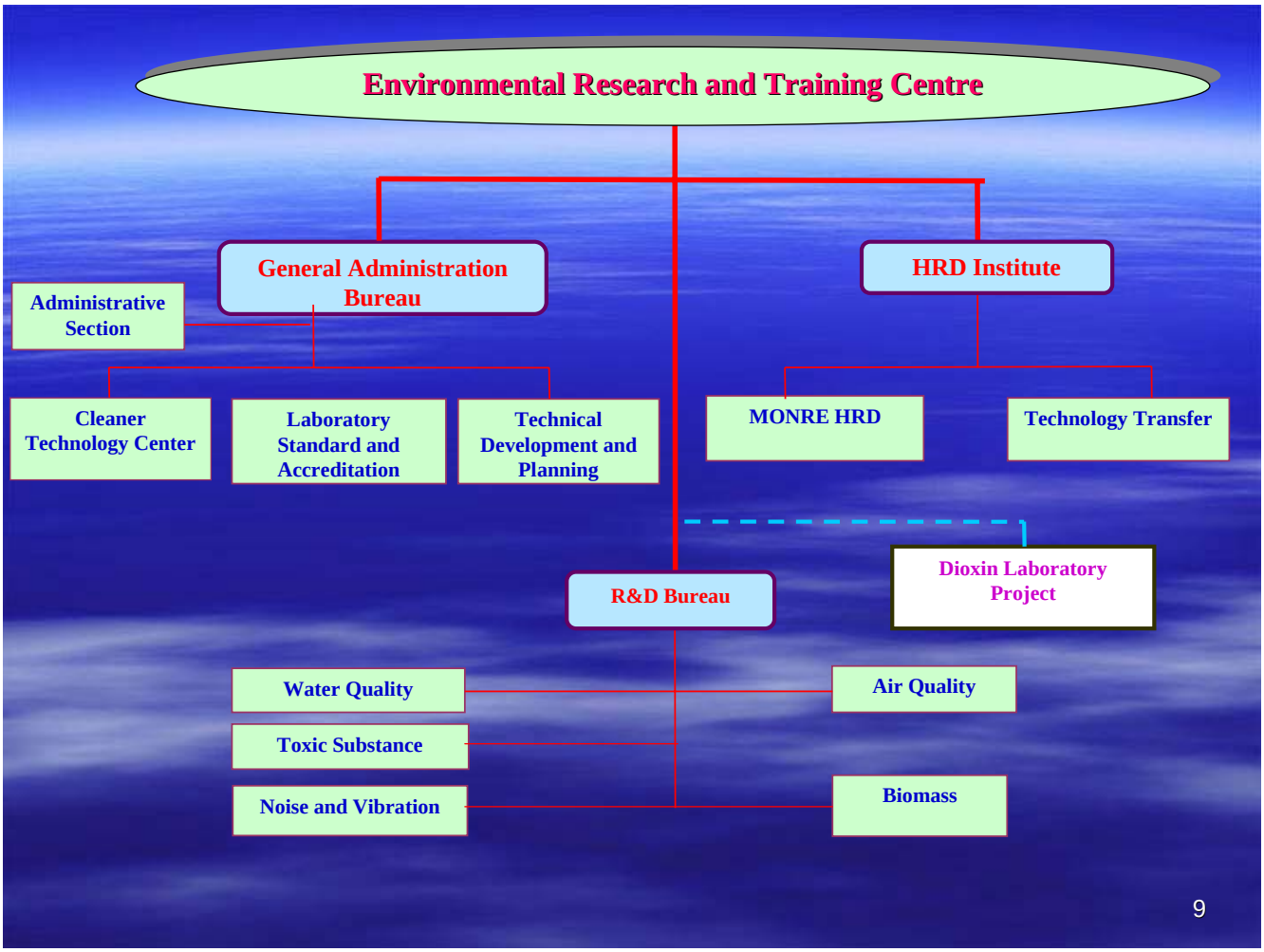
STRENGTHEN CAPACITY BUILDING FOR HUMAN RESOURCE DEVELOPMENT AND PROMOTION OF RESEARCH AND DEVELOPMENT IN MANAGING ENVIRONMENT AND NATURAL RESOURCES

TASK/MISSION

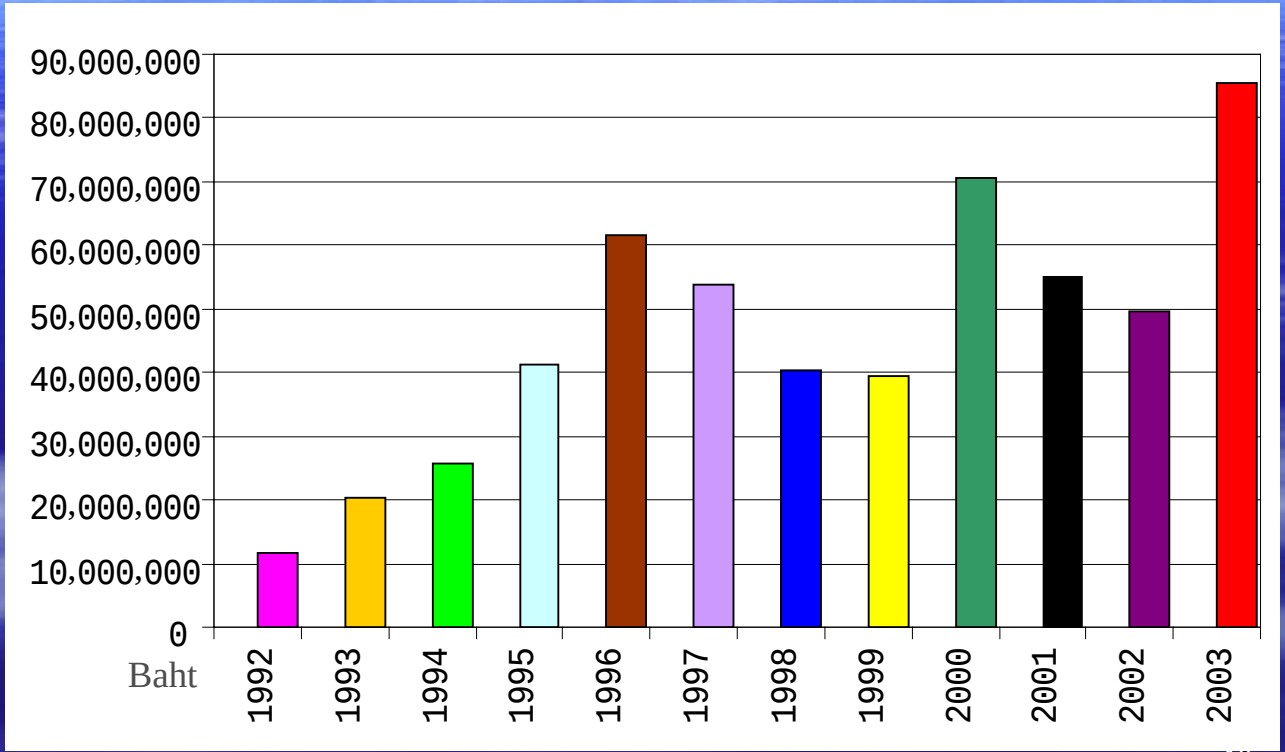
Training

Research

Laboratory



BUDGET for fiscal year 1992-2003



ERTC BUDGET 2004: 97 Million Baht

	million baht
• Salary	17.5
• Office Operation	13.8
• Building & Equipment	8.3
• R&D, Promotion and Transfer	57.5

ERTC Manpower

Government Officials (Professional Staff)	60
Technicians and Workers	19
Project Staff (Temporary Staff)	87
Total	**166**

Doctoral Degree	5
Master Degree	30
Bachelor Degree	85
Under Bachelor Degree	46
Total	**166**

Role of ERTC in Environmental Management

During the past ten years, ERTC undertook over 40 research works regarding water,air, and toxic substances. Ten to thirteen training programs were given annually with more than 5,000 participants from central and regional agencies, private organizations, academic institutions, etc., since its inception to 2002.

Research Output

- Input for Further Advance Research
- Input for Regulation Set Up
- Product (directly used)
- Product (directly transfer)

http://www.ertc.deqp.go.th/

ERTC Database

- Training curriculum
- Research Projects
- Other publication

Intranet

- Announcement
- Equipment database
- Standardization database

Other organization database

- Research organization
- Laboratory

Subjects to learn at ERTC:

- Status of present environment in Thailand
- Most critical environmental issues
- JICA's contribution to research in Thailand

Present status of the environment in Thailand

- Water quality
- Air quality
- Noise pollution
- Solid waste and Hazardous Substance Management
- Most critical environmental issue

Water Quality

Major problems concerning water resource are water shortage, flooding, and poor water quality. Domestic sewage, industrial effluents, and agricultural run-off all contribute to increasing pollution of surface, coastal and ground water.

Contamination is particularly severe in the Bangkok Metropolitan Region. According to preliminary estimates, water pollution is estimated to cost between 0.6 and 1% of the GDP, annually

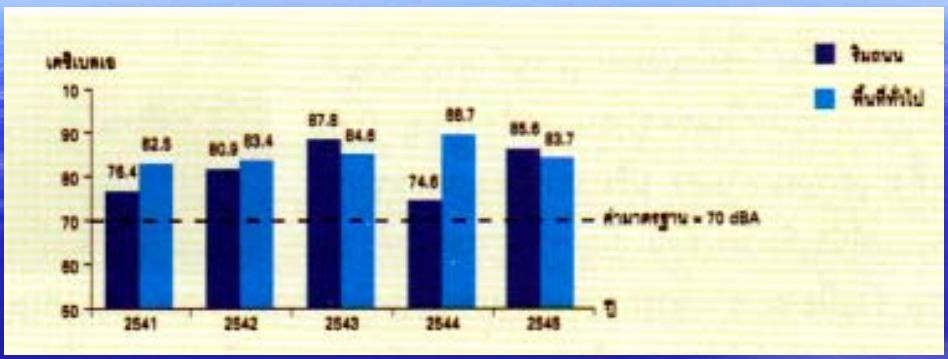
Air Quality

Thailand has made remarkable progress over the past decade in combating air pollution. With the exception of particulate (PM10 and PM2.5) and Ozone, all pollutants now comply with the country's air quality standards.

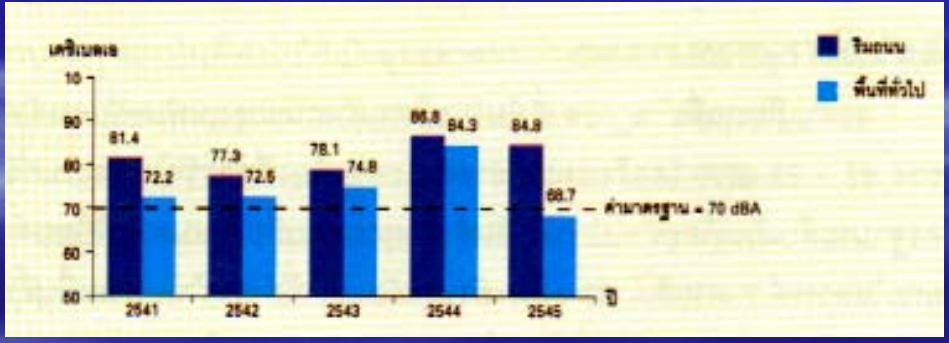
ambient PM, the pollutant with the most serious health impacts, still exceeds standards along traffic corridors. This is particularly serious along roadsides in urban areas such as Bangkok. In non-urban areas, sources such as agricultural burning also contribute significantly to particulate pollution. Furthermore, Ozone levels are causing concern, with maximum values exceeding the standard.

Although the drop in most air pollutant levels in Thailand has resulted In declining health costs, they still cost the equivalent of 1.6% of GDP annually.

Noise Pollution



Leq 24-hr. in Bangkok 1998-2002



Leq 24-hr. in other provinces 1998-2002

Solid waste and Hazardous waste

Solid wastes:

The amount of municipal solid wastes of the country in the year 2001 was around 14.4 Mton in which BMA contributed about 24% of the total. In terms of management, it was found that the collection system has been improved in most of the areas. However, the methods of solid wastes disposal are improper. Besides, the existing landfill sites could not be operated due to protests from the local communities. The government has managed the solid waste problems by supporting such strategies as reuse and recycling, improvement of collection system, and promotion of public participation.

Solid waste and Hazardous waste

Hazardous wastes:

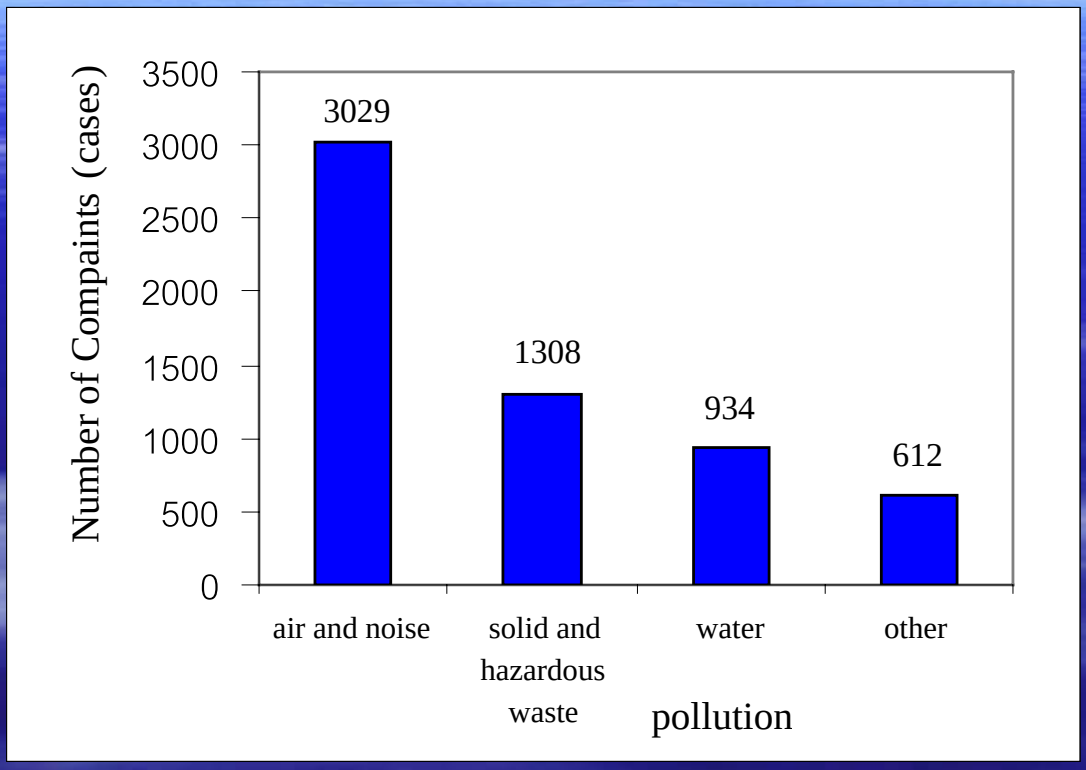
In the year 2001, the amount of hazardous wastes (HW) in the country was around 1.68 Mton. Industrial HW contributed by 78% and community HW by 22%. At present, factories for HW disposal can manage only 30% of the total HW. Therefore, HW dumping Can be commonly found in various places. It is Recommended that control should be enforced at the Sources of HW, meanwhile the industrial sector Should be encouraged to adopt an effective disposal Management system that allow for more public Participation.

Most critical environmental issues

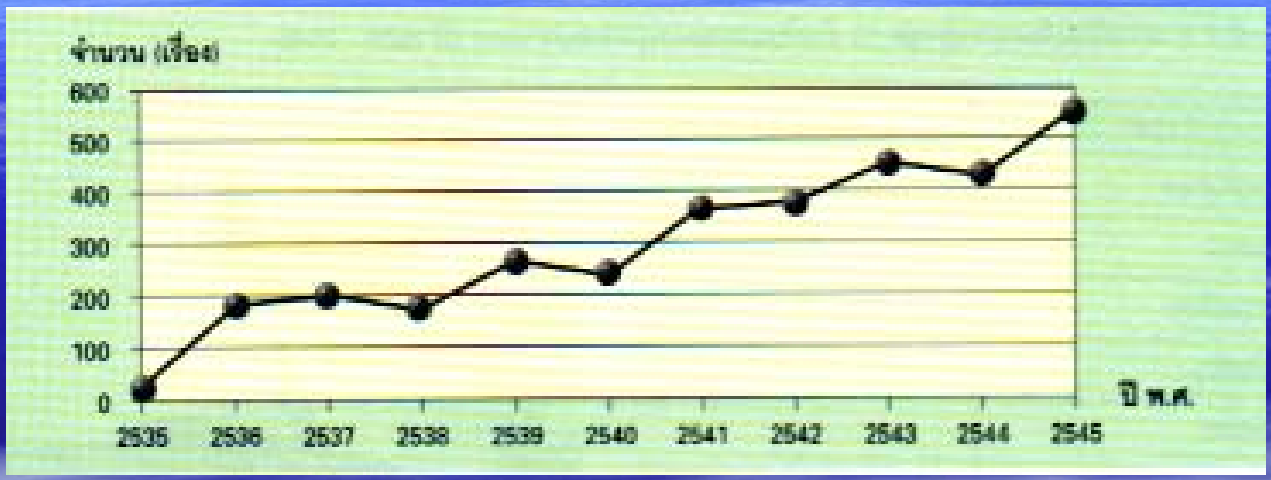
The lack of an integrated approach combined with poorly enforced laws, weak capacity and insufficient investment, have exacerbated the pollution in Thailand. Limited community participation, and the low involvement 0f private sectors has pushed the burden onto the government in addressing the issues.

Key environmental issues in Thailand include water pollution, air pollution and solid wastes. The problems can be obviously seen by the increasing number of complaint cases in the country year by year.

Most critical environmental issues



Most critical environmental issues



Number of complaint cases 1992-2002

source: Pollution Control Department

JICA's contribution to ERTC during 1991-1996

During 1991-1996, ERTC received technical cooperation from JICA which provided Japanese experts, machinery, equipment and other materials, as well as capacity build-up training for ERTC officials in Japan. The grant strengthen the ERTC's roles in research and training towards society and environment since its inception to present time.

JICA's contribution to ERTC during 1991-1996

The Center's research works were acceptable and led to prescription of measures, formulation Of policy, and implementation plan of Environmental management of the country.
It also plays an important roles in locality Administration as it has been assigned by MONRE to prepare training programs for basic Management and how to draw up environmental Quality management plan to train environmental Officials nationwide in 2003.

JICA's contribution to ERTC during 1991-1996

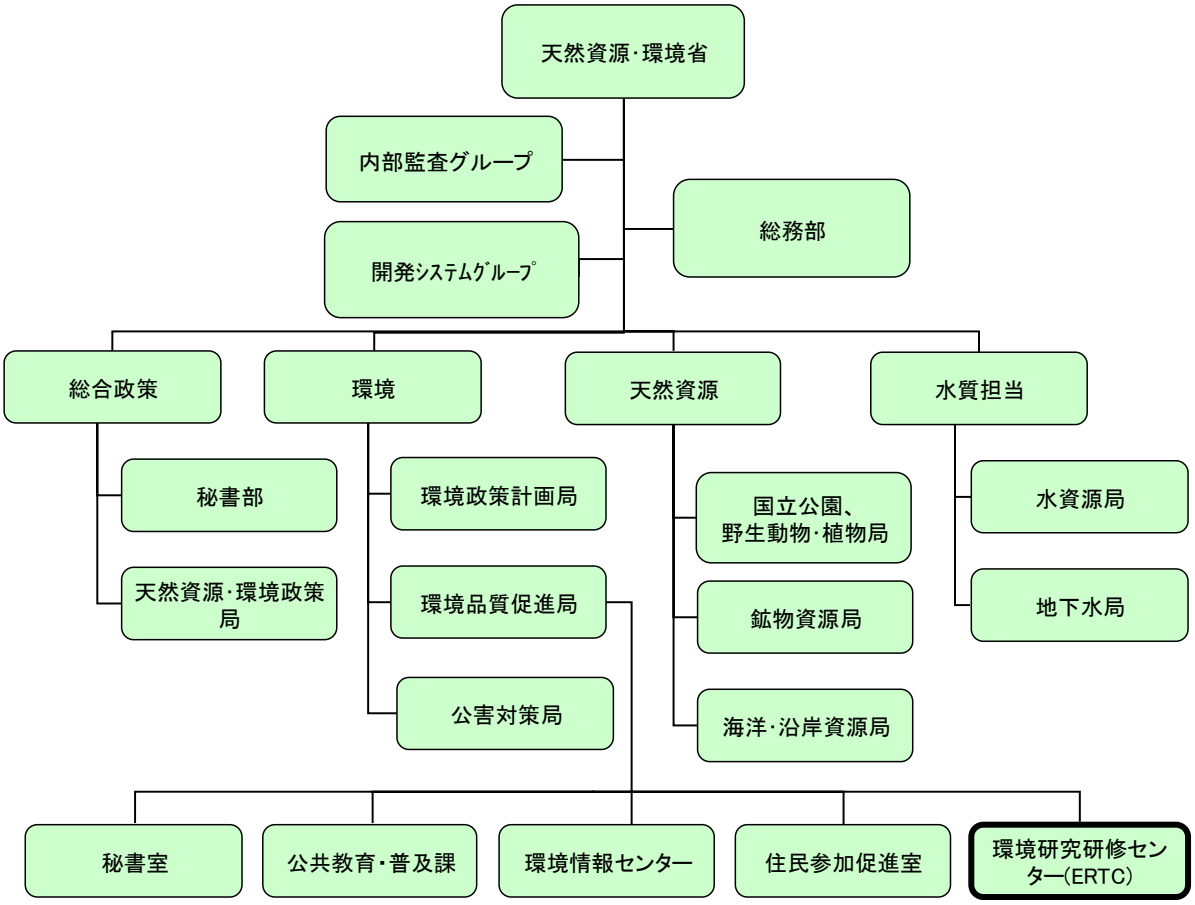
However, ERTC is still in need of assistance from foreign organizations especially for personnel development and research support in the form of exchange programs, or on-the-job training, or network construction.

This is to enhance sustainability of Thailand's management of natural resources and environment in the future.

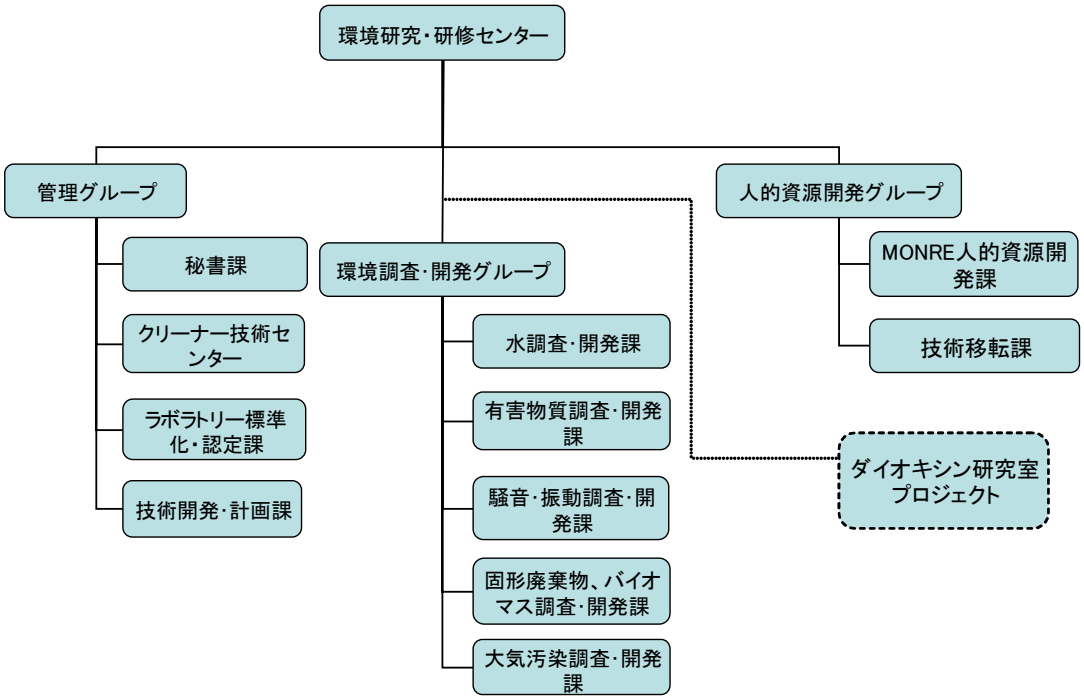
ERTC に係る経緯

年月	主要事項	備考
1975.12	・タイ政府、国家環境質保全法制定 「国家環境委員会（NEB)」組織、事務局として「環境庁（ONEB)」を設立 ・タイ政府、「環境研究研修センター（ERTC)」設立を計画	・日本に対し、ERTC 設立のための無償資金協力（無償）および環境研修計画にかかるプロジェクト方式協力（プロ技協）を要請（1983）
1985.5	・「要請背景調査団」派遣（5.22－5.29）：最適な環境研究研修内容検討のための長期専門家派遣を提言	
1985.12	・環境研究研修にかかる個別専門家派遣 関荘一郎氏（環境庁、1985.12－1988.3、派遣先　ONEB） 秋山　高氏（産業医科大、1986.4－1987.4、派遣先　ONEB）	
1987.8	・タイ側、再度 ERTC 設立にかかる無償・プロ技協を日本側に要請	・「ERTC 基本計画」作成、タイ側に提出（1987.8）
1988.3	・「予備調査団」（プロ技協）派遣（3.15－3.22）：ERTC 設立はタイがその直面している環境行政上の諸問題に取り組むため、緊急に実現すべきプロジェクトであると結論	
1988.11	・「基本設計調査団」（無償）派遣（11.27－12.24）	
1989.3	・「基礎調査団」（プロ技協）派遣（3.14－4.14）：タイの環境行政の実態を示す制度的・技術的情報の収集「ドラフト・フィージビリティ調査説明調査団」（無償）派遣（3.12－3.17）	
1989.11	・ERTC プロジェクト国内委員会設置	
1990.2	・第 1 次実施協議調査団派遣（2.25－3.6）	
1990.3	・第 2 次実施協議調査団派遣（3.26－4.1）（3.29　R/D の署名）	
1990.4	・プロジェクト協力開始（90.4.1－）	

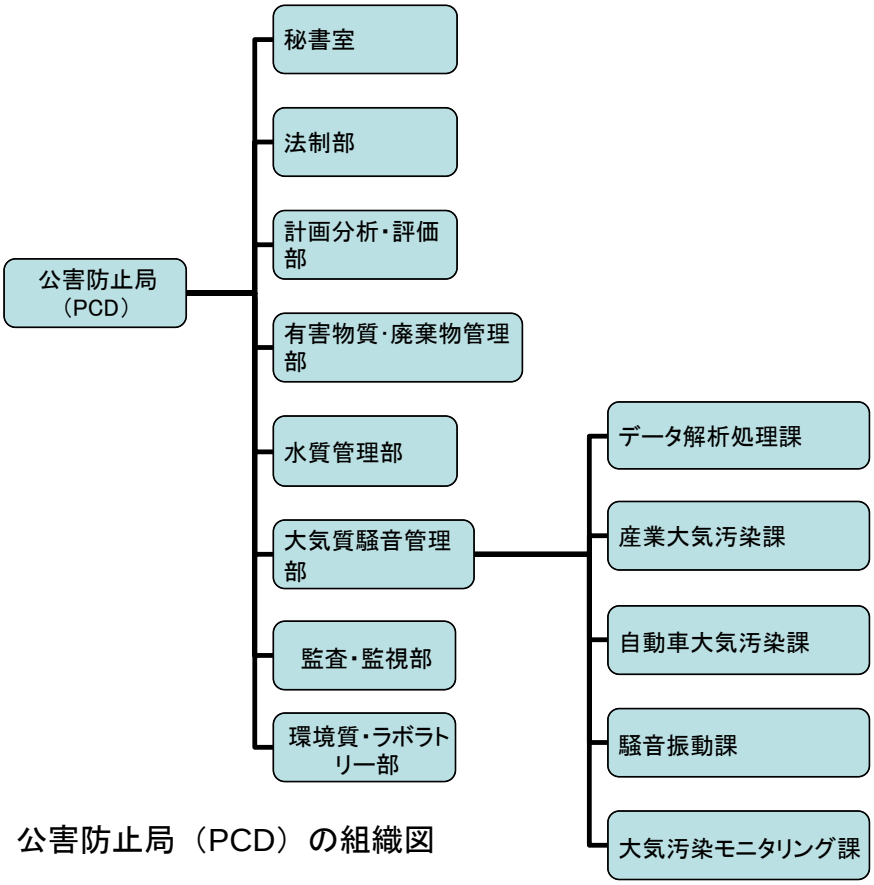
1990.10	・長期専門家（7 名）順次派遣	
1991.1	・「計画打合わせ調査団」派遣（1.14－1.20）	
1991.1	・全長期専門家の派遣終了：日本側プロジェクト体制が整う	
1991.4	・プロジェクト方式技術協力を開始（1.14－５年間）	
1991.11	・環境研究研修センター（ERTC）完成	
1992.3	・巡回指導調査団の派遣（3.1－3.7） ERTC 開所式	・国家環境質保全強化法改正（1992）
1993.3	・「計画打合わせ調査団」派遣（3.21－3.27）	・環境庁（ONEB）が科学技術環境省に改組:環境政策計画局（OEPP)、環境汚染規制（公害対策）局（OEPP)、環境質促進局（DEQP）の三局に整備（1992）
1993.11	・「計画打合わせ調査団」派遣（11.22－11.27）	
1994.12	・「終了時評価調査団」派遣（12.5－12.14）	
1995.3	・全長期専門家の派遣期間終了	
1995.4	・プロジェクト協力を 2 年間延長(4.1)	
	・長期専門家 7 名派遣	・ERTC 組織体制が汚染事象別の構成に改正（1995）
1996.4	・長期専門家（交代）2 名派遣	
1996.10	・「終了時評価調査団」派遣（10.16－10.26）	・フォローアップ投入実績 投入機材：6400 万円 長期専門家：延べ 9 名 短期専門家：延べ 12 名
1997.3	・プロジェクト協力終了(3.31)	
2004.2	・第三国研修「酸性雨対策」実施中（2004.2－2007.2（予定））	
2004.10	・「環境研究能力プロジェクト事前評価調査団」派遣（10.11－10.16）	



天然資源環境省（MoNRE）の組織図



環境研究・研修センター（ERTC）の組織図



公害防止局（PCD）の組織図

世界銀行国別環境開発パートナーシップ
タイにおける環境分野への取り組み（2004 年－2007 年）概要

１．背景

タイ国では、1997 年に住民の環境保全の権利を保障するための新たな法律が制定され、2002 年に天然資源環境省（MoNRE : Ministry of Natural Resources and Environment）が設立した。世銀は、タイ国におけるこのような行政面での改革と共に、国レベルにおける環境問題の出現、及び住民レベルにおける環境保全への動きの盛り上がり等に時宜を得て、国別環境開発パートナーシップ（Country Development Partnership for Environment: CDP-E）を開始した。

２．CDP-E の目的

世銀は、CDP-E を提案することで、環境分野の中期的改革アジェンダに対応するための戦略的・協調的なアプローチをタイ国政府に提供し、同国の環境質の向上を支援することを目的としている。

３．CDP-E が取組む主要分野

CDP-E は、選択的アプローチを用いることで、特定の中期的優先分野に取組んでいる。主要分野は以下の通りである。

（１）大気質：タイ国政府がこれまで取り組んできたバンコクにおける粉塵・浮遊粒子軽減への支援を行う。

（２）水質：地域機能参加型アプローチ（area-function-participation approach）による流域管理を行う。特に汚染が進んでいる同国北部の Ping 川流域を優先的に対象とする。

（３）廃棄物管理：再利用（reuse）及びリサイクル（recycle）の促進、並びに処分業務の向上に焦点を当てる。

（４）地球環境へのコミットメント：オゾン層破壊物質、二酸化炭素、その他の有害物質の削減への支援を行う。

（５）制度及び手段：様々な環境改善アプローチへの参加体制、協力体制及び資金調達のための体制を強化する。

４．CDP-E の大気質分野への取り組み

世銀は、CDP-E を通じ、バンコクにおける包括的なディーゼル汚染削減管理戦略及び行動計画を発展させることを短期的な目標としている。その主要な取り組みとしては、以下の通りである。（詳細については Matrix2: Development Matrix 1 Component1: Improving Air Quality in Bangkok 参照）

＜成果＞バンコクにおける大気中の粉塵、浮遊粒子汚染濃度が低減する。

＜活動および指標＞

◇　１年目

- PM2.5 に関するデータベースを構築する。
- ディーゼル車からの汚染排出量算定するモデルを構築する。
- ディーゼル汚染対策に関する現在の政策フレームワークを評価する。
- 重要なステークホルダーに対してディーゼル汚染削減計画案を提示し、それを評価するためのワークショップを開催する。
- 天然資源環境省に対し、ディーゼル汚染削減計画を提案する。
- 調査結果を公開、普及させるためのワークショップを開催しステークホルダーによる評価を行なう。
- 公害管理局、陸上交通局、タイ国家警察およびバス業界等の民間セクターに対するキャパシティービルディングプログラムを策定する。

◇　２年目

- ディーゼル汚染を削減するための政策実施に向け、ステークホルダーからの合意を得るために一連のワークショップおよび一般市民向けキャンペーンを開催する。
- 以下の項目を含む政策的、技術的提言を実行する。
  ・ディーゼル車に対する、より厳しい排出基準を設ける。
  ・車検制度の定着および車両の整備を行なうためのインセンティブを醸成するメカニズムを構築する。
  ・バンコク公共交通機関に対し、ディーゼル車に対する新基準および車両整備のメカニズムを適用する。
- PM2.5 に関するデータベースを更新する。

◇　３年目

- 継続して政策的、技術的提言を実行する。
- PM2.5 に関するデータベースを更新する。
- 本プログラムの評価報告書を作成する。
- 本プログラムの成果を他国においても適用できるよう国際シンポジウムを開催し、成果の普及に努める。

以上

添付資料：

（１）CDP-E 概要

（２）Matrix1: Results Summary

（３）Matrix2: Development Matrix 1; Component1: Improving Air Quality in Bangkok

（４）Matrix3: Partnership Matrix

EXECUTIVE SUMMARY

i. Background: As the Country Assistance Strategy (Partnership for Development Strategy, 2003-2005) explains, the nature of the relationship between Thailand and Bank has evolved from one of borrower-lender to that of facilitating knowledge sharing and providing policy advise on medium-term structural issues. This "new" partnership approach focuses on diagnostic and monitoring work with a limited amount of implementation support for selected critical issues in Thailand's overall national development agenda. This document provides a framework for a knowledge partnership between Thailand and the World Bank for improving environmental quality, which is one of the four pillars of the national development agenda. Since 2000, the Bank has been supporting diagnostic work through the *Thailand Environment Monitor* series, and together with the proposed *Country Development Partnership for Environment* provide a strategic and coordinated approach for addressing the medium-term environmental priorities.

ii. Environmental Challenge: Management of natural resources and the environment, overlooked during the high growth years, has emerged as a higher priority. Consultations with stakeholders have consistently identified natural resources and the environment as requiring urgent attention. In particular the challenges are:

- *Improving environmental quality:* Thailand's economic expansion has been accompanied by significant environmental costs. Rapid expansion of industry and increasing population, especially in urban areas, has rapidly increased the levels of pollution (solid and hazardous waste, air, noise, and water). Fine particles in Bangkok's air continue to exceed standards at major roads and intersection[1], and 35 percent of surface water is classified as poor and very poor[2]. The resulting risks to human health are high. Thailand needs to focus on more effective enforcement of environmental laws; stronger institutional capacity, both national and local; and in creased investments in pollution prevention and control, with private sector participation; and
- *Sustaining natural resources:* Land conversion, slash-and-burn agriculture, and intense exploitation of water have led to rapid deterioration of natural resources. Forest cover fell drastically from 53 percent in 1961 to 25 percent in 1998, and over-harvesting of marine fisheries has reduced fishing yields by 80 percent between 1963-1993[3]. Of particular concern is water scarcity, which occurs against a backdrop of low availability, high pollution, and increasing per capita consumption. In 2000, Thailand ranks the lowest in ASEAN for annual per capita water availability[4], but it ranks 14th in the world in industrial organic water pollution[5]. To better balance conservation and exploitation of natural resources, the country needs to ensure an integrated approach to sustainable resource management, eliminate harmful subsidies (such as excessive use of pesticides and over-fishing), and assist in the capacity building of local institutions and communities.

iii. Recent Developments: A new Constitution was framed in 1997, which for the first time guarantees the right of communities to protect and manage the environment and natural resources and in October 2002, the Government established a new Ministry of Natural Resources and Environment (MoNRE), as part of the overall public sector restructuring. These developments plus the emergence of environment and natural resource issues on the national agenda; and a rapidly expanding civil society and community-level environmental movement, provide an opportune time for the proposed Country Development Partnership for Environment (CDP-E).

1 PCD, 2003, State of the Pollution Report 2002, Bangkok, Thailand, p. 17
2 PCD, 2003, State of the Pollution Report 2002, Bangkok, Thailand, p. 3
3 http://www.unepscs.org/ProjectComponent/Fishery/Problems/problems.htm
4 World Resources Institute , 2003, World Resources 2002-2004, Washington, DC, pp. 274-277
5 World Bank, 2003, World Development Indicators 03, Washington, DC, pp. 140-143.

iv. CDP-E Priorities: Using a selectivity approach, the specific medium-term priorities for the CDP-E have been identified. Accordingly the CDP-E, will focus on improving environmental quality, and is organized around four specific themes -- *air quality, water quality, and waste, global environment commitments* and one cross-cutting theme -- *institutions and instruments* -- which are described below.

- *Air Quality:* The focus is to support Government's continuing efforts to reduce fine particulate matter in Bangkok.
- *Water Quality:* Integrated watershed management will be addressed by piloting the "area-function-participation" approach in priority watersheds. Ping River Basin in Northern Thailand has emerged as the priority. In addition, the CDP-E will selectively target point sources of pollution like enterprises (manufacturing and livestock) and municipal wastewater treatment facilities to control pollution from land-based sources to rivers and coastal waters.
- *Waste Management:* The focus is to expand reuse and recycling efforts and improve disposal practices.
- *Global Environment Commitments:* The thrust will be the continuing efforts to support the government and private sector to reduce ozone depleting substances and carbon dioxide and initiate new efforts to contain other selected harmful chemicals.
- *Institutions and Instruments:* The Bank has previously supported the Government with analytical studies that contributed to the establishment of MoNRE. With this being achieved, the CDP-E will now focus on strengthening specific instruments for participation, compliance and financing.

v. Results: The CDP-E is supported by a results-based monitoring system that will allow the progress to be monitored by stakeholders. The CDP-E activities, outputs and outcomes (intermediate and desired) are presented in a two part document, and summarized in the attached chart.

- The Development Matrix begins with a definition of *outcome*-oriented objectives for each selected theme of the CDP-E. For each objective, the *outputs* to be realized are identified and benchmarked so that progress can be tracked during the three-year period. The supporting capacity building *inputs* are also identified in this matrix; and
- The Partnership Matrix further elaborates the *inputs* and identifies funding opportunities for specific capacity building initiatives. These initiatives would be funded through both internal and external (international partners) sources.

vi. Implementation and Partnership Arrangements: The CDP-E will be implemented over a three year period between 2004 and 2007. MoNRE will be the main counterpart agency and the Pollution Control Department will function as the technical secretariat. For each theme or component, the mandated agency will lead the work. Permanent Secretary of MoNRE will chair a Steering Committee to provide guidance and oversight for the overall program, while specific working groups will assist individual components to build consensus. An important aspect of identifying CDP-E priorities, included consultation with civil society organizations and the private sector, and some have expressed strong interest to collaborate in the implementation of the CDP-E, which is already evident from their role in the preparation of Environment Monitors. The international partners include the Japan Bank for International Cooperation, United States-Asia Environment Partnership and the United Nations Development Program. The private sector participation will be facilitated through the Federation of Thai Industries. Resource mobilization will be a continuous process, and the funds needed for the first year for some of the components have already been mobilized. The Government and the Bank will exchange letters at the launch of the CDP-E which will outline the respective commitments for the successful implementation of the program.

CDP-E Component and Activity	Objectives	Inputs * *indicates seed funding available*	Outputs	Outcome
A. Component 1: Improving Air Quality in Bangkok				
Diesel Pollution Reduction Strategy for Bangkok	Reducing diesel emissions from public and private buses to improve air quality in Bangkok	USD 2.5 million* Government – PCD, LTD, BMA Others - US-AEP, private sector, WB (CAI-Asia ESMAP)	- City-level diesel emission database - Policy and technical options to reduce fine particulate matters from diesel emission - Action plans and information dissemination	Reduced fine particulate ambient pollution levels in Bangkok
B. Component 2: Improving Water Quality in Priority River Basins				
Participatory Watershed Management for Ping River Basin	- To improve environmental quality in the Ping River Basin through participatory management - Improved environment quality in other river basins	USD 2.1 million* Government - MoNRE Others – WB (ASEM)	- Participatory micro-watershed management model - Build capacity of stakeholders - Strengthen regulatory and incentive to modify behavior of watershed users	Improved surface water quality in target areas
Wastewater Management	- Improved surface water quality through (a) improved performance of selected municipal wastewater facilities and (b) improved livestock waste management	*USD 4 million* Government - DLD, PCD Others – WB (GEF, PPIAF, BNWWP)	- Policy and management options to improve the performance of selected municipal wastewater facilities - Livestock waste management strategy and action plan	
C. Component 3: Improving Waste Management				
Waste Management	- Expand reuse, recycling, and safe disposal of municipal solid waste	*USD 1 million* Government - PCD, EF, Local Administration Others - private, USAID, USAEP, JBIC and WB)	- Policy options and action plan to expand waste reuse and recycling - Build capacity of local governments to improve disposal facilities	Increased volumes and percentages of municipal waste that is recycled
D. Component 4: Global Environment Commitments				
ODS Phase-Out and Chemical Management	- Enable Thailand to fulfill its obligations to international protocols by phasingout ODS and reducing CO2 emission	USD 50 million* Government - DIW, DEDE Others – private sector, WB (GEF, OTF	- National ODS Phase Out strategy and action plan - Replacement of 17 CFC chillers with high energy efficiency non CFC chillers	- Reduced ODS usage in line with the agreement with the Executive Committee of the multilateral fund - Reduced CO2 emissions by at least 18,800 tons of carbon equivalent / year
E. Component 5: Strengthening Institutions and Instruments				
Environmental Institutions Development	- To develop policy, regulatory, judiciary, technical, and financial instruments to improve the effectiveness of the environmental regulatory system	*USD 1.5 million* Government - MoNRE, NESDB, MOF, BOB, DOH, ONEP, PCD Others - JBIC, USAEP, WB	- Implementation of economic instrument and public disclosure tools - Strengthen Environmental Fund and improve codification of environmental budget and expenditure - Systematize public participation in the EIA process - Enhance the role of the judiciary in promoting sustainable development	Indicators of improved EIA procedures; reduced waste per industrial output; reduced ambient pollution levels in hotspot areas

MATRIX 1: RESULTS SUMMARY

CDP-E Strategy: The specific objective is to improve environmental quality (the brown agenda) by supporting the implementation of the reform agenda with the corresponding capacity building, technical assistance, analytical advisory and investment needs through a coordinated approach. The expansion of the CDP-E to include natural resources conservation (the green agenda) will be considered later, once more diagnostic work is completed.

Impact	*Long-term consequence of the outcomes, the development changes in society of the economy of environment to which activity contributes*	**Reach/Partners**	**Risks**
National (2015): Achieving MDG Goal 7 in all regions of the country (see annex 2 for baseline information)		• Contribution of all sectors of the society	• Lack of RTG commitment • Lack of coordination among agencies and other stakeholders
Outcome	*Direct and short-to-medium term effects of outputs on the beneficiaries of the activities supported by the CDP*	**Reach/Partners**	**Risks**
Desired Outcome: National Goal (2006): Preserving and rehabilitating natural resources for sustainable use and maintaining environmental quality to achieve the environmental targets set out in the 9th Plan Intermediate Outcomes: • Reducing diesel emissions from public and private buses and trucks to improve air quality in Bangkok and its vicinity • Developing participatory and integrated watershed management framework for Priority River Basins (especially, Ping River Basin in Northern Thailand) to control pollution • Reducing environmental hazard through reduction, recycle, reuse, and safe disposal of solid and hazardous waste in selected municipalities • Phasing out ozone depleting substances and reducing CO2 emission • Strengthening selected participatory, compliance, and financing instruments to improve the performance of environmental governance, in general, and waste management facilities, in particular.		• Strong government-led program • Donors support incremental capacity needs • Partnership between the government and CSO	• Lack of commitment from new Ministry (MoNRE); Coordination among units within MoNRE • Problems in coordination with other ministries • Inadequate resources and commitment to implement • Delays in implementation

Output	*Most immediate results produced by the CDP*	**Reach/Partners**	**Risks**
• Undertake study on reducing air pollution from diesel engines and provide policy recommendations • Provide support to MoNRE and local communities to carry out a participatory watershed management in Ping River Basin • Provide support to MoNRE and local governments to prepare options paper on rehabilitation plan including financing and institutional arrangements for wastewater treatment facilities in selected locations • Provide support to MoNRE to enhance the disposal and recycling practices • Provide support to reduce waste form livestock (pig) farms. • Continuous implementation support for ODS phase out programs • Provide support to the Administrative and the Supreme courts to enhance the role of the judiciary in promoting sustainable development • Facilitate the revision of the EIA guidelines to formalize and strengthen public participation • Facilitate the dialogue with MoNRE and MOF to strengthen the Environmental Fund • Facilitate the dialogue between MoNRE, Budget Bureau, NESDB, and MOF to improve the tracking of environmental expenditure and investments • Provide capacity building toolkits and carry out training workshops for stakeholders		• Involvement of government, civil society and local community representatives in shaping outputs • Participation of donors in the preparation work and review of draft outputs • Involvement of academics and environmental think tanks	• Discontinuation of stakeholders in the process • Timely internal review of documents • Quality of consultants and timeliness of recruiting process

Input	*Resources provided by the Bank, Government and other Donors to implement the components identified above*		**Reach/Partners**	**Risks**
World Bank (FY04-07) Resources (USD, million) - Budget = 0.4 - Trust Fund = 2.5 (approx.) - Ozone Trust Fund= 47.5 - GEF = 2.5 (additional 0.85 requested) Expertise - Staff from EASES (Bangkok and Washington), ENV, DECRG, and WBI - Consultants	**Government (FY04-FY07)** Counterpart (US$ million) Component 1: 0.25 Component 2: 1.5 Component 3: tbd Component 4: tbd Component 5: 0.12 In addition, contribution in kind: - Staff time of about 3 staff years - Office facilities - Logistics for meetings, workshops and forums - Others	**Partners (FY04-FY07)** Additional funding will be mobilized from: - JBIC, JICA, USAID, USAEP, US-EPA and UNDP for specific program areas (expected USD 2.5 million) - Private sector - (to be determined)	• Additional funding from other donors • Regional sharing of knowledge and best practices • Coordinating on-going and planned efforts	• Inadequate trust fund resources • Inadequate budget availability from government counterpart and from the Bank • Staff lacking appropriate skills • Delays in procurement of consultant services due to insufficient knowledge of procedures.

MATRIX 2* : DEVELOPMENT MATRIX 1 Component 1: Improving Air Quality in Bangkok

Component	1.1 Diesel Pollution Reduction Strategy for Bangkok			
Outcome	Reduced fine particulate ambient pollution levels in Bangkok			
Output Benchmarks			*Inputs – Technical Assistance*	
Year 1	Year 2	Year3		
- Completed database of ambient fine particulate matter (PM2.5) - Construct models to estimate diesel vehicle emissions - Review current policy framework that affects diesel vehicle emissions - Completed analysis of policy and technical options to reduce diesel emissions - Workshops to review draft Diesel Emission Reduction Plan with participation from key stakeholders. - Provide Diesel Emission Reduction Plan to MoNRE - Workshop to disseminate findings and gather stakeholders' evaluation - Capacity building program for PCD, DLT, TISI, RTP and participated repair shops, bus concessionaires, and private sector	- Series of workshops and public campaign to built consensus of key stakeholders to pave the way to implement policy and technical options to reduce emission from diesel vehicles - Begin the implementation of the recommendations from the policy and technical options paper. This may include the following: - Issued stricter standards for new and old diesel vehicles - Established appropriate incentive and/or enforceable mechanism for routine vehicle inspection and preventive maintenance - Revised BMTA concession contracts to reflect stricter emission standards and preventive maintenance - Updated database of ambient fine particulate matter	- Continued implementation of the recommendations from the policy and technical options paper. - Updated database of ambient fine particulate matter - Evaluation report of the implementation programs - International symposium to disseminate findings of the program leading to replication potential to other countries	Strategies, Plans, Regulations, Tools and Techniques - PCD works with local and international experts, DLT, TISI, BMA, and private sector to develop Diesel Emission Reduction Plan - Build database of ambient fine particulate matter - Review current policy framework that affects diesel vehicle emissions - Develop scientific models to estimate diesel vehicle emissions - Prepare Diesel Emission Reduction Plan - Develop financing plan - Develop management model - Prepare implementation guidelines Demonstration and Pilots PCD works with DLT and private sector to establish scientific models to estimate diesel vehicle emission for different categories of diesel vehicles based on survey and laboratory testing. - Pilot testing procedures in various locations through out Bangkok Training and Skills Enhancement - PCD works with experts to develop and carry out training the trainers and skill enhancement program for the staff of PCD, DLT, RTP, BMA, and private sector. Outreach - PCD works with experts to develop and implement the outreach and dissemination program including: (i) workshops; (ii) publication; and (iii) private sector forum.	
Target and Indicator	**National:** Urban air quality (particulates and toxic substances)		Current Exceed standards at some locations	2006 within national standard
	MDG 7: N/A		1990 -	Most Recent -
Partners	**National**	PCD, LTD, TISI, RTP		
	Local	BMA, BMTA, bus concessionaires, communities, higher education institutes, private sectors, and NGOs		
	International	ADB, USAID, USAEP, US-EPA, WB (CAI-Asia, ESMAP, NTFESSD)		

*Note: more detail monitoring indicators are being developed in consultation with stakeholders

MATRIX 2: DEVELOPMENT MATRIX 2.1 Component 2: Improving Water Quality in Priority River Basins

Component	2.1 Participatory Watershed Management for Ping River Basin			
Outcome	Improved surface water quality in target areas			
Output Benchmarks			*Inputs – Technical Assistance*	
Year 1	Year 2	Year3		
- Using existing information, a rapid analysis will be done of the entire watershed to assess the health, livelihood and environmental status A detailed stock-taking exercise including environmental and health analysis, household surveys and perception surveys to determine the linkages between environment and poverty - Establishment of Micro-water shed Associations or Boards through a participatory exercise - Action planning process that will be led by the respective community-led Boards, in consultation with local and national government agencies. - Detailing the relevant operational processes in the form of guidance notes, e.g., technical, operational, awareness, and education toolkits. - Disseminating the processes and products of the action planning process with a wider audience. - Developing criteria and process for selecting facilitators, and their training	- Identifying community training needs (for each specific micro-water shed) for implementing component 1 through an interactive process led by facilitators - Developing the relevant training material for the three types of tool kits (mentioned above) - Delivering training programs at the community level, directly and through extension agents. Therefore, the capacity building program will be tailor made to suite the specific issues in a particular micro-water shed. - Identification of key polluters through a combined process of conventional and community monitoring - Selection of 20-25 sources in each micro-watershed - Adaptation to appropriate incentive mechanisms for each "pollution source group implement a community-local government partnership, where the performance of environ mental services will be monitored by and disclosed to the public.	- Provision of extension services to dialogue with the "pollution source groups" on the regulatory and incentive options - Implementation of the program in the 3 pilot micro-watersheds - Assessing the performance of the "pollution source groups" after a period of one year. The Government counterpart funding would be used for capacity building and implementation of this component, while ASEM funds will support the planning and monitoring aspects. - National and regional work shops to disseminate the result of this Technical Assistance	Strategies, Plans, Regulations, Tools and Techniques - Criteria for selecting micro-watershed within in the Ping River Basin - The Participatory micro-watershed Management Model, including the establishment of Boards or Associations - Participatory Environment and Poverty Assessment reports - Preparation of technical, organizational and educational toolkits - Capacity Building plan - Eco-labeling Framework for products - Disclosure of environmental performance - Results Measurement Framework Demonstration and Pilots Implementation of participatory micro-watershed management model and regulatory and incentive programs by local communities and private enterprises with support from local and national government agencies Training and Skills Enhancement - Preparation of needs assessment - Delivery of training programs - Evaluation of training programs - Number of participant trained - Number of participants who later become extension trainers Outreach - Provincial and National Workshops - Report translation and application - Community exchange programs - Information dissemination via print/non-print media	
Target and Indicator	**National:** Dissolved oxygen (DO) level of major rivers, mg/l (throughout the year)			Current: DO (more than 2mg/l) and BOD (not exceed 4mg/l) exceed standards in the river basins in dry season 2006: more than 2 mg/l
	MDG 7: Proportion of population with sustainable access to an improved water source (percent)			1990: 71 Most Recent: 80
Partners	**National**	MoNRE, MOAC, MOIND, NESDB		
	Local	Provincial and local governments, communities, higher education institutes, and NGOs		
	International	WB (ASEM)		

MATRIX 2: DEVELOPMENT MATRIX 2.2 Component 2: Improving Water Quality in Priority River Basins

Component	2.2 Wastewater Management		
Outcome	Improved surface water quality in target areas		
Output Benchmarks			*Inputs – Technical Assistance*
Year 1	Year 2	Year3	
- Review the status of different wastewater sources (e.g., domestic, industrial, agriculture, live stock, etc.) and status of wastewater treatment systems and their environmental and social impacts. - Assess the performance of the existing municipal wastewater facilities (MWF) - Develop specific strategy and action plan to manage waste from livestock sector - Prepare Options Paper (or Rehabilitation Framework) for policy and management actions required to rehabilitate MWFs. The paper should include technical specifications, financing options, operational and institutional arrangement (with private sector involvement), capacity of the local government, willingness and ability to play and public participation program - Undertake dissemination and awareness raising - Workshops to present results to the national government and civil society. - Publication and dissemination of rehabilitation framework	- Adoption of the rehabilitation frame work by central and local governments - Design performance criteria for selecting local governments - Use demand-driven approach to prequality local government interested in rehabilitating MWFs - Workshops to discuss implementation guidelines to rehabilitate wastewater treatment facilities - Negotiations with the Environment Fund to allocate funds - Select first round of municipalities - Capacity building program for local governments, communities - Capacity building program for local community to monitor the performance of the wastewater treatment systems - Implementation of the rehabilitation plan by local government with participation from PCD and local community. - Implementation of participatory pilot program to manage waste from livestock sector in selected locations with participation from DLD, local government, farmers, and communities	- Workshops to review progress of the piloted implementation with key stakeholders. - Continue to implement the rehabilitation plan by local - Continue implementation of livestock waste management pilots - Capacity Building program for, local government, community and farmers organizations - Carried out National and International dissemination workshops to share lessons learned	Strategies, Plans, Regulations, Tools and Techniques - PCD and partners works with local and international experts, local governments and communities to develop the Options Paper or Rehabilitation Framework including: (i) Set up selection criteria for the priority municipalities; (ii) Review current status MWFs; (iii) Conduct willingness to pay survey; (iv) Assess private sector interest; (v) Prepare rehabilitation plan; (vi) Develop financing plan; (vii) Develop management and operational guide-lines; - DLD works with partners to select priority watersheds and develop strategy and action plan to address waste from livestock sector. Demonstration and Pilots - The participating local governments work with MoNRE and experts to implement the rehabilitation framework - Technical support are provided to local communities to monitor the performance of the wastewater treatment systems - DLD works with partners to pilot livestock waste management programs in selected locations in the priority watersheds Training and Skills Enhancement - PCD and DLD works with experts to develop and carry out training the trainers and skill enhancement program for the government officials, local government agencies, and communities, and farmers Outreach - PCD and DLD works with partners to develop and implement the outreach and dissemination program including: (i) work shops; (ii) publication; (iii) municipality and civil society exchange; (iv) education and awareness raising programs

Target and Indicator	**National:** Dissolved oxygen (DO) level of major rivers, mg/l (throughout the year)	Current: DO (more than 2 mg/l) and BOD (not exceed 4mg/l) exceed standards in some river basins in dry season	2006: more than 2 mg/l
	MDG 7: Proportion of population with sustainable access to an improved water source (percent)	1990: 71	Most Recent: 80

Partners	**National**	PCD, WMA, DLD, DOLA, DPW, MIND, NESDB
	Local	Provincial and local governments, communities, private sector, universities , and NGOs
	International	WB (GEF, PPAIF), JBIC and FAO

MATRIX 2: DEVELOPMENT MATRIX 3 Component 3: Improving Waste Management

Component	Waste Management			
Outcome	Increased volumes and percentages of municipal waste that is recycled			
Output Benchmarks			*Inputs – Technical Assistance*	
Year 1	Year 2	Year3		
- Review and compare best practices in solid waste management focusing on reuse, recycle, and safe disposal - Select priorities provinces based on findings from Thailand Environment Monitor 2003, to develop policy option and action plan to increase reuse, recycling, and safe disposal - Identify current status of waste management in the selected locations - Develop policy options and action plan focusing on incentive programs and instruments to achieve the outcome above, with participation from local government, community, private sector, and NGO - Identify capacity building needs for local government to improve disposal facilities - Workshops to discuss findings with stakeholders. - Workshops to review results with PCD and key stakeholders. - Awareness raising campaign to increase reuse and recycling - Dissemination of incentive programs and instruments	- Implementation of the policy options and action plan in selected locations with participation from key stakeholders - Workshop to review the implementation progress including the impact of the awareness raising campaign - Capacity building program for local government to improve disposal facilities and practices - Capacity building program for local community to monitor the performance of the integrated solid waste management systems - Continuation with the awareness raising campaign to increase reuse and recycling	- Workshops to review progress of the implementation with key stakeholders. - Continue capacity Building program for, local government and community organizations - Carried out National and International dissemination workshops to share lessons learned. - Capacity building support for implementation of waste reduction and recycling incentive program.	Strategies, Plans, Regulations, Tools and Techniques - PCD works with key stakeholders to develop the policy options and action plan focusing on incentive programs and instruments to expand reuse, recycling and safe disposal of municipal solid waste - Set up selection criteria for the priority province - Review current status of the solid waste collection, disposal, and treatment systems and best practices - Assess private sector interest - Prepare policy options and action plan - Prepare implementation guidelines Demonstration and Pilots - The participating local governments work with PCD and partners to implement policy options - Technical support to local communities to monitor the performance of the local governments - Technical support for preparing legal and implementing guidelines for waste reuse and recycling program. Training and Skills Enhancement - PCD works with partners to develop and carry out training the trainers and skill enhancement program for local government agencies, and communities. Outreach - PCD works with partners to develop and implement the outreach and dissemination program including: (i) awareness raising campaign; (ii) workshops; (ii) publication; (iii) municipality and civil society exchange	
Target and Indicator	National: 1. Proportion of solid waste recycled (percent) 2. Number of provinces implementing sound waste collection and disposal system (number of provinces)		Current 11	2006 more than 30 more than 38
	MDG 7: N/A		1990 -	Most Recent -
Partners	**National**	PCD, DOLA, NESDB, Magic Eye		
	Local	**Provincial and local administrations**, universities, communities, private sector, NGOs		
	International	USAID, USAEP, JBIC, and WB		

MATRIX 2: DEVELOPMENT MATRIX 4 Component4: Global Environment Commitments

Component	ODS Phase-Out and Chemical Management			
Outcome	- Reduced ODS usage in line with the agreement with the Executive Committee of the multilateral fund - Reduced CO2 emissions by at least 18,800 tons of carbon equivalent / year			
Output Benchmarks			*Inputs – Technical Assistance*	
Year 1	Year 2	Year3		
- Continuation of the implementation of the Building Chiller Replacement Project - Semi-annual evaluation of the performance of all 17 new non-CFC and high-energy efficiency chillers - Continue implementation of individual subprojects in foam, MAC, commercial refrigeration, and halon sectors - Continue implementation of the National CFC Phase Out Plan according to the work plan for CY04 - Continue implementation of Institutional Strengthening program - Develop Methyl Bromide phase-out strategy	- Complete the monitoring and evaluation of the lessons learned and key performance of the Building Chiller Replacement Project - Complete implementation of all individual subprojects in foam, MAC, commercial refrigeration, and halon sectors - Continue implementation of the National CFC Phase Out Plan according to the work plan for CY05 - Continue implementation of Institutional Strengthening program - Finalize the Methyl Bromide phase-out strategy and submit for to the Executive Committee of the Multilateral Fund for approval. - Develop a national strategy to ad dress toxic and hazardous substances	- Complete the Project - Continue implementation of the National CFC Phase Out Plan according to the work plan for CY06 - Continue implementation of Institutional Strengthening program - Implement the Methyl Bromide Phase-out strategy - Finalize the national strategy to effectively manage toxic and hazardous substances	Strategies, Plans, Regulations, Tools and Techniques - DIW continue to work with partners to implement the strategies and action plans to phase out the use of ODS in Thailand, including monitoring and enforcement. - DIW works with partners to develop strategies and action plans to ensure effective management of toxic and hazardous substances, especially those used in and generated from industries. Demonstration and Pilots - DIW continue to work closely with financial intermediary and the enterprises to implement the above strategies and action plans. Training and Skills Enhancement - DIW continue to work with partners on capacity building activities to enhance Government' s capacity to implement, monitor, evaluate, and enforce national strategies to phase out ODS. - DIW works with partners on capacity building activities to enhance Government' s capacity to implement, monitor, evaluate, and enforce national strategies to ensure effective management of toxic and hazardous substances. Outreach - DIW continue to work with partners to develop and implement the outreach and dissemination program including: (i) awareness raising campaign; (ii) workshops; (ii) publication	
Target and Indicator	**National target:** Achieve the ODS phase-out targets as agreed with the Executive Committee of the Multilateral Fund		Current -	2006. -
	MDG 7: • Thailand is expected to meet the country obligations to the Montreal Protocol • Carbon dioxide emissions (ton/per capita)		1990 1.9	Most Recent 3.3
Partners	**National**	DIW, IFCT, MoNRE, DEDE, EEPO, MOF, GSB, LTD, MOPH, MOAC		
	Local	Building owners, chiller suppliers, financial institutions, private sector,		
	International	GEF, MP, UNDP, UNIDO, UNEP, and WB		

MATRIX 2: DEVELOPMENT MATRIX 5 Component5: Strengthening Institutions and Instruments

Component	Environmental Institutions Development			
Outcome	Indicators of improved EIA procedures; reduced waste per industrial output; reduced ambient pollution levels in hotspot areas			
Output Benchmarks			*Inputs – Technical Assistance*	
Year 1	Year 2	Year3		

- Continue dialogue with MoNRE to identify capacity building and technical assistant needs to move forward with the modernization of EIA and reforms to EF
- Continue dialogue with MoNRE to identify capacity building and technical assistant needs to move forward with the implementation of public disclosure initiative and economic instruments to control pollution
- Establish dialogue with MoNRE, NESDB, MOF, BOB, to track public and private environmental budgets, expenditures, and investment
- Initiate dialog with NESDB on national policy that promote sustainable development
- Establish the capacity building program to enhance DOH capability to implement, monitor, and evaluate environmental and social impacts from highway projects
- Provide support to the Administrative and the Supreme courts to enhance the role of the judiciary in promoting sustainable development
	- Based on existing studies, develop strategy and policy options to modernize EIA and EF
	- Develop strategy and policy options to apply various economic instruments to control pollution, including the implementation of a public disclosure program.
	- Workshops to review and discuss various strategies and policy option paper
	- NEB considers various strategic paper i.e., EIA, EF, Public Disclosure, and Economic Instruments
	- Develop strategy and policy options to promote sustainable development.
	- Continue monitoring and evaluation of DOH capacity to address the environmental and social issues.
		- Implementation of the strategy to modernize EIA and EF
		- Identify priority sources of pollution to implement the public disclosure program in selection locations
		- Identify priority economic instruments to be implemented on a pilot basis
		- Capacity Building program for MoNRE and other government officials and key stakeholders.
		- Organize a National and International (especially countries in GMS) dissemination workshops to share lessons learned.
		- Carry out the environmental expenditure tracking exercise
		- Implementation of the agreed strategy, policy, and/or action plan.
		- Continue monitoring and evaluation of DOH capacity to address the environment and social issues.
			Strategies, Plans, Regulations, Tools and Techniques
			- MoNRE works with partners to develop strategy and policy options to strengthen EIA, EF, and Economic and Social Instruments. The strategy may include:
			  - Review and update previous studies and best practices
			  - Policy options
			  - Institutional arrangement based on the policy options
			  - Financing and budgeting plan
			Demonstration and Pilots
			- MoNRE works with partners to implement public disclosure program in selected locations
			- MoNRE works with partners to carry out the environment expenditure tracking exercise
			- DOH implements the EIA guideline on selected project areas
			Training and Skills Enhancement
			- MoNRE works with experts to develop and carry out training the trainers and skill enhancement program for the staff of MoNRE, local government agencies, and communities.
			- DOH works with partners to carry out the capacity building program
			Outreach
			- MoNRE and other agencies works with experts to develop and implement the outreach and dissemination program including: (i) workshops; (ii) publication; (iii) local government, community and civil society exchange	

Target and Indicator	National targets: N/A		Current -	2006 -
	MDG 7: Integrate the principles of sustainable development into country policies and programs and reverse the losses of environmental resources		1990 -	Most Recent 20-year perspective plan (1996) National Agenda (2000)
Partners	National	**NEB, MoNRE**, ONEP, PCD, DEQP, MOF, BOB, NESDB, DOH, NSO, Administrative and Supreme Coutrs		
	Local	Provincial and local government, communities, higher education institutes, private sectors, and NGOs		
	International	USAID, USAEP, US-EPA, JBIC, and WB		

MATRIX 3: PARTNERSHIP MATRIX

(This excludes Bank's administrative budget of US$ 0.4 million over three years)

Activity	Estimated Amount (million, USD)						Total Funding (US$ million)	Sources
	Year 1		Year 2		Year 3			
	Government & Partners	WB	Government & Partners	WB	Government & Partners	WB		
Component 1: Improving Air Quality in Bangkok								
1.1 Diesel Pollution Reduction Strategy for Bangkok	0.13	0.75	0.170	0.96	0.075	0.43	2.5	Government - MoNRE Others - US-AEP, private sector, WB (CAI-Asia ESMAP)
Component 2: Improve Water Quality in Priority River Basins								
2.1 Participatory Watershed Management for Ping River Basin	0.56	0.3	0.7	0.34	0.16	0.082	2.1	Government - MoNRE Others - WB (ASEM)
2.2 Wastewater Management							4.0 (proposed)	Government - DLD, PCD Others - WB (GEF, PPIAF, BNWWP)
Component 3: Improving Waste Management								
3.2 Waste Management							1.0 (proposed)	Government - PCD, EF, Local Administration Others - private, USAID, USAEP, JBIC and WB
Component 4: Global Environment Commitments								
ODS Phase Out and Chemical Management	0.70	4.73	0.91	6.08	0.40	2.7	15.53	Government - DIW, DEDE Others - private sector, WB (GEF, OTF)
Component 5: Strengthening Institutions and Instruments								
4.1 Environmental Institution Development							1.5 (proposed)	Government - MoNRE, NESDB, MOF, BOB, DOH, ONEP, PCD Others - JBIC, USAEP, WB
Total All Components	1.39	5.78	1.78	7.38	0.635	3.212	26.63	

Draft Report

The Study on Environmental Sector Priority in Thailand – Identification of Key Environmental Issues in and around Thailand (Phase I)

Submitted by
Social Research Institute
Chiang Mai University

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1. Management Overview

1. Thailand is a developing country which has experienced major economic growth during the last two decades. The agricultural sector, the main driving force behind the Thai economy before the 1970's, was replaced by the manufacturing sector in the 1980's and since the 1990's, the latter has accounted for more than three-quarters of Thailand's export earnings. From 1987, Thailand attained double-digit real growth rates for three consecutive years and has emerged as one of the world's fastest growing economies. Despite the 1997 economic crisis, manufacturing industry together with the tourism sector continue to develop and constitute the major pillars for the Thai economy.

2. Like other countries, economic growth and industrial development in Thailand have been achieved at a price reflected in the deterioration of natural resources and the environment. The growth in population has also put more pressure on the environment. Despite the industrialized economy, more than sixty percent of the population is still engaged in agriculture in rural Thailand. Provision of land to support the livelihood of poor people has been one of the central problems for all Thai governments during the last fifty years. The problem has been reinforced by the promotion of cash crops cultivation causing continuing encroachment into the forest and public land.

3. The conflicting policies of conservation and economic exploitation of forests pursued by various governments have led to frequent conflicts between the state and the people, and even among the government agencies possessing authorities in land management under different laws. This has been further aggravated by the introduction of big development projects, such as dams, gas pipelines and power plants, without adequate public participation and comprehensive environmental impact assessment. Despite the government's land reform program initiated since 1975, a large number of farmers remain either literally landless or having insufficient land to support their subsistence living.

4. In addition to land resource problems, Thailand is encountering increasing water shortage in the dry season. Water conflicts have arisen frequently during the last two decades due to competing water uses among the various economic sectors. Thailand is still one of the few countries which have no water law or rules for the provision of equitable and efficient water use. Intensive and unsustainable exploitation of fisheries since the 1960's has depleted the resources within the Thai seas causing big social impacts on the poor coastal fishing communities and making the future of the overgrown Thai fishing fleet become problematic.

5. The growth in the transport sector, energy consumption and industrial production during the last four decades are the major cause of air and water pollution.

Obsolete laws and inadequate law enforcement, as well as fragmented administration, make control of point source pollution ineffective. The phenomenal increase in the consumption of manufactured goods including electrical and electronic equipment has raised another issue concerning the management of community hazardous waste which has significant implication for environmental preservation both domestically and internationally.

6. There has been development in term of laws and policies to deal with all these natural resources and environmental management problems. A number of forest laws were introduced in the 1960's based on conservation and control over resource use objectives. These are namely the National Park Act, the National Forest Reserve Act and the Protection of Wild Animals Act (subsequently replaced by legislation of the same title in 1992). Over the years, the Thai government has adopted several policies mostly in the form of cabinet resolutions to deal with the problems of people living in the forest as defined by the state. The Agricultural Land Reform Act was enacted in 1975 with an aim to distribute land to poor farmers. All these laws and policies have all but failed to solve the problems with little impact on the alleviation of poverty.

7. The Earth Summit held in Rio de Janeiro in 1992 sparked a wave of environmental conservation awareness in Thailand, leading to the enactment of several environmental laws and policies. These include the seemingly innovative National Enhancement and Conservation of Environmental Quality Act (NEQA), the Preservation of Wild Animals Act, the Public Health Act, the Factory Act and the Hazardous Substances Act. The Ministry of Environment (now the Ministry of Natural Resources and Environment or MONRE) was established in the same year. The NEQA requires that national medium-term and long-term environmental and natural resource management plans be prepared. Provincial environmental management plans are also to be prepared in each province. However, most of these laws and policies fall short of being an effective tool for solving environmental problems. The NEQA introduced the polluter pays principle in Thai environmental legislation for the first time. Yet, the application of the principle is still too restricted. Other principles necessary for the implementation of sustainable development such as the precautionary principle have rarely been discussed.

8. Of most importance in the development of environmental laws and policies is the promulgation of the 1997 Thai Constitution. Essentially, the Constitution stipulates the principle of public participation in natural resource and environmental management. The important provisions include community right in the conservation, management and utilization of natural resources (Section 46), the right to a decent and healthful environment and the duty of project proponents to conduct environmental impact assessment (Section 56), the right to information (Section 58), the right of stakeholders to be consulted with regard to projects and activities having adverse impact on them and their community as well as the right to express their views through a public hearing process (Section 59). The Constitution also provides for decentralization of powers to local governments which include the functions to manage natural resources and the environment. However, experience during the last seven years has shown that the spirit of the Constitution, especially the principle of public participation, has yet to be realized.

9. The most recent administrative changes that will have significant impacts on the management of natural resources and environment are the public service reform and the restructuring of the public service system. Although the reform was initiated during the Chuan administration (1997 – 2001), it has gained momentum only after Prime Minister Thaksin came into power and gave it a go-ahead signal. Three significant changes that have occurred include: first, the Ministry of Natural Resources and Environment was formed in 2002; secondly, strategic management has been embedded into public service system and activity-based budgeting process was replaced by performance based budgeting and thirdly,

the citizen- focused objective is stressed and public participation as part of the governance has become mandatory.

10. The forming of the new Ministry of Natural Resources and Environment has both up and down sides. While most natural resources and environment related departments are now in the same ministry providing greater hope for a more holistic and integrated management of the ecosystems, land management and the Royal Irrigation Department are still left with the Ministry of Agriculture and Co-operatives. The split of the Royal Forest Department into three departments has further fragmented management into specialized lines. The split was also so unequal that the Royal Forest Department was almost paralyzed in the first stage of the separation. Although the Department of Groundwater Resources still exists, the task which is its expertise, drilling for groundwater, has been transferred to local governments. While the Department of Water Resources is full of people with expertise in road construction, the Department of Mineral Resources which had been separated from the Ministry of Industry came to the new Ministry with most of the specialists but not the equipment. In the longer term, this chaotic transformation will finally settle for the better, but in the short term, it is difficult to say that during the past few years, Thailand has had more effective capacity for managing natural resources and environment.

11. The following sections discuss natural resources status and governance issues in Thailand.

3. Environmental Quality

Water Pollution

57. By and large, inland water quality has fluctuated during these past few years.[1] Judged by the level of Biochemical Oxygen Demand (BOD), in 1999, households were the main source of polluted water generating close to 73 percent of water pollution while the industry sector generated 21 percent and the agriculture sector only 5 percent. To improve water condition, treatment of household wastewater is necessary.

58. Monitoring of surface water quality in 49 major rivers and 4 fresh water reservoirs in 2003 shows that 32 percent of these water sources were classified as having good water quality, 31 percent as having moderate quality, and another 31 percent as having deteriorating quality.[2] The remaining 6 percent were classified as having very deteriorated water quality. This includes the lower *Chao Phraya* river, the lower *Thachin* river, the lower *Lam Ta Klong* river and Lake *Songkhla*, where the problems have become more serious. Along the coastal areas, the water quality in the inner Gulf of Thailand (*Chao Phraya* delta, *Thachin* delta, *Mae Klong* delta and 12 *Thanwa* Canal delta (in *Samutprakhan*)) has also deteriorated.

59. Considered by region, using Dissolved Oxygen (DO) loading, water condition in the northern rivers is comparatively the best and far above standard levels (Figure 19). In the South and Northeastern, the condition is fair and above standard (Figure 20 and 21). It is rivers in the central region, where the water condition has deteriorated, especially in the

1 Pollution Control Department, 2003

2 Pollution Control Department, 2003

middle *Thachin*, the lower *Thachin* and *Chao Phraya* (Figure 22). The DO loadings in these three rivers are much lower than standards. Owing to the fact that these three rivers flow through the most densely populated areas and that water pollution is generated mainly by the household sector, solutions to polluted water treatment must take into account the waste management behaviors of households. It is not sewage alone that is disposed of from households into the waterways, but rather the mix of both liquid and solid wastes. Engineering solutions such as construction of community waste water treatment facilities, which are designed to handle solely sewage treatment, will not be sufficient to solve the problem**.**

60. The deterioration of fresh water quality comes from both point source and non-point source polluters. Point source water pollution such as industry is manageable, but lack of effective enforcement is a limiting factor. Non-point source water pollution is more difficult to manage. Apart from the need for comprehensive wastewater treatment infrastructure, environmental education as well as people's participation in water quality monitoring is needed for effective management.

61. However, policy response to this problem in early years was to construct wastewater treatment plants for municipal areas around the country. From the total of 87 wastewater treatment plants, 68 are completed, 11 plants are under construction and 3 plants were rejected.[3] These treatment sites cover only 37 percent of total municipal areas.[4] The full potential of those facilities currently in service is about 2.8 million cubic meters per day. However, it is estimated that only 50-60 percent of the full potential has been utilized. Lack of capable staff and budget are the factors limiting the successful operation of wastewater treatment plants at the provincial level, which are the responsibility of local government organizations.[5] Water pollution management plan is now being drafted by the Pollution Control Department applying the area-function-participation and decentralization concepts.

62. Coastal waters have shown a clear deteriorating trend (Table 24). Moreover, 88 oil spills causing water pollution was recorded in the last 30 years. Four of them caused severe damages to the Thai coastal ecology system.

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[3] Pollution Control Department, 2003

[4] Thailand Development Research Institute, 1999

[5] Office of the Auditor General of Thailand 2002. Evaluation of the Environmental Management under the provincial environment management operational Plan.

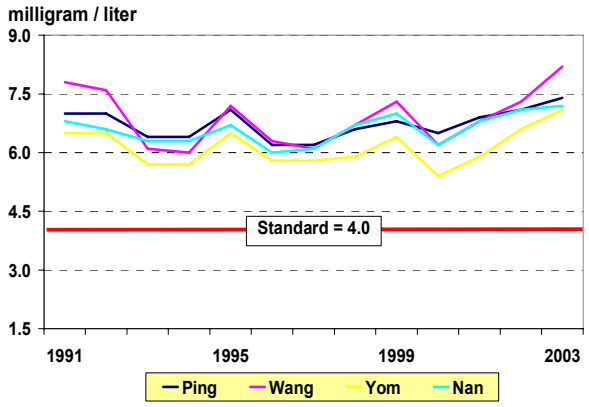

Figure 19 Dissolved Oxygen Level: Northern Rivers

Source: Pollution Control Department

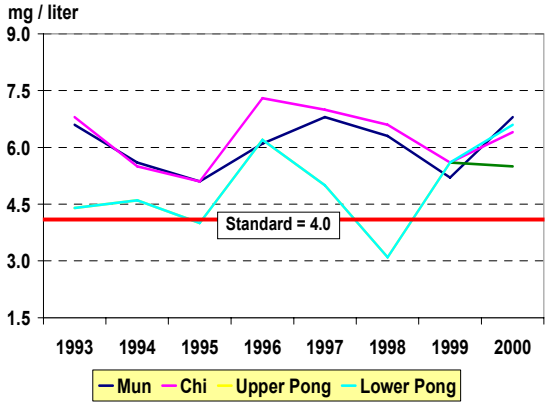

Figure 20 Dissolved Oxygen Level: Northeastern Rivers

Source: Pollution Control Department

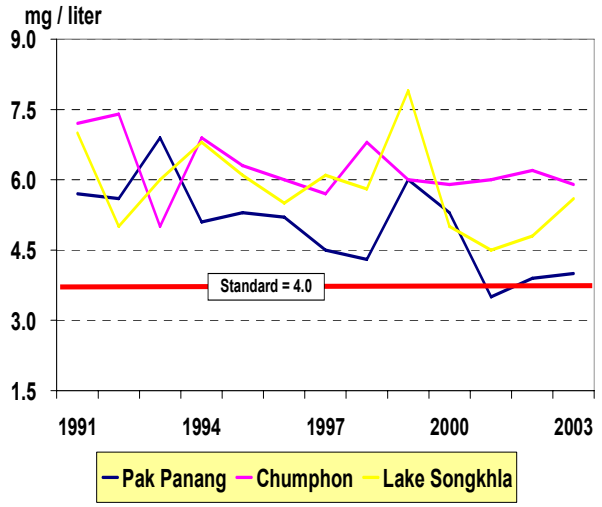

Figure 21 Dissolved Oxygen Level: Southern Rivers

Source: Pollution Control Department

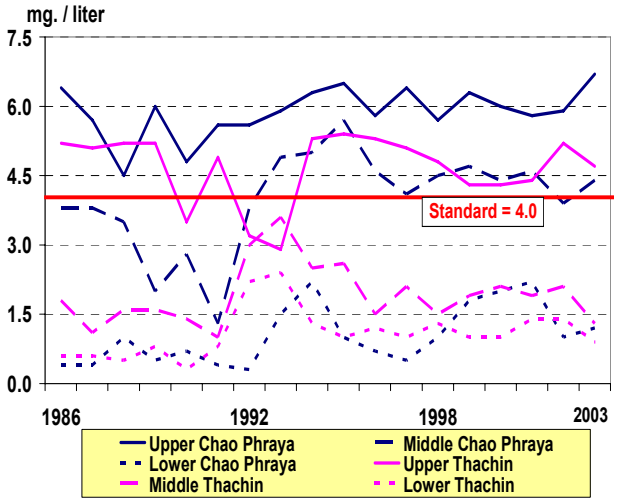

Figure 22 Dissolved Oxygen Level: Central Rivers

Source: Pollution Control Department

Table 24 Water Pollution Indicators

Policy/Goals	Unit	Type	1997	1998	1999	2000	2001	2002	2003	2004	Result
1. Surface waterquality - The lower Chao Phraya River -DO not less than 4 mg/l, - Chao Phraya tributaries -DO of not less than 2 mg/l by the year 2006 - Water quality not to decline from existing state. - The lower Thachin river -DO of not less than 4 mg/l -Thachin tributaries –DO not less than 2 mg/l. - Main rivers flowing through urban areas- not less than designated Surface Water Quality Standards.											-
Percentage of surface water quality above standards	%	S	-	-	-	-	18	40	31		↓
2. Seawater quality- to conform to the Coastal Water Quality Standards with priority given to important tourist sites and the upper Gulf of Thailand.											-

Policy/Goals	Unit	Type	1997	1998	1999	2000	2001	2002	2003	2004	Result
Percentage of coastal water quality above standards	%	S	-	-	-	-	-	84.00	68.00		↓

Source: Adjusted from ONEP (2005)

Note:

- *Indicator types*: P – pressure indicator; S – state indicator; R – response indicator
- *Indicator results*: ↑ in the same direction as the target; ↓ in the opposite direction of the target
- *Evaluation results*: (++) (+) in the same direction as the target, (–) (– –) in the opposite direction of the target

Air pollution

63. The major problem of air pollution was particulate matter (< 10 μ)(PM10) in Bangkok, *Samutprakarn*, Chiang Mai and *Saraburi* provinces (Figure 23). The increase in the volume of PM10 caused by the grinding and cements industries in *Chalermprakiat* district in *Saraburi* province has led to the area being designated as an environmental protection area. The action taken by the government to solve air pollution include the preparation of an operational plan within the framework of the national master plan regulating the control of open burning (2004-2008), the improvement of diesel engines standards from EURO 2 to EURO 3, and the reduction of sulfur amount in diesel fuel.

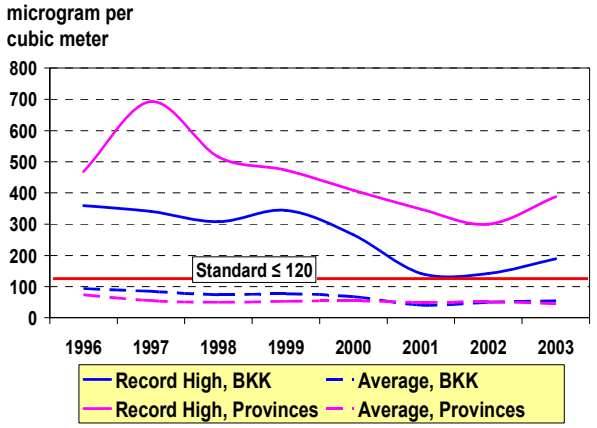

Figure 23 Dust with average size less than or equal to 10 micron (PM-10)
Source: Pollution Control Department

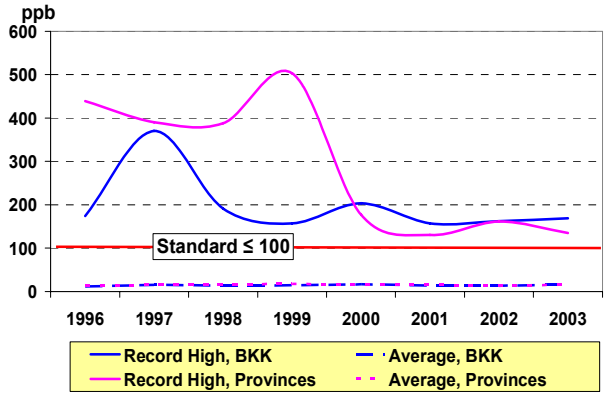

Figure 24 Ozone level
Source: Pollution Control Department

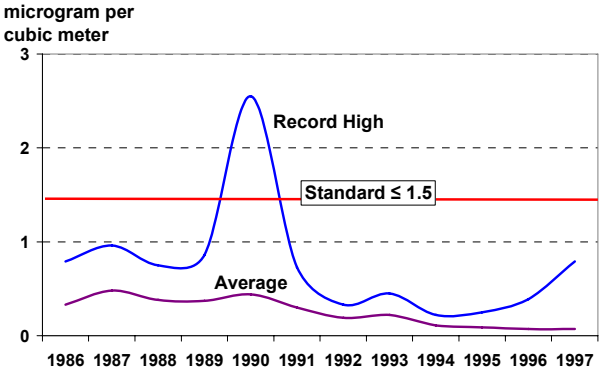

Figure 25 Lead level in Bangkok
Source: Pollution Control Department

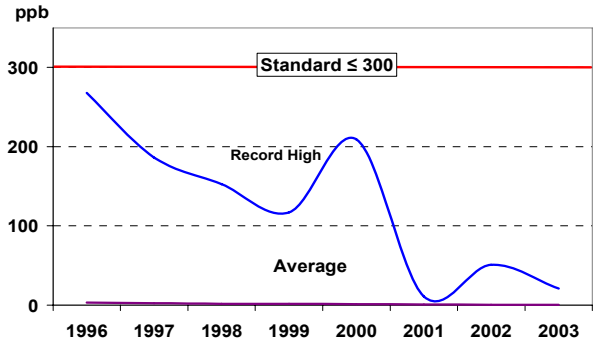

Figure 26 Sulfur Dioxide Level, Mae Moh, Lampang
Source: Pollution Control Department

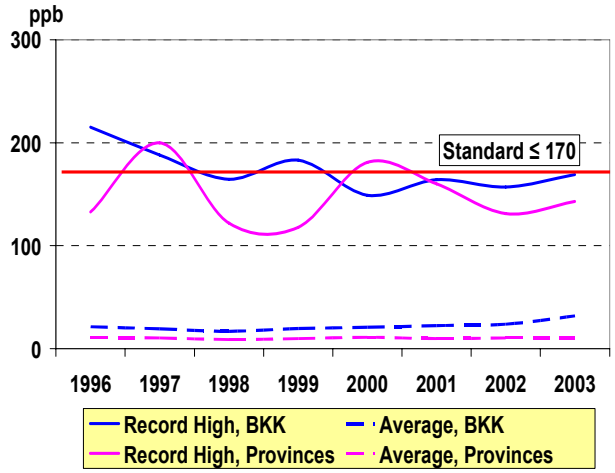

Figure 27 Nitrogen Dioxide Level
Source: Pollution Control Department

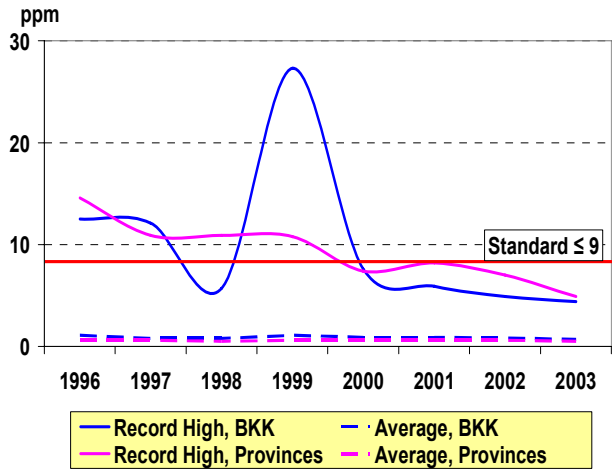

Figure 28 Carbon Monoxide Level
Source: Pollution Control Department

Table 25 Air Pollution Indicators

Policy/Goals	Unit	Type	1997	1998	1999	2000	2001	2002	2003	2004	Result
1. Air quality in pollution control zones and urban areas, particularly dust, will be within designated Ambient Air Quality Standards. In particular, dust contamination in general areas will have an annual average of not more than 0.1 mg/m^3, and dust contamination in roadside areas will have a maximum 24-hour average concentration o not more than 0.3 mg/m^3.											–
- Percentage of days with PM10 level above standard in Bangkok *	%	S	-	-	8.41	12.77	9.98	3.73	5.02		↓
2. Other pollutants in ambient air will remain within designated standards, particularly carbon monoxide, beginning in the year 1997.											+
- Percentage of days with CO level above standard in Bangkok *	%	S	-	-	0.00	0.00	0.00	0.00	0.00		↑
- Percentage of days with O_3 level above standard in Bangkok *	%	S	-	-	0.00	0.02	0.00	0.01	0.05		↑
3. The concentration of air pollutants in industrial zones and general communities, particularly sulfur dioxide and nitrogen oxides, will be within designated standards.											

Source: Adjusted from ONEP (2005)

Note:

- *Indicator types*: P – pressure indicator; S – state indicator; R – response indicator
- *Indicator results*: ↑ in the same direction as the target; ↓ in the opposite direction of the target
- *Evaluation results*: (++) (+) in the same direction as the target, (–) (– –) in the opposite direction of the target

Noise pollution

64. The average noise level in Bangkok is higher than the standard of 70 decibel (A), especially when packed traffic is the major source. In 2003, there were 5.48 million automobiles registered in Bangkok. Although public transportation has undergone extensive improvement, there were 514,530 automobiles newly registered during the year 2003 alone. With the traffic problem unlikely to improve in the foreseeable future, increasing number of automobiles will lead to more noise pollution. Implementation of engineering solutions such as installation of insulation in motorways will not be sufficient in the long-run. Average noise level in the provincial areas, on the other hand, was well within standard levels and has

decreased in the recent years (Figure 29). Outside Bangkok and its vicinity, noise pollution is serious in *Na Pralan* district of *Saraburi* province, and *Hat Yai* district of *Songkhla* province. Table 26 shows the results of monitoring the policy and goals in controlling noise pollution.

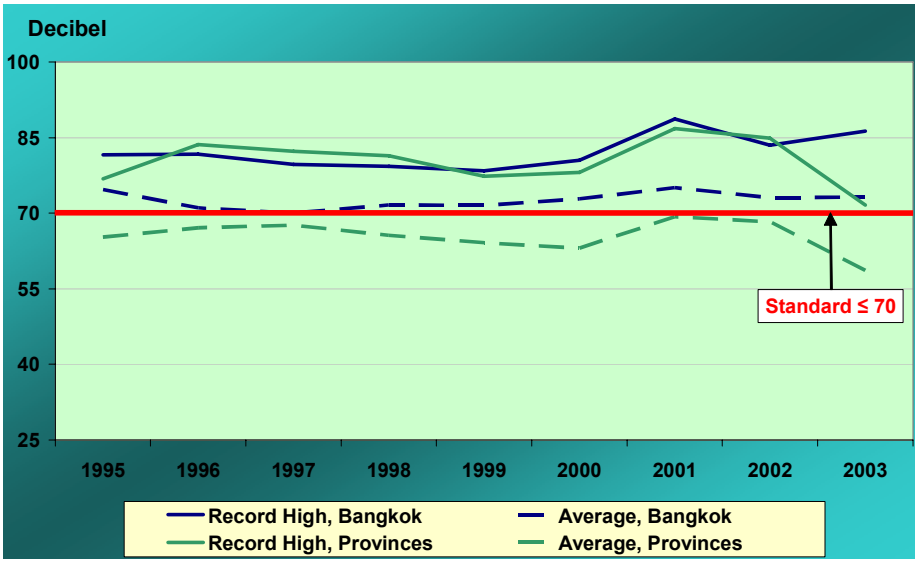

Figure 29 Noise Level
Source: Pollution Control Department

Table 26 Noise Pollution Indicators

Policy/Goals	Unit	Type	1997	1998	1999	2000	2001	2002	2003	2004	Result
1. To control the general level of noise in all areas of the country, with an 24-hour average level of not more than 70 decibels (A)											–
- Percentage of days with noise level above standard in Bangkok and vicinity	%	S	-	-	-	-	-	96	88		↓
- Percentage of days with noise level above standard in countryside	%	S	-	-	-	-	-	10	11		↓
2. To control noise and vibration pollution at point of origin to be within standards, including noise from vehicles, noise and vibration from business premises and communities.											+

Source: Adjusted from ONEP (2005)

Note:

- *Indicator types*: P – pressure indicator; S – state indicator; R – response indicator
- *Indicator results*: ↑ in the same direction as the target; ↓ in the opposite direction of the target
- *Evaluation results*: (++) (+) in the same direction as the target, (–) (– –) in the opposite direction of the target

Wastes

65. The volume of solid waste from households throughout the country has been increasing at the average of 1 percent per year from 1997 to 2003. In 2003, the volume of household solid waste was approximately 39,240 tons per day or 14.4 million tons per year (Figure 30). Twenty-four percent of the solid wastes are created in Bangkok and its vicinity, 31 percent from *Muang Pattaya* and municipal areas and the remaining 45 percent from non-municipal areas. Solid waste collection and disposal in Bangkok achieved 99 percent of the total volume of solid waste generated, while proper solid waste collection and disposal in

municipal areas accounted for only 35 percent of the total solid wastes.[6] Proper solid waste collection and disposal is rarely found in non-municipal areas.

66. End-of pipe solutions for solid waste management (solid waste collection and disposal systems such as sanitary landfills) become more difficult due to land use conflicts and opposition from residents in the potential landfill sites. Alternatively, waste management at source of origin such as recycling and reuse has been promoted throughout the country. Recyclable solid waste has been increasing from 19 percent of total solid wastes generated in 1997 to 36 percent in 2003, while recyclable industrial waste increased from 29 percent in 1997 to 49 percent in 2003. In 2003, there are 31 recycle plants and 49 industrial plants which use recycled materials for production. These indicators indicate a certain level of progress in waste management. In the future, the recycle rate can be improved because of the high supply of recyclable solid wastes. Local governments usually levy user charge for wastes collection and disposal but the charges are generally too low to cover the costs for wastes management (e.g. 40 baht a month per household while the actual costs are at least twice as much).

67. As far as hazardous waste is concerned, the quantity of hazardous wastes in Thailand has increased significantly during the last two decades. The economic and social development has generated both industrial wastes and community wastes at the level exceeding the country's waste management capacity. The Pollution Control Department estimated that in 2003, there were about 1.8 million tons of hazardous wastes in Thailand. This consisted of 1.4 million tons of industrial waste or 78 per cent of the total hazardous waste and another 0.38 million tons of community hazardous waste. More than 64 per cent of the hazardous wastes or 1.07 million tons were generated in Bangkok and its vicinity.

68. Based on the number of registered hazardous waste treatment plants, Thailand has the capacity to manage only 0.18 million tons or approximately 11 per cent of the hazardous wastes (Pollution Control Department, 2001). A significant amount of hazardous wastes are improperly treated on site and there are occasionally instances of illegal dumping of hazardous wastes on public land.

69. Thailand does not have a single authorized agency to exercise an integrated control over hazardous waste management. Under the 1992 Factory Act, the Department of Industrial Works (DIW) of the Ministry of Industry has the authority to prescribe rules and regulations governing the management and disposal of industrial wastes. The Industrial Estate Authority of Thailand has the same power with respect to factories situated in the twenty-three industrial estates throughout the country. Both government agencies have developed some kinds of manifest system document aiming to control the movement of hazardous wastes from waste generating plants to waste disposal facilities.

70. Waste treatment and waste recycle plants are required to register with DIW. These are classified as factories typed 101, 105 and 106 out of all 106 categories of factories. This can be elaborated as follows:

(1) Type 101 consists of waste treatment plants which carry out hazardous and non-hazardous waste treatment and disposal. The methods used involve various techniques of waste treatment, incineration, stabilization and landfill. As of 2003, there are 119 factories of this category.

[6] At present there are 107 solid waste collection and disposal in the municipal areas.

(2) Type 105 consists of waste separation plants. Recoverable wastes are separated from the non-recoverable wastes which are then disposed by landfill. As of 2003, this category has 54 registered factories.
(3) Type 106 consists of recycle plants which carry out recovery and recycle activities. As of 2003, there are 42 registered plants of this category.[7]

71. These three types of factories combined are insufficient to handle the increasing amount of hazardous wastes. Most of the laws and policies have focused mainly on the control and management of industrial wastes. At present, the measures for management of hazardous wastes from other sources are far from adequate. Clinical wastes from medical care in hospitals and medical centers are managed and treated on site by incineration under the supervision of the Department of Health while those from private clinics are collected along with ordinary solid wastes.

72. A significant gap exists in the management of community hazardous wastes. Community wastes are non-point source pollution and therefore are more difficult to regulate than other point source pollution such as industrial wastes. Community hazardous wastes are diverse ranging from hazardous discharges from businesses such as film processing shops, laundry facilities, garages and petrol stations to hazardous household wastes including chemicals, insecticides, paints, fluorescence light bulbs and electrical and electronic equipment disposed by consumers. Discharges from small businesses in communities are generally not subject to emission standards control and household wastes are usually collected along with ordinary solid wastes. Under the 1992 Public Health Act, local governments are responsible for collecting and disposing of solid wastes. Since household or community wastes are not separately collected, they are disposed of at the same landfill sites. Such practices are harmful to the environment since hazardous substances can seep through the soil and contaminate the water table in the long run.

73. Table 27 and 28 show the estimated proportion of community hazardous wastes generated by the various regions of Thailand and the different sources of community hazardous wastes

Table 27 Community hazardous wastes generated by different regions

Region	Quantity (percentage)
Bangkok metropolitan area	31
Bangkok vicinity	6
Central region	16
Northeast region	22
Northern region	14
Southern region	11
Total	100

Source: Pollution Control Department, 2003

Table 28 Proportion of different sources of community hazardous wastes

Sources	Quantity (percentage)

[7] DIW Information Centre, February 2004.

Garages	48
Households	22
Agriculture activities	10
Petrol stations	9
Hospitals	5
Laboratories	1
Other sources	5
Total	100

Source: Pollution Control Department, 2003

74. The fast-growing consumption of manufactured goods by communities and households has raised attention to the problems of managing community hazardous wastes, especially in the light of tightening environmental regulations on hazardous wastes in the European Union (EU). As far as wastes from electrical and electronic equipment (WEEE) are concerned, the recent two directives issued by the EU restricting the use of certain hazardous substances in electrical and electronic equipment (EEE) and prescribing producers' responsibility in the collection and disposal of WEEE have prompted both the Ministry of Industry to study the methods for managing WEEE and the Pollution Control Department the legal measures to manage community wastes from disposed manufactured products including WEEE. Both studies have been completed but it is not clear whether they will ever be adopted by the government.

75. In designing a system for managing community hazardous wastes, it has been suggested that economic instruments be used. According to the study conducted by the Social Research Institute, Chiang Mai University on the laws to regulate community hazardous wastes management, it is proposed that the most appropriate model for Thailand is to introduce product charges for manufactured goods which would become hazardous wastes when discarded. The revenue from the charges can be used to set up deposit refund schemes to buy back used products from consumers. Such mechanism would help to create incentives for consumers to separate and return the wastes. Currently DIW is also proposing a draft law which would employ economic instruments in dealing with industrial point sources. Essentially, this would take the form of pollution tax levied from the amount of pollution discharge from factories.

76. Effective waste management depends to a great extent on a change in consumers' behaviors. Although technical solutions are most relevant for handling pollution and wastes, they require less effort to implement. To achieve behavioral changes, more effort is needed (Figure 31).

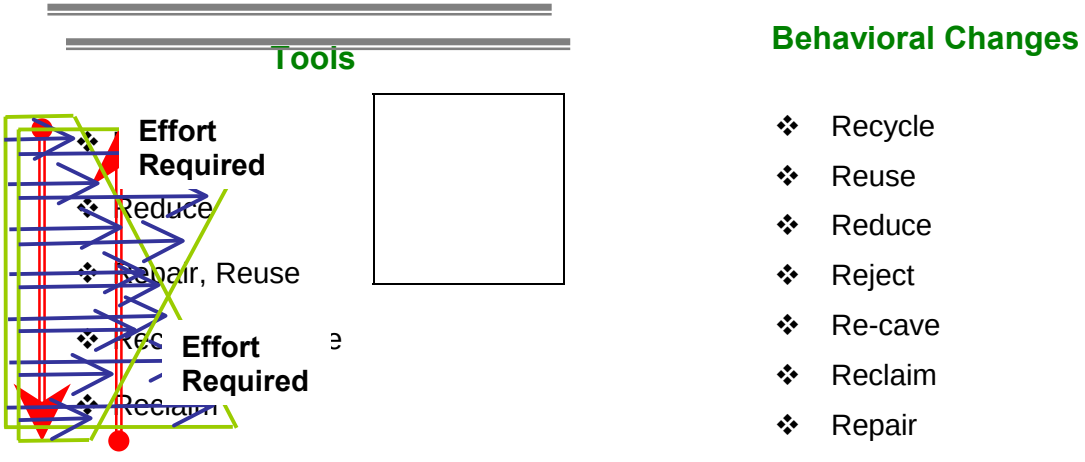

Figure 31 Efforts employed in Technical Solutions versus Behavioral Changes
Source: Dr. Thongchai Pansawat, Advisor to Pollution Control Department, 2005

Table 29 Solid and Hazardous Wastes Indicators

Policy/Goals	Unit	Type	1997	1998	1999	2000	2001	2002	2003	2004	Result
Solid Waste and Night Soil											
1. To reduce or control solid waste generation to the rate of not more than 1.0 kg/capita/day. Have Bangkok and communities throughout the country utilize waste of not less than 15 percent of the total solid waste generated.											+
- Solid waste per capita per day	kg/day/capita	P	1.96	1.82	1.86	1.83	1.19	1.20	1.18		↑
- Percentage of solid waste recycled	%	R	18.71	21.19	23.13	26.20	28.40	32.99	36.22		↑
- Percentage of industrial waste recycled	%	R	28.72	37.90	44.44	44.44	45.13	48.25	48.78		↑
- Number of recycled plants	#	R	-	-	-	-	-	25	72	80	↑
2. All solid waste left from collection in municipal districts is to be collected, and for outside municipal districts not more than 10 percent o the total solid waste is to be left.											–
3. To ensure that each province has a master plan and management plan for sanitary solid wastes and night soil disposal, and every municipality and sanitation district have proper solid waste and night soil disposal systems.											–
Hazardous Substances											
1. To reduce and control pollution from hazardous materials generated by all sources, by not allowing impacts on public health and welfare.											–
- Number of hazardous substance accidents	#	S	-	-	-	20	24	27	28		↓
- Percentage change of imported hazardous substance	%	P	-5.29	-3.42	8.36	5.04	29.66	17.21	-14.25		↑
- Percentage change of produced hazardous substance	%	P	9.11	1.03	0.71	44.17	73.86	13.18	20.36		↑
2. To formulate an emergency action plan for hazardous material accidents, especially in high-risk areas at provincial and national levels.											+
3. To establish a toxicology center and an information center for hazardous materials at the national level.											+
Hazardous Wastes											
1. To reduce and control pollution from hazardous wastes from all sources in both industrial and in domestic sectors, by not allowing impacts to the environment and public health.											–
- Hazardous wastes from industrial sector	million tons	P	1.40	1.31	1.25	1.29	1.31	1.40	1.41		↓
- Hazardous wastes from communities	million tons	P	0.32	0.34	0.35	0.36	0.37	0.38	0.39		↓
2. To collect and destroy at least 95 percent of the hazardous wastes from industrial sector and 90 percent from domestic sector.											–
3. All public and private hospitals to have proper systems to manage infectious wastes, including separating, collecting, transporting, treatment, and destroying.											–
- Infectious waste	tons	P	18,200	19,665	21,000	13,250	15,300	20,000	22,500		↓

Source: Adjusted from ONEP (2005)

Note:

- *Indicator types*: P – pressure indicator; S – state indicator; R – response indicator
- *Indicator results*: ↑ in the same direction as the target; ↓ in the opposite direction of the target
- *Evaluation results*: (++) (+) in the same direction as the target, (–) (– –) in the opposite direction of the target


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