

バングラデシュ人民共和国
環境局 (Department of Environment)

バングラデシュ国
環境管理アドバイザー業務

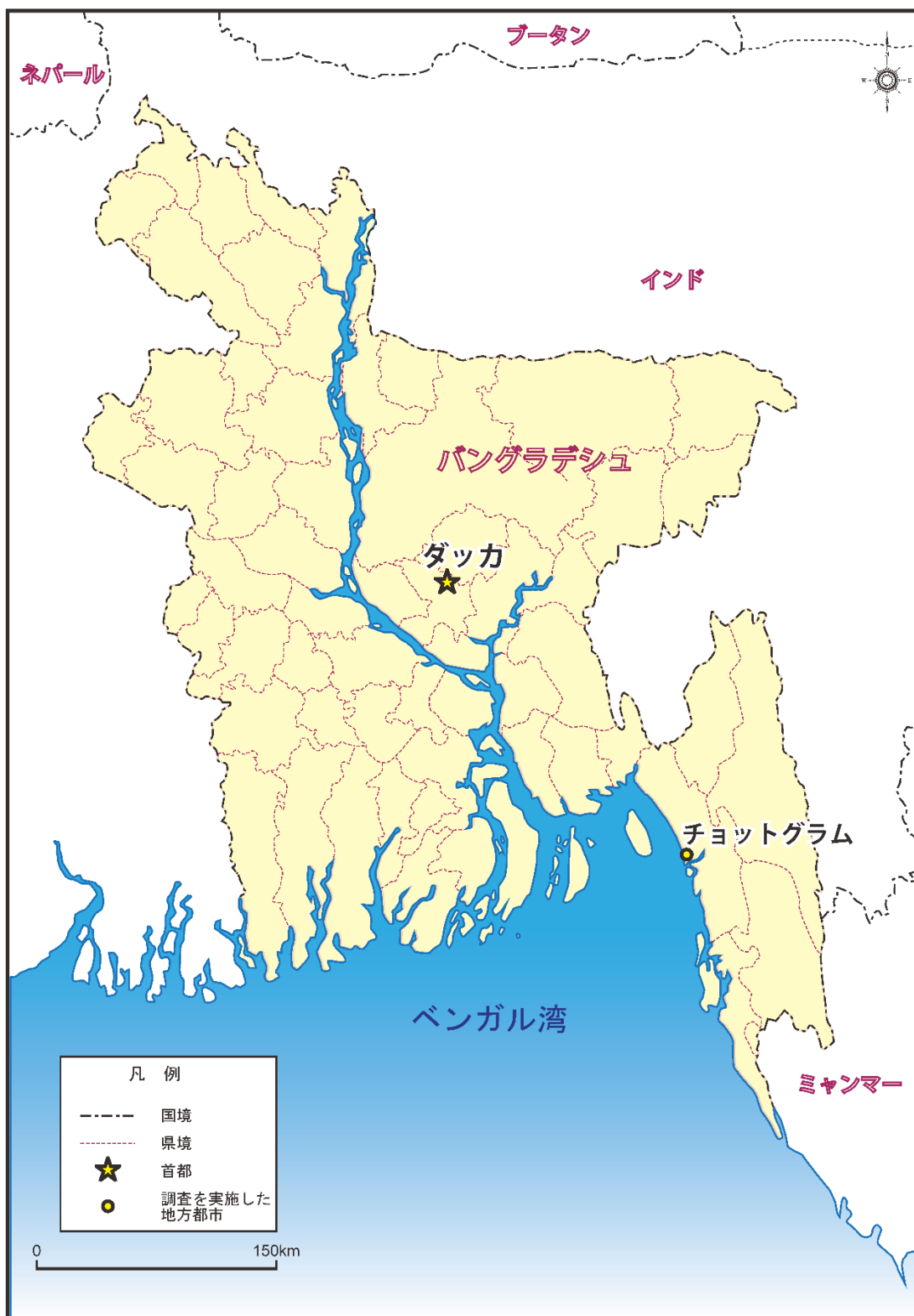
事業完了報告書

2023年11月

独立行政法人
国際協力機構 (JICA)

日本工営株式会社

環境
JR
23-111



出典：“Surface and Ground Water Quality Report 2016”, “New Clean Dhaka Master Plan (2018-2032)”

出典: JICA 専門家チーム

業務対象地域図

Bangladesh 国環境管理アドバイザー業務

事業完了報告書

目次

	ページ
1. 序章	1
1.1 背景及び経緯	1
1.2 本業務の目的	1
1.3 本業務の概要	2
1.4 水質汚濁対策、廃棄物管理の状況	5
1.4.1 水質汚濁対策の状況.....	5
1.4.2 廃棄物管理の状況.....	7
2. 活動内容.....	8
2.1 現況及び課題抽出に係る活動（成果 1）	8
2.1.1 環境管理基本法令.....	8
2.1.2 DoE の組織	10
2.1.3 DoE の職務	15
2.1.4 水質汚濁対策分野の現況及び課題.....	16
2.1.5 廃棄物管理分野の現状及び課題.....	21
2.2 能力開発に係る活動（成果 2）	29
2.2.1 環境局全体の関わる活動.....	29
2.2.2 水質汚濁対策分野の活動.....	31
2.2.3 廃棄物管理分野の活動.....	39
2.3 最終セミナー	51
2.3.1 目的及び概要.....	51
2.3.2 結果.....	52
2.3.3 協議内容.....	52
3. 業務実施運営上の工夫.....	54
3.1 全体面での運営上の工夫.....	54
3.1.1 プロジェクト全体に関する事項.....	54
3.2 水質汚濁対策分野	55
3.3 廃棄物管理分野	55
4. 成果の達成度	57
4.1 成果 1：DoE の環境管理行政を行う際の水質汚濁対策、廃棄物管理に おける法規制、制度上の課題の明確化.....	57
4.2 成果 2：DoE が包括的な環境管理を行うために必要な能力向上に 向けた分析・検討の実施.....	57
5. 今後の提言	63
5.1 プロジェクト上位目標達成に向けた提言	63
5.1.2 水質管理.....	63
5.1.3 廃棄物管理分野.....	63

添付資料：ワークショップ資料、助言関連資料

表一覧

表 1-1	本プロジェクトの活動の概要.....	2
表 1-2	実施したワークショップ等の概要（水質汚濁対策）	3
表 1-3	実施したワークショップの概要（廃棄物管理）	3
表 1-4	DoE が今後行うべき活動	4
表 2-1	環境管理基本法規の概要.....	8
表 2-2	2023 年の ECR の改訂の概要.....	9
表 2-3	本プロジェクトで協働した主な DoE 本部管理職.....	10
表 2-4	DoE 本部の主な部署の概要	11
表 2-5	地表水の環境基準（ECR(2023)）	18
表 2-6	水質汚濁対策に係る他ドナーの支援.....	19
表 2-7	BEST プロジェクトの概要.....	20
表 2-8	廃棄物管理に係る規則.....	22
表 2-9	関連する他ドナー案件.....	28
表 2-10	水質汚濁対策に係る第一回目のワークショップの概要.....	32
表 2-11	水質汚濁対策に係る第二回目のワークショップの概要.....	33
表 2-12	ラボ認証取得支援の活動の概要.....	36
表 2-13	チョットグラム環境分析ラボラトリーの ISO 取得に向け必要な作業の整理.....	37
表 2-14	廃棄物管理に係る第 1 回目のワークショップの概要.....	48
表 2-15	廃棄物管理に係る第 2 回目のワークショップの概要.....	49
表 2-16	最終セミナーの概要.....	51
表 2-17	DoE が今後行うべき活動	52
表 4-1	水質汚濁対策分野の現状と課題、及び今後の活動案.....	59
表 4-2	廃棄物管理分野の現状と課題、及び今後の活動案.....	61

図一覧

図 1-1	Buriganga River の水質(2018年).....	6
図 1-2	Buriganga River の水質の傾向(2010年-2018年).....	6
図 2-1	DoE 組織図.....	13
図 2-2	Divisional Office の配置図.....	14
図 2-3	ECR 改定に伴う EIA 手続きの変更.....	17
図 2-4	廃棄物関連法や戦略についての策定の変遷.....	22
図 2-5	SWM Rule で示された廃棄物管理に係る主な関係省庁及び 地方自治体の関係... ..	26
図 2-6	地方自治体における廃棄物管理の流れ.....	27
図 2-7	2023-24 年の DoE の予定する研修に係る予算配分計画.....	30
図 2-8	研修ニーズに係る質問票の回答結果.....	31
図 2-9	水質汚濁対策に係るワークショップで使用したスライドの例 (ECR と水質汚濁防止法の内容の比較).....	34
図 2-10	水質汚濁対策に係るワークショップで使用したスライドの例 (排水処理メカニズム).....	35
図 2-11	水質汚濁対策に係るワークショップで使用したスライドの例 (排水処理の基礎と練習問題).....	36
図 2-12	DoE と地方自治体(LGI) との連携のイメージ図(JICA 専門家チームの提案).....	39
図 2-13	National Coordination Committee 内のワーキンググループ設置.....	40
図 2-14	廃棄物管理に係る法令、政策の制度整備に係る変遷と必要な今後の改善.....	41
図 2-15	都市廃棄物に関する制度整備及び能力強化、関係者との調整に係る変遷と 今後の活動提案.....	42
図 2-16	日本の地方自治体の廃棄物管理データを取りまとめた モニタリングシートの例.....	43
図 2-17	日本の地方自治体の廃棄物管理データを取りまとめた日本全体の ごみフローの事例.....	43
図 2-18	産業廃棄物に関する制度整備及び能力強化、関係者との調整に係る変遷と 今後の必要な活動.....	44
図 2-19	日本の循環型社会、廃棄物管理に関する関連法.....	45
図 2-20	産業廃棄物、特に有害廃棄物のモニタリングシステム.....	45
図 2-21	医療廃棄物に関する制度整備及び能力強化、関係者との調整に係る変遷と 今後の活動提案.....	46
図 2-22	将来的な DoE Waste and Chemical Wing の組織体制の一案.....	47
図 2-23	新クリーンダッカマスタープラン 2018-2032 の目標.....	50

写真一覧

写真 1-1	ダッカ市の水路(Tongi Khal)の 状況.....	5
写真 1-2	ダッカ市の周辺都市(ガジプール市)の既存最終処分場のオープンダンピングの 状況.....	7

略語表

3R	Reduce, Reuse and Recycle	リデュース、リユース、リサイクル
ADB	Asian Development Bank	アジア開発銀行
ADG	Assistant Director General	副局長
BEST	Bangladesh Environmental Sustainability and Transformation	Bangladesh 環境持続可能性・変革プロジェクト (世界銀行のプロジェクトの名称)
BOD	Biochemical Oxygen Demand	生物化学的酸素要求量
BWDB	Bangladesh Water Development Board	Bangladesh 水開発庁
CAMS	Continuous Air Monitoring System	大気常時監視システム
CBP	Cox Bazar Paurashava	コックスバザール
CC	City Corporation	市役所
CCC	Chottogram City Corporation	チョットグラム市役所
CDM	Clean Development Mechanism	クリーン開発メカニズム
CETP	Common Effluent Treatment Plant	共同排水処理場
CFU	Colony Forming Unit	コロニー形成単位
CGP	City Governance Project	シティ・ガバナンス・プロジェクト
COD	Chemical Oxygen Demand	化学的酸素要求量
CRDP-II	Second City Region Development Project	都市地域開発プロジェクト II
CRM	Certified Reference Material	標準認証物質
CTEIP	Coastal Towns Environmental Infrastructure Project	沿岸町環境インフラプロジェクト
DD	Deputy Director	副局長
DG	Director General	総局長
DNCC	Dhaka North City Corporation	北ダッカ市役所
DO	Dissolved Oxygen	溶存酸素
DoE	Department of Environment	環境局
DPHE	Department of Public Health and Engineering	公衆衛生工学局
DSCC	Dhaka South City Corporation	南ダッカ市役所
ECA	Environmental Conservation Act	環境保全法
ECC	Environmental Clearance Certificate	環境クリアランス証明書
ECR	Environmental Conservation Rules	環境保全規則
EIA	Environmental Impact Assessment	環境影響評価
EPR	Extended Producer Responsibility	拡大生産者責任
EQS	Environmental Quality Standard	国家環境品質基準
ETP	Effluent Treatment Plant	排水処理施設
FCDO	Foreign, Commonwealth and Development Office	外務・英連邦開発省(イギリス)
GCC	Gazipur City Corporation	ガジプール市役所
GDP	Gross Domestic Product	国内総生産
GIS	Geographic Information System	地理情報システム
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit	ドイツ国際協力公社

IEE	Initial Environmental Examination	初期環境調査
ISO	International Organization for Standardization	国際標準化機構
IT	Information Technology	情報技術
JICA	Japan International Cooperation Agency	独立行政法人国際協力機構
LGD	Local Government Division	地方行政総局
LGED	Local Government Engineering Department	地方行政技術局
LGI	Local Government Institute	地方自治体
MGSP	Municipal Governance Service Project	地方自治体行政・サービス事業
MoEFCC	Ministry of Environment and Forest and Climate Change	環境・森林・気候変動省
MoC	Ministry of Commercial	商業省
MoF	Ministry of Finance	財務省
MoI	Ministry of Industry	工業省
NCC	Narayanganji City Corporation	ナラヤンガンジ市役所
NEAP	National Environmental Action Plan	国家環境管理行動計画
NRM	Natural Resource Management (Wing)	天然資源管理(部門)
RDF	Refuse Derived Fuel	ごみ固形燃料
RS	Remote Sensing	リモートセンシング
SCRDP	Southern Chottogram Regional Development Project	南部チョットグラム地域開発事業
SDGs	Sustainable Development Goals	持続可能な開発目標
SIDA	Swedish International Development Cooperation Agency	スウェーデン国際開発協力庁
SOP	Standard Operating Procedures	標準操作手順書
SRF	Solid Recovered Fuel	ごみ由来の代替燃料
SWM Rule	Solid Waste Management Rule	固形廃棄物管理規則
TDS	Total Dissolved Solids	総溶解固形物
UDCGP	Urban Development and City Governance Project	都市機能強化事業
UGIIP-III	Third Urban Governance and Infrastructure Improvement Project	第3次都市ガバナンス・インフラストラクチャー改善プロジェクト
UNDP	United Nation Development Program	国連開発計画
WASA	Water and Sewerage Authority	上下水道公社
WB	World Bank	世界銀行
WBA	Ward Based Approach	ワードベーストアプローチ
WCM	Waste and Chemical Management (Wing)	廃棄物・化学物質管理(部門)

1. 序章

1.1 背景及び経緯

Bangladesh は 2000 年以降、堅調な経済成長を遂げている。一方で、急激な都市化や工業化に伴い大気汚染、水質汚濁、廃棄物の増加、騒音等の多様かつ深刻な環境問題に直面している。適切な処理がなされていない生活排水や産業排水の放流により、都市部の河川のみならず流域全体での水質汚濁が著しく、人口増に起因する廃棄物問題等による社会への悪影響が危惧され、 Bangladesh 国内では環境汚染、公害対策強化の社会的要求が強まっている。国際協力機構 (JICA: Japan International Cooperation Agency) はこれら環境問題への対応として、技術協力、無償資金協力等を通じた南北ダッカ市、チョットグラム市等の廃棄物管理能力強化に取り組んできた。また、世界銀行 (WB: World Bank) 等の他ドナーも、援助協調の枠組みのもと大気汚染対策をはじめとする環境管理支援を実施している。 Bangladesh 政府は、2041 年までに貧困撲滅を達成した先進国化を目指すと共に、持続的な経済成長の達成に向けて、環境問題に伴うリスクや生態系の損失を軽減しつつ、人間の生活を改善し社会の不平等を解消する環境政策の実施を目指すとしている。さらに「第 8 次 5 ヶ年計画」(2020/21~2024/25 年度) では、汚染者負担原則の運用開始、都市水域の水質基準の向上、大気質の改善、及び環境パフォーマンス指数の世界ランキングを下位 5% (2018) から 2025 年までに上位 50%、2041 年までに上位 30% 入りにまで改善すること等を具体的な目標として掲げ、都市環境マネジメントの改善を重点分野として設定し、持続可能な開発目標 (SDGs: Sustainable Development Goals) を踏まえた開発アプローチを順次進めている。

Bangladesh における環境政策の監督官庁である環境・森林・気候変動省 (MoEFCC: Ministry of Environment, Forest and Climate Change) は、環境保全法の整備や各種計画・戦略・プログラムを策定し、同省管理下の環境局 (DoE: Department of Environment) が、それらに沿って政策制度の策定、査察・モニタリング、許認可発行等を適切に行うことが求められている。しかしながら、DoE の人材の不足等により、制定された法律が適切に運用されていない等の状態を招いている。

こうした状況を踏まえ、本事業は、特に DoE においてニーズが高いことが確認されている水質汚濁対策と廃棄物管理を中心として、包括的な環境管理を行うための課題を整理し、今後の環境管理の実施能力強化や体制構築に必要な施策の検討に資する支援・助言を行うことを目的として実施された。

1.2 本業務の目的

急激な都市化や工業化に伴う環境問題に対して、これを管理する法制度及び体制が十分でなく管理能力が不足している。本業務はこれらの課題解決に向け、DoE を主なカウンターパートとして、現状に即した環境管理体制及び能力の向上を図ることを目的とする。

本目的の下に設定されているプロジェクト目標、及び成果及び活動は以下に示すとおりである。

プロジェクト目標

環境管理行政 (主に水質汚濁対策・廃棄物管理) の改善のための課題が整理され、包括的な環境行政を行うための DoE の能力強化に向けた方向性が示される。

成果及び活動

成果 1：DoE の環境管理行政を行う際の水質汚濁・廃棄物管理における法規制、制度上の課題が明らかになる。

活動 1-1：現行の公害・環境汚染問題に係る政策、法制度、実施体制、対策等を分析し、課題を抽出する。

活動 1-2：水質汚濁対策・廃棄物管理対策に係る環境基準の設定や規制遵守に向けた査察・モニタリング体制の構築等に関する法令・ガイドライン策定や各種制度設計に向けた環境行政の課題を抽出する。

活動 1-3：水質汚濁対策・廃棄物管理分野における類似案件及び他ドナーによる取り組み状況を整理・分析し、今後の課題を抽出する。

成果 2：DoE の包括的な環境管理を行うために必要な能力向上に向けた分析・検討が行われる。

活動 2-1：DoE の体制や能力を踏まえた上で、環境管理行政における DoE と他省庁、自治体の役割分担及び連携・調整の強化の検討に資する支援・助言を行う。

活動 2-2：DoE に対して政策・制度、活動計画、人材育成の検討に資する支援・助言を行う。

活動 2-3：MoEFCC、DoE 職員を対象とした現地研修、ワークショップ、セミナー等を開催する。

1.3 本業務の概要

本業務の活動は以下のとおり実施された。

業務期間：2021 年12 月～2023 年11 月

カウンターパート：DoE

主な実施活動：本プロジェクトで実施してきた活動の概要は、表 1-1 に示すとおりである。

表 1-1 本プロジェクトの活動の概要

年月	水質汚濁対策	廃棄物管理
● 成果 1：課題の抽出		
2022.2	● 法制度の情報収集	
2022.3	● キックオフミーティングの開催	
2022.5-6	● 水質汚濁対策に係る情報収集	● 廃棄物管理に係る情報収集
2022.8	● コーディネーション・ミーティングの開催	
2022.9-11	● 水質汚濁対策の課題検討	● 廃棄物管理の課題検討
2022.12-2023.1	● 水質汚濁対策の課題検討に係るワークショップ（排水管理制度、排水処理施設の技術）	● 廃棄物管理の課題検討に係るワークショップ（廃棄物管理制度）
2023.5	● DoE にこれまでの水質汚濁対策に係る活動報告書を提出し、意見交換を実施	● DoE にこれまでの廃棄物管理に係る活動報告書を提出し、意見交換を実施

年月	水質汚濁対策	廃棄物管理
● 成果 2：今後の環境管理活動強化に向けた提言		
2023.2-3	● チョットグラムの環境分析ラボラトリ認証に向けた活動支援	● 今後の活動検討に係るワークショップ
2023.7	● 今後の活動検討に係るワークショップ	
2023.8-10	● DoE による最終セミナーの準備、提言の取り纏め	
2023.11	● 最終セミナーの実施 ● 業務完了報告書の作成	

出典：JICA 専門家チーム

本業務で実施した主な活動としてワークショップが挙げられる。ワークショップは水質汚濁対策、廃棄物管理のそれぞれの分野で各 2 回、計 4 回実施した。ワークショップでは日本の環境管理制度の紹介や基本的な排水処理技術といった技術的な内容の紹介と併せ、DoE が優先的に取り組むべき課題、及び課題解決のために DoE が行うべき活動の検討を行った。なお、水質汚濁対策については、ワークショップの他にチョットグラムの DoE 環境分析ラボラトリに対して、現状の課題を確認するギャップ分析、将来的なラボ認証取得のために必要な活動内容、活動スケジュール、及び概算予算を検討した。ワークショップ等の概要を表 1-2 及び表 1-3 に示す。

表 1-2 実施したワークショップ等の概要（水質汚濁対策）

ワークショップ	開催日	参加者		内容
第 1 回 ワークショップ	2023 年 2 月 1 日	35 名	DoE	<ul style="list-style-type: none"> 排水処理施設 (ETP: Effluent Treatment Plant) の処理技術に係る基本的な知識に係る演習 日本の水質汚濁対策に係る法律制度と水質汚濁対策の歴史 DoE が優先的に取り組むべき課題に係る協議
第 2 回 ワークショップ	2023 年 7 月 9 日	26 名	DoE	<ul style="list-style-type: none"> DoE が行うべき活動に係る協議
環境分析ラボ認証取得支援	2023 年 3 月 15 日 -16 日	10 名	DoE チョットグラム環境分析ラボラトリ	<ul style="list-style-type: none"> ラボラトリの品質管理に係るギャップ分析 ラボラトリ認証に係る活動、スケジュール、予算の検討

出典：JICA 専門家チーム

表 1-3 実施したワークショップの概要（廃棄物管理）

ワークショップ	開催日	参加者		内容
第 1 回 ワークショップ	2022 年 12 月 21 日	51 名	DoE、ダッカ市及びその周辺市役所、チョットグラム市役所	<ul style="list-style-type: none"> 日本の廃棄物管理制度及び現場での廃棄物管理活動の紹介 DoE が優先的に取り組むべき課題に係る協議

ワークショップ	開催日	参加者		内容
第2回 ワークショップ	2023年7月20日	38名	DoE、ダッカ市及びその周辺市役所、チョットグラム市役所、WB、ドイツ国際協力公社 (GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit)	<ul style="list-style-type: none"> • 廃棄物管理規則 (SWM Rule: Solid Waste Management Rule) に規定される報告及び計画策定に係り必要な事項の整理・共有 • 南北ダッカ市の廃棄物管理計画の紹介、共有 • DoE が行うべき活動に係る協議

出典：JICA 専門家チーム

本業務で得られたファインディングを踏まえ、DoE が今後行うべき活動を整理した。本提案については、2023年11月に実施した最終セミナーで DoE 及び JICA 専門家チームにより関係者に共有された。最終セミナーで提案された DoE が今後行うべき活動を表 1-4 に示す。

表 1-4 DoE が今後行うべき活動

分野	制度面での現況	DoE が行うべき活動
水質汚濁対策	環境保全規則 (ECR: Environmental Conservation Rule) が 2023 年に改訂され、河川、湖沼、沿岸域の水質モニタリング、及び排水モニタリングに係る要求が強化された。	(短期的に求められる活動) <ul style="list-style-type: none"> • 産業排水発生源に対するインスペクション、及び環境クリアランス証明書 (ECC: Environmental Clearance Certificate) の発行、更新作業を適切に実施するための技術研修の継続的な実施 • 環境分析ラボラトリの機材を適切に運用し分析結果の品質を確保するための研修の実施、及びラボラトリ認証制度取得のための活動の実施 (長期的に求められる活動) <ul style="list-style-type: none"> • 産業排水以外の排水も含めた汚濁負荷検討のための関連省庁・機関との連携強化 • 流域単位での排水管理を実現するための制度の検討、関係機関との連携 • 国際河川等に係る越境汚染問題への取り組み
廃棄物管理	SWM Rule が 2021 年に制定され、廃棄物の発生・処理状況の報告、及び管理計画策定の義務が明確となった。	(短期的に求められる活動) <ul style="list-style-type: none"> • SWM Rule で求められる活動を地方自治体が実施できない要因の確認、及び優良事例の収集 • 地方自治体によるモニタリング及び管理計画策定の確実な実施を促すための指導能力強化に係る研修の実施、及び指導のためのツールの作成 • 産業廃棄物管理に係るモニタリングのパイロット活動の実施と民間を含めた関係者との協議の実施 • 廃棄物管理体制の強化 (DoE、National Coordination Committee) (長期的に求められる活動) <ul style="list-style-type: none"> • 総合的な産業廃棄物の発生・処理状況のモニタリングシステムの構築

出典：DoE 及び JICA 専門家チーム

1.4 水質汚濁対策、廃棄物管理の状況

1.4.1 水質汚濁対策の状況

(1) 中央省庁の実施体制、法制度の整備状況

Bangladesh の水質管理は MoEFCC の DoE が責務を有している。法制度に関しては、1995 年に制定された環境保全法(ECA: Environmental Conservation Act) の下で 1997 年に ECR が制定されており、水質環境基準や排水基準が設定され、工場への排水処理設備の設置の導入が義務付けられた。しかしながら、排水処理施設は設置・維持管理費等が課題となり導入が進まず、特に皮革産業・繊維業が集積するダッカ市周辺で水質汚濁が顕著となったため、2009 年に 4 河川 (Buriganga 川、Shitalakshya 川、Turag 川および Balu 川) が生態学的危機地域に指定されている。その後、2023 年に ECR が改訂され、水質の環境基準及び排出基準のパラメータが増やされている。ただし、新たに追加されたパラメーターについての技術的な解説などは無く、これらの新基準に基づいて環境行政を執行する職員への訓練・能力強化が必要な状態である。

(2) 水質モニタリングの実施状況及び水質汚濁の現状

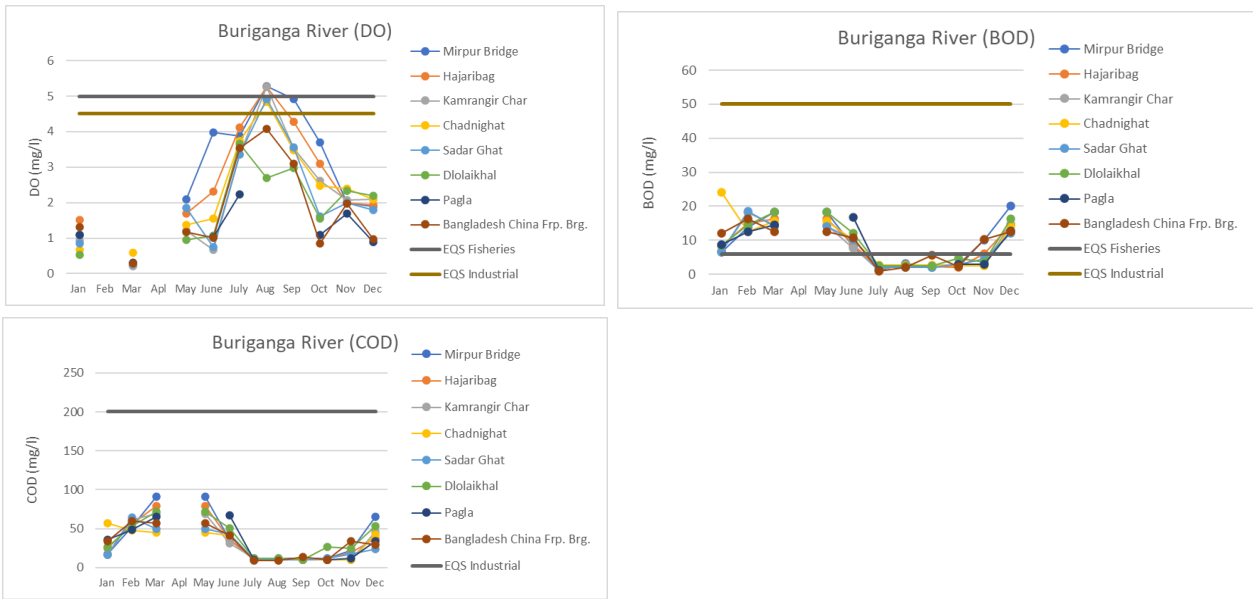
DoE は、1973 年に水域の水質のモニタリングを開始している。地表水の水質監視は 28 河川 66 地点で実施されている。測定項目は pH、溶存酸素 (DO: Dissolved Oxygen)、生物化学的酸素要求量 (BOD: Biological Oxygen Demand)、化学的酸素要求量 (COD: Chemical Oxygen Demand) など 12 項目であり、現地観測及び室内分析により毎月測定されていたが、コロナの流行後は、定期的なモニタリング活動の報告が滞っている。

水質のモニタリング測定結果から、ダッカ周辺やチョットグラム市、クルナ市といった地方の主要都市の河川で生活排水、産業排水による水質汚濁が懸念されている。特にダッカ市周辺では水量が減少する乾季に水質がさらに悪化し、2016 年の測定結果では DO はほぼ 0mg/L の極貧酸素状態であり、BOD は 50mg/L、COD は 200mg/L を超え、著しい有機汚濁が確認されている。水域のモニタリングレポートの最新版は 2018 年の水域の水質レポートである。このレポートにあるダッカ市に近い Buriganga River の水質を例として図 1-1 に示す。



出典：日本工営

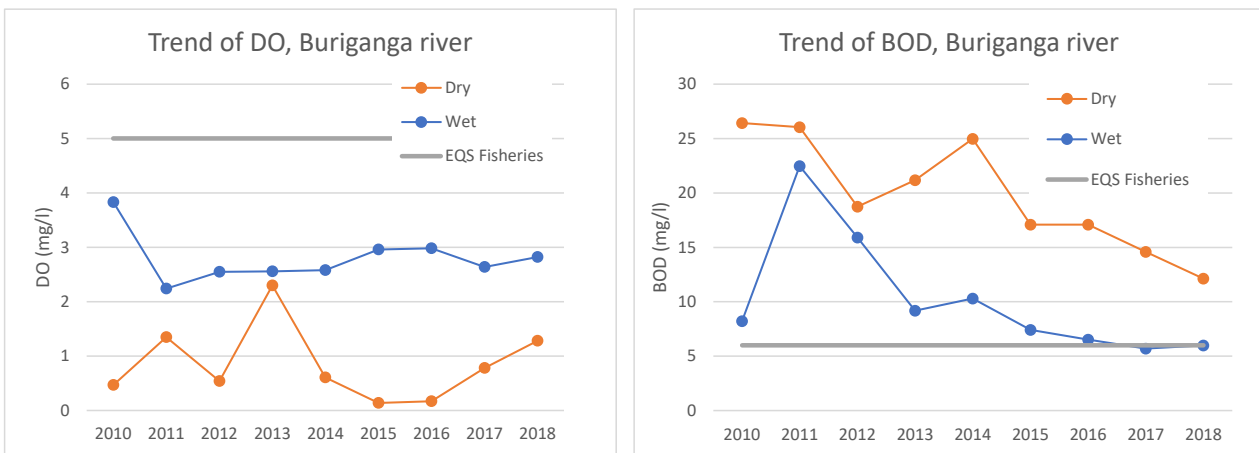
写真 1-1 ダッカ市の水路(Tongi Khal)の状況



出典：Surface and Ground Water Quality Report 2018 の記載データから JICA 専門家チームが作成

図 1-1 Buriganga River の水質 (2018 年)

上記の最新の調査結果からも引き続き乾季の DO の濃度が低く BOD、COD が上昇する傾向が見られる。この結果は Buriganga River の本流であるが、支流部では 2016 年と同様に BOD は 50mg/L、COD は 200mg/L を超える水質が見られる。また Buriganga River の近年の水質の傾向を図 1-2 に示す。近年の水質の傾向は DO が横ばい、BOD は若干の改善傾向が見られるものの依然として環境基準を超過している。



出典：Surface and Ground Water Quality Report 2018 の記載データから JICA 専門家チームが作成

図 1-2 Buriganga River の水質の傾向 (2010 年-2018 年)

乾季の水質悪化に伴い、地下水の取水量が増加している。産業排水としては、皮革工業や染色業の排水の影響が大きい。これらの業種の排水には重金属が含まれる。排水基準には重金属類を含む多くの項目が設定されているが、現状で環境水の分析は基礎的な項目に限られているため、重金属類等の人の健康に影響を及ぼす物質による環境水の汚染状況は把握されていない。

1.4.2 廃棄物管理の状況

(1) 中央省庁の実施体制、法制度の整備状況

DoE が廃棄物管理に関する法制度の整備を実施し、規制官庁として、各地方自治体を実施する廃棄物管理の実施状況や事業者から発生する事業系廃棄物の監督及びモニタリングの責務を有している。また、地方行政・農村開発・協同組合省（Ministry of Local Government, Rural Development and Cooperatives）の地方行政総局（LGD: Local Government Division）が、地方自治体を実施する廃棄物管理を統括する責務とともに、計画策定や施設整備に関する技術的支援を実施する責務を有している。廃棄物管理の実務（機材調達、施設整備、運営維持管理）は LGD の下で各地方自治体を実施している。法制度としては、Hazardous Waste and Ship Breaking Waste Management Rule、Hazardous Waste (E-waste) Management Rule、Medical Waste Management and Processing Rule などが整備されており、廃棄物管理の基本法である SWM Rule も 2021 年に制定された。一方、E-waste や Ship Breaking Waste 以外の有害廃棄物に関する法律や循環型社会に向けた基本法、使い捨てプラスチックの削減、グリーン購入に関する法制度等はまだ制定されておらず、廃棄物関連法制度は、整備途上であるといえる。

(2) 廃棄物管理の実施状況

Bangladesh の廃棄物管理分野において JICA は、2003 年に開始された開発調査より約 20 年間、技術協力プロジェクト、無償資金協力（一般無償、環境プログラム無償、草の根無償等）や JICA 海外協力隊等の様々なプログラムを活用しながら、南北ダッカ市及びチョットグラム市を中心に収集運搬、最終処分、組織改善、環境教育、3R (Reduce, Reuse and Recycle)等の廃棄物管理全般の様々な分野について継続的に支援している。そのため、例えば、収集運搬の指標である収集率に着目すると南北ダッカ市やチッタゴン市では 80%を超えている。一方で、地方都市 (Paurashava)¹では、50%～60%であり、郡 (Upazila)²では廃棄物の収集サービスが提供されていない。最終処分に関し、南北ダッカ市では、準好気性の衛生埋立処分場が整備されているが、ダッカ市の周辺都市や上記の地方都市ではオープンダンプの状況である。



出典：JICA 専門家チーム

写真 1-2 ダッカ市の周辺都市（ガジプール市）の既存最終処分場のオープンダンプの状況

¹ Paurashava は、Bangladesh の地方自治体の行政単位であり、Municipality として訳される。

² Upazila は、Bangladesh の地方自治体の行政単位であり、Sub district として訳される。

2. 活動内容

2.1 現況及び課題抽出に係る活動（成果 1）

2.1.1 環境管理基本法令

(1) 概要

バングラデシュにおける環境管理に係る基本的な法律は、表 2-1 に示すとおりである。

環境管理に係る基本法は、ECA であり、その要求事項を実施するための細則を定めた規則が ECR である。

表 2-1 環境管理基本法規の概要

No.	名称	年	文書の概要
1	National Environmental Policy	1992, 2018 年 (最終更新)	<p>国家環境政策は環境政策の遂行に係る一連の分野別行動指針を示したもので以下の内容を含んでいる。</p> <ul style="list-style-type: none"> 環境汚染活動の把握と管理 全分野での環境に配慮した開発の徹底 持続可能かつ環境に配慮した天然資源の利用 地球環境保全のための地域的・国際的な相互協力の推進 環境教育、及び環境保全に係るキャパシティ・ビルディング・世論の構築 他分野の政策戦略における環境政策と戦略の内包化 必要なすべての部門における環境影響評価と戦略的環境アセスメントの実施 国際的な環境イニシアティブへの積極的な関与とそのため必要な国・地方レベルでの行動の実施
2	Bangladesh Environment Conservation Act (ECA)	1995 (2010, 2023 年改正)	<p>本法律は、環境局長が、環境保全のため、汚染管理・予防・緩和に係る適切かつ必要な活動を行う権限を規定している。</p> <p>加えて、以下の内容を規定している。</p> <ul style="list-style-type: none"> 生態系危険区 (Ecologically Critical Area) の設定・管理 ECC の取得義務 自動車排ガスの規制方針の提示 大気・水質・騒音・土壌の各地域・目的別の基準の公布 廃棄物の排出及び排出に関する許容限度の提示 環境汚染の管理・軽減、保全、環境改善に関する環境ガイドラインの策定
3	Environmental Conservation Rules (ECR)	1997 (2023 年改正)	<p>1997 年の環境保全規則は、1995 年の環境保全法に基づいて公布された規則である。本規則は、以下を規定する。</p> <ul style="list-style-type: none"> 環境大気、地表水、地下水、飲料水、工業排水、排出物、騒音、車両排気に関する国家環境基準 (EQS: Environmental Quality Standard) 環境影響評価 (EIA: Environmental Impact Assessment) の実施手順 ECC の取得手順

No.	名称	年	文書の概要
			<ul style="list-style-type: none"> 産業・開発プロジェクト・活動のカテゴリーに応じた、初期環境調査（IEE: Initial Environmental Examination）及び EIA の実施手順 環境管理計画の要件 公害等の影響を受けた者、又は影響を受けるおそれのある者による損害賠償請求の手續
4	National Environmental Action Plan (NEAP)	1995	NEAP は、1995 年～2005 年にかけての環境管理行動計画を示したものである。国内で環境影響を及ぼす主要な要因の特定、環境劣化の防止・低減措置の提案、自然環境の回復、及び持続的な開発の推進について行動計画を示している。
5	Environmental Court Act	2000 (2002 年, 2010 年に改訂)	環境裁判法は、環境裁判所の設置及びこれに付随する事項について規定している。この法律はまた、環境裁判所の管轄権、裁判所命令に違反した場合の罰則、特別治安判事裁判所における裁判手續き、捜査手續き、環境裁判所の監督権、上訴手續きと上訴裁判所の設立等を規定している。

出典：JICA 専門家チーム

(2) ECR の改訂の概要

ECR は 2023 年に改訂されている。主な改訂内容は表 2-2 に示すとおりであり、EIA 手順及び ECC 取得手順の一部改定や水質に係る環境基準、排水基準について基準項目の追加や一部項目の基準値の更新が定められている。現在、DoE の分析ラボは追加された項目の全てについて十分な分析が可能な体制とはなっていない。

表 2-2 2023 年の ECR の改訂の概要

主な変更点		内容
EIA	事業区分の変更	環境影響の程度に応じた事業区分の変更(注:バングラデシュ国では環境影響の度合いに応じて、事業を色で区分している) ・新しいカテゴリ(イエロー)の追加
	報告書	<ul style="list-style-type: none"> EIA 報告書作成に関するガイダンスの提示 EIA 報告書の評価・承認プロセスの提示 承認手續き費用の更新
ECC	ECC 取得手順	・ECC 取得プロセスの更新
	有効期限	・グリーン・クラスとイエロー・クラスの ECC 有効期限の更新
環境被害の評価と補償		汚染管理の不備により環境被害を生じさせた事業者に対する ECC 停止手續きの実施
環境基準・排出基準		地表水質: <ol style="list-style-type: none"> 陸水地表水質: <ul style="list-style-type: none"> NO₃-N、NH₄-N、PO₄-P、全 Cr、Pb、TDS、化学的酸素要求量 (COD) などのパラメータを新たに追加 沿岸地表水質 <ul style="list-style-type: none"> 16 のパラメータの追加 飲料水水質 <ul style="list-style-type: none"> 生物化学的酸素要求量 (BOD) の削除 農薬(アルドリノ/ディルドリン)、界面活性剤の追加 下水排水 <ul style="list-style-type: none"> 窒素 (NO₃-N) とリン (PO₄-P) の基準がより厳しくなった 産業排水:

主な変更点		内容
		<ul style="list-style-type: none"> ・沿岸地表水質の基準を追加 ・残留塩素及びバイオアッセイ試験(農薬製造業のみ)の追加 <p>6. 事業所別排水</p> <ul style="list-style-type: none"> ・肥料工業、パルプ・製紙工業、蒸留所、砂糖、食品加工、魚加工、乳製品：水温の追加 ・繊維工業：色、水温、COD の追加 ・染色業・印刷業：硫化物、フェノール化合物、Pb、Cd、Co、Ni の追加 ・皮なめし業：塩素およびフェノールの追加 ・食品加工、魚加工、乳製品：pH の追加 ・原油精製所：10 のパラメータの追加 ・農薬産業：35 のパラメータの追加 ・電池製造業、塗料業、セラミックタイル：衛生用関連パラメータの追加

出典：JICA 専門家チーム

2.1.2 DoE の組織

(1) 概要

バングラデシュ国における環境管理に係る体制整備は、1972年の国連人間環境会議での議論を踏まえて開始された。1977年には、環境汚染管理委員会及び環境汚染管理本部が設立され、その後、1985年に公害対策部が設立されたのち、1989年にDoEが設立された。同局は、本部の他にDhaka、Chattogram、Khulna、Bogra、Barisal、Sylhet、Rangpur、MymensinghにDivisional Officeを配置し、加えて49のDistrict Officeを設置し環境管理に係る業務を遂行している。DoE本部に対しての聞き取りによれば、現在配置が計画されている職員数1,133名に対して実際に配置されているのは2022年において586名とのことである。

図2-1にDoEの組織図を、また図2-2にDivisional Officeの配置状況を示す。

DoEは要員不足に悩まされている一方、将来的には4,392名の職員の配置を計画している。後述するWBの支援事業、Bangladesh Environmental and Sustainability Transformation (BEST) プロジェクトを実施するにあたって、DoEは職員の増員を約束しており、Planning Wingによれば、来年以降、毎年100人程度の増員を計画しているとのことである。今後、既に職務についている職員も併せ、特に新規雇用の職員に対する研修計画及び各職員の能力の把握のための活動が重要になると考えられる。

(2) DoE本部の組織

本プロジェクトで協働した主なDoE本部の部署及び管理職は表2-3に示すとおりである。

表 2-3 本プロジェクトで協働した主な DoE 本部管理職

部署	管理職
DoE	Director General (DG) : 最高責任者
	Additional Director of General (ADG) : DG の補佐役
Natural Resource Management Wing (NRM Wing)	Director : 部門長。本プロジェクトのプロジェクト責任者 Deputy Director : 副部門長。水質汚濁対策の主要カウンターパート
Waste and Chemical Management Wing (WCM Wing)	Director : 部門長 Deputy Director : 副部門長。廃棄物管理の主要カウンターパート

部署	管理職
Monitoring and Enforcement Wing	Deputy Director : 副部門長。事業場に対する立入検査に係る優先課題、及び今後必要な活動について協議
Planning Wing	Deputy Director : 副部門長。BEST プロジェクトの進捗について協議。
Environmental Clearance and Certificate Wing (ECC Wing)	Director : 部門長。事業場の排水処理施設に係る ECC 発行及び EIA 手続きに係る優先課題、及び今後必要な活動について協議

出典：JICA 専門家チーム

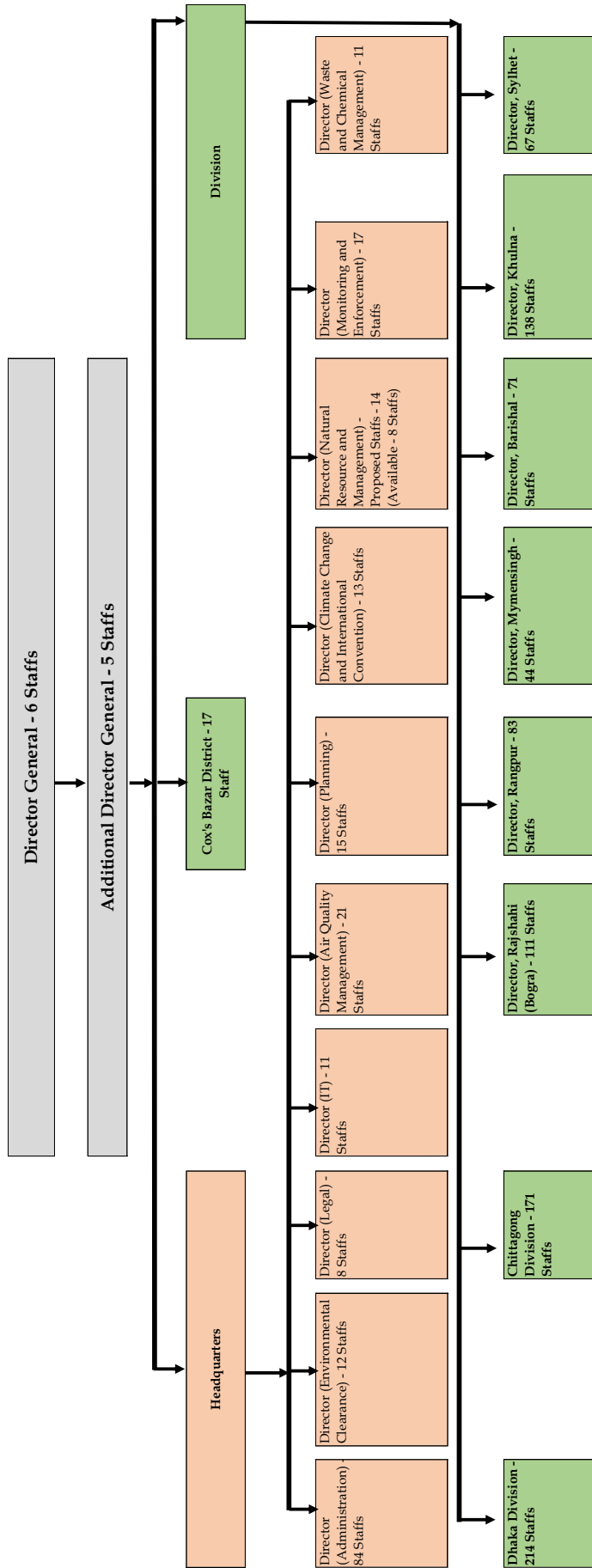
DoE 本部の主な部署の概要は表 2-4 に示すとおりである。

表 2-4 DoE 本部の主な部署の概要

部署名	概要
Natural Resource Management Wing (NRM Wing)	<ul style="list-style-type: none"> ● 主担当業務は以下のとおり。 <ul style="list-style-type: none"> - 環境水質モニタリング - 啓発活動 - 河川環境管理及び自然生態系管理 ● 他部署と連携した活動も実施。 <ul style="list-style-type: none"> - EIA レビュー (Environmental Clearance Wing と連携) - 汚染源管理 (Monitoring and Enforcement Wing と連携) ● 水の管理に際しては各関係機関と連携している。 <ul style="list-style-type: none"> - 河川水: Ministry of Shipping - その他の水域: Ministry of Water Resource - 農業用水利用: Ministry of Agriculture
Waste and Chemical Management Wing (WCM Wing)	<ul style="list-style-type: none"> ● 廃棄物管理の Wing が設立されたのは 2020 年。非常に新しい部署であり。組織の能力強化が必要。 ● 同 Wing は、廃棄物管理の中央省庁は、地方自治体との連携が必要となるがこれまで地方自治体と十分に連携は行えていなかった。SWM Rule が整備されたことで、中央省庁と地方自治体の役割分担が明確にされた。同ルールの中で、DoE 及び地方職員のキャパシティ・ディベロップメントを重要視している。 ● 主担当業務は以下のとおり。 <ul style="list-style-type: none"> - 有害化学物質の輸入許可手続き - 有害廃棄物のモニタリング - 廃棄物管理に関する法制度整備 - 各自治体を実施する廃棄物管理のモニタリング ● 他部署と連携した活動も実施。 <ul style="list-style-type: none"> - EIA レビュー (Environmental Clearance Wing と連携) ● 他省庁や自治体との連携による管理活動も実施している。 <ul style="list-style-type: none"> - SWM Rule が策定され、各自治体を実施する廃棄物管理のモニタリングを実施する機関としての役割が明確になった。 - LGD、地方行政技術局 (LGED) や公衆衛生工学局 (DPHE) との連携については、充分とはいえない。 - SWM Rule が制定され、今後、各自治体を作成する廃棄物管理計画や年次報告書のレビューが必要となる。

部署名	概要
Monitoring and Enforcement Wing	<ul style="list-style-type: none"> ● Monitoring and Enforcement Wing は工業に対する検査に係る日常的な作業を行う。関係当局からの勧告により、検査を行う場合もある。 ● 検査の結果、排出基準を超過する事例には罰金を科す。罰金の額は、排出される物質ごとに設定されたデフォルトの罰金の金額、違反した日数、排出量で算出される。 ● 汚染排出者が罰金を支払わなかった場合、事業ライセンスの取り消し。電気・水供給の停止。といった措置を行う。
Environmental Clearance Wing	<ul style="list-style-type: none"> ● Environmental Clearance Wing は ECR に従って、環境社会影響評価書等、事業実施者からの提出書類を審査・評価する。その結果、申請が ECR の内容を満足していれば ECC を発行する。 ● ECC は定期的な更新が必要だが、Environmental Clearance Wing は本更新作業も管轄する。
Planning Wing	<ul style="list-style-type: none"> ● Planning Wing は、DoE の計画策定部門であり、各ドナー案件の窓口の役割を有している。 ● DoE の組織強化が必要。DoE はすでに目標達成に必要な組織と現有組織のギャップを明確にしており、4,392 人のスタッフからなる総合的な環境管理を実施するための新しい組織構成を提案している。 ● DoE の包括的な能力開発計画は既に計画委員会に提出されており、活動が開始されている。
Human Resource Development Wing	<ul style="list-style-type: none"> ● DoE のトレーニングニーズの確認、及び研修を立案、実施する部署 ● 研修は政府職員としての基本的な知識を得る研修、環境に係る基本的な知識の習得に係る研修、及び技術的な研修(Needs based training)で構成されている。

出典：JICA 専門家チーム



注：朱色のボックス：本部の各 Wing を示す。また鶯色のボックス： Divisional Office を示す。
 出典：DoE 提供資料を基に JICA 専門家チームが作成

図 2-1 DoE 組織図



出典：JICA 専門家チーム

図 2-2 Divisional Office の配置図

2.1.3 DoE の職務

DoE の主な職務は環境管理に係る規制に関する活動を実施することにある。DoE の web サイトによれば主な職務は以下のとおりである。

環境管理全般

- 政府・民間の様々なプロジェクトに対するレビュー・評価に基づく、環境管理に関する意見の提示
- ディストリクト（県）の中にあるウパジラ（郡）レベルの各委員会のメンバーとして、国内の各省庁やその下位組織、地方自治体と連携した積極的な環境管理の推進

EIA 及び ECC 対応

- 環境影響評価(EIA)報告書の審査・承認、助言の提示
- ECA および ECR を踏まえた事業申請の環境配慮の内容の評価、及び ECC の発行
- ECC 文書に基づく申請内容の検査、および更新

モニタリング・インスペクション・苦情対応

- 大気・水質のモニタリング、排ガス、排水の分析、環境分析サンプルの定期的な収集、分析、データの保存、および国内の様々な地域における池、井戸、および飲料水のモニタリング報告書の作成
- 新規または既存の工場/プロジェクトに対する検査の実施
- 環境汚染に関する苦情の受理、調査、無差別伐採の防止、汚染車両の調査
- および試験後の環境クリアランスの適用ベースでの発行;

罰則の付与

- 環境保全法規に違反した者・機関に対する環境裁判所への提訴、汚染事業所の特定、違反者に対する法的措置等の付与
- 汚染者に対する補償の強制回収

廃棄物管理

- 廃棄物管理に関する国の戦略を踏まえた総合的な廃棄物管理計画の策定
- 廃棄物管理に係る地方公共団体の監督および連携

気候変動対策

- 気候変動の影響に対処するための国内および国際レベルでの行動

自然環境保全

- 生態学的に重要な地域(Critical Area)の設定、管理
- 貴重種の保全
- 生物多様性保全に係る取組み

国際的な取り組みへの対応

- 環境に関する様々な国際的条約、協定及び議定書の国内での義務履行のための措置の実施

化学物質の管理

- 有害化学物質の輸入、輸送、使用等の管理、オゾン層破壊物質の管理

啓発活動

- 環境に対する一般の意識の醸成、環境情報の提供、広報活動の実施
- 環境保全・管理への国民参加を促進するため、様々な社会・文化・経済団体とのパートナーシップ活動の実施
- 環境保全・管理に関する官民の能力開発を目的とした各種研修、ワークショップ、交流会等の実施

調査・研究

- 重要環境問題に関する各種プロジェクト・研究の実施

2.1.4 水質汚濁対策分野の現況及び課題

(1) 水質汚濁対策に係る環境基準の設定や規制遵守に向けた査察・モニタリング体制の構築等に関する法令・ガイドライン策定や各種制度設計に向けた環境行政の課題

1) 水質汚濁対策に係る基準及び DoE の環境行政

水質汚濁対策の分野では ECA と ECR により DoE の環境行政が執られている。ECA は環境保全活動全般に関する基本法であり、環境保全活動全般に関する方針が規定されている。一方 ECR は、ECC 手続きに関する政府及び事業者のための実際の環境保全手続きを規定している。また ECR では水質パラメータの基準値についても規定している。すなわち ECC は Bangladesh における水質汚濁対策の実務的な手続きを規定している。DoE の水質汚濁対策に係る活動は、この ECC 制度に基づいて執られている。ECR でカテゴリーが規定されている工業分野及び新規開発プロジェクトは、それらの操業前に ECC を取得する必要がある。DoE の Environmental Clearance Wing は ECR に従って、事業実施者からの提出書類を審査・評価する。その結果、申請が ECA 及び ECR の内容を満足していれば Environmental Clearance Wing が ECC を発行する。この ECC には環境保全に係る条件が付加されており、この中に水質汚濁対策に係る対策が記されていることが多い。この ECC に付加される条件は、例えば、ECR に規定される排水基準を守らなければならない、排水処理施設を設けなければならない、排水処理施設は正しく運用されなければならない等である。

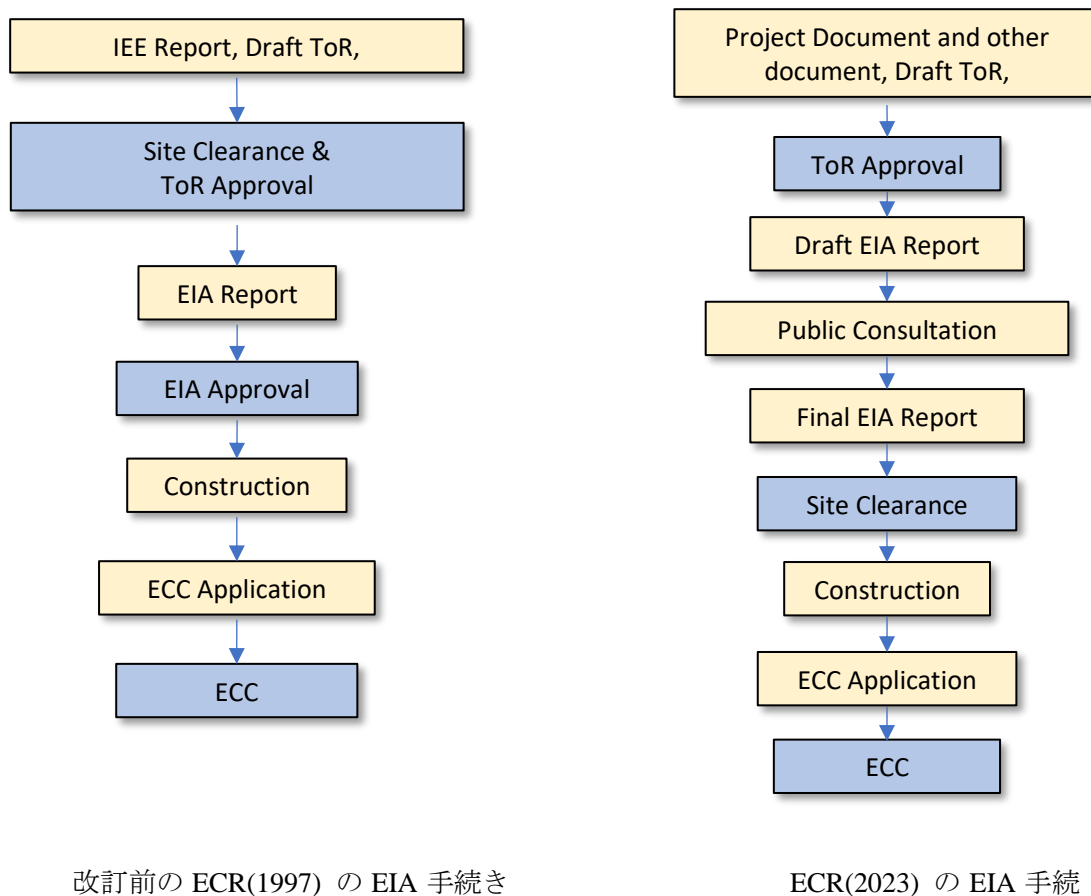
Monitoring and Enforcement Wing は、ECC を取得したプロジェクトや工業分野の工場から排出される排水の環境パラメータをチェックし、プロジェクト所有者や工場所有者に罰則やペナルティを科す。Monitoring and Enforcement Wing の職員は排水基準の超過などの違反があると、Mobile Court を開催し、工場所有者への罰金の金額を決定する。Monitoring and Enforcement Wing の指示に基づいて DoE の地方事務所職員が地方にある ECC を取得した工場の検査を行い、採取したサンプルを DoE のラボに送る。その分析結果に基づいて Monitoring and Enforcement Wing は過料を定める。

以上が ECA 及び ECR に基づく DoE の水質汚濁対策に係る行政活動のアウトラインである。

2) 水質汚濁対策に係る環境行政上の課題

a) 法制度上の課題

水質汚濁対策の重要な施策として、排水の排出を予定する事業者に対する EIA 実施時に、設置する排水処理施設の妥当性を確認し、ECC を発行する手続きがある。2023 年に改訂された ECR (ECR(2023)) では ECC の発行に係る制度の見直しが図られている。ECR では工業分野の環境負荷に応じてカテゴリが定められており、環境負荷が小さいものから Green, Yellow, Orange, Red の 4 カテゴリに分類され、それぞれに ECC の取得に必要な手続きが異なる。最も環境負荷が大きく事が想定される Red カテゴリでは EIA レポートの提出が求められる。改定後の ECR2023 ではこのカテゴリ分類が改正された。また Red カテゴリで求められる EIA の手続きも大きく改定された。改定された EIA 手続きの比較を図 2-3 に示す。



出典：JICA 専門家チーム

図 2-3 ECR 改定に伴う EIA 手続きの変更

DoE では改定前の ECR(1997) に対応した EIA ガイドラインを改訂中である。ECR では、水質の環境基準及び排出基準のパラメータが増やされている。ただし、新たに追加されたパラメータについての技術的な解説などは無く、これらの新基準に基

づいて環境行政を執行する職員への訓練・能力強化が必要である。改定後の ECR で制定された水質の地表水環境基準を表 2-5 に示す。

表 2-5 地表水の環境基準 (ECR(2023))

No	水利用の種別	基準値											
		pH	DO mg/l	BOD mg/l	NO ₃ -N mg/l	NH ₄ ⁺ -N mg/l	PO ₄ ³⁻ -P mg/l	Total Cr mg/l	Pb mg/l	Hg mg/l	Total Coliform (CFU/100ml)	TDS mg/l	COD mg/l
1	飲料水 (殺菌後)	6.5-8.5	≤6	2	7.0	0.1	0.1	0.02	0.03	0.001	100	1000	10
2	レクリエーション活動	6.5-8.5	≤5	3	7.0	0.3	0.5	0.2	0.05	0.001	50	1000	10
3	飲料水 (一般的な処理後)	6-9	≤5	3	7.0	0.3	0.5	0.02	0.03	0.001	5000	1000	25
4	漁業	6-9	≤5	6	7.0	0.3	0.5	0.05	0.1	0.004	5000	1000	50
5	工業冷却水	6.5-8.5	≤1	12	-	2.7	-	0.1	0.1	0.05	-	1000	100
6	灌漑用水:	6.5-8.5	-	12	5.0	1.5	2.0	0.1	0.1	0.002	50,000	1000	100

注) 赤字が ECR2023 で追加・変更されたパラメータ

出典: ECR (2023)

Monitoring and Enforcement Wing が行っている水質の監視と執行について、現場検査の結果に基づく罰金の賦課に関する Environmental Court Act がある。しかし、排水処理施設の設置や運営を改善するための行政指導に関する規則等はない。つまり罰金は科すことができるが、排水処理施設の設置や正しい運営を促す法制度が欠けている。

また、河川流域の水質を管理できる法制度は見当たらない。河川などの水域の水質保全を目的とした法制度は強化されつつあるが、流域についての水質保全の概念はバングラデシュの環境法には見られない。また Ecological Critical Area などの保護地域定めているものの、この同地域の上流側の水質管理に関する法制度は無い。

b) 環境行政執行能力の課題

Monitoring and Enforcement Wing が行っている水質の監視と執行について、DoE 職員にしか検査の資格がないが、それに対して検査実施体制は脆弱である。一般に、工業化地区には膨大な数の施設があるにもかかわらず、地方事務所には少数の検査職員しかいない。また監視と施行についてのガイドラインは現在作成中である。

工業セクターの ECC の審査は Environmental Clearance Wing の職員が行うが、特に若手の職員の排水処理に関する基礎的な知見が不足している。Red カテゴリのプロジェクトで提出される EIA には排水処理施設の詳細な設計計算が求められているが、その審査に必要な知見が不足している。

現在の ECA、ECR の管理対象は主に工業セクターからの排水管理に限られており、他の排水である家庭からの排水や農業分野からの排水は対象とされていない（ただし、下水処理場は ECC の対象事業にはなっている）。従って DoE の職員は工業セクター以外の知見に乏しい。流域の全体の水質管理の概念はまだ確立されていない。

c) 他省庁との協力に関する課題

関連省庁である Bangladesh 水開発庁（BWDB: Bangladesh Water Development Board）、公衆衛生工学局（DPHE: Department of Public Health and Engineering）、上下水道公社（WASA: Water and Sewerage Authority）との協議はあるようだが十分ではない。地方事務所の下級職員が行う検査や取締りについては、他機関と協働した活動はない。また、地方自治体への協力は要請されていない。特に工業地帯を有する地方都市では、工場の数に対して検査数が大きく不足している。ECR は、ECC の発行と実際の排水水質の監視活動を DoE 職員のみ限定している。工場の排水検査と ECC に基づく取締りは、DoE の独占的活動である。これが人手不足の主な原因となっている。DoE は排水の質をチェックする独占的な権限を持っているが、Bangladesh 全土の施設をチェックするにはスタッフの数が少ない。また将来流域の水質管理を行う場合には他省庁との関係強化、情報共有は不可欠である。

(2) 水質汚濁対策に係る他ドナーの取り組み状況と今度の課題

水質汚濁対策に係る他ドナーの取り組みとして MoEFCC 下の DoE を支援する二つのプロジェクトが進行中である。一方、Ministry of Local Government, Rural Development and Cooperatives 下にある WASA に対して複数の下水処理プロジェクトが進行している。表 2-6 に水質汚濁に係る他ドナー支援を示す。

表 2-6 水質汚濁対策に係る他ドナーの支援

実施機関	ドナー	プロジェクト名	概要
DoE	WB	BEST Project	主要汚染源の水質汚濁物質の発生・放流抑制への投資支援により、排水処理施設の設置と運用による、工業発生源の汚染物質流出に取り組む。また DoE の水質試験の能力向上を図る。（2023 年 8 月より開始）
	GIZ	Sustainability in the Textile and Leather Sector (STILE)	繊維、皮革セクターの排水処理及び環境基準と法規制のための DoE の能力開発（2020 年より進行中）
WASA	Government of China	Dasherbandi Sewage Treatment Plant (STP)	ダッカ WASA Dasherbandi 下水処理場の建設。（2015 年 - 2022 年）
	ADB	Rayerbazar STP	ダッカ WASA Rayerbazar 下水処理場の建設。（2021 年 - 2026 年）
	WB	Chittagong Water Supply Improvement and Sanitation Project (CWSISP)	雨水排水マスタープラン セプティックスラッジ処理のパイロット事業（2020 年 - 2022 年）
	South Korea Environmental Defense Fund	STP Feasibility Study on Catchment 3	チョットグラム WASA キャッチメント 3 の下水処理場 FS

実施機関	ドナー	プロジェクト名	概要
	French Development Agency (AFD)	STP Feasibility Study on Catchment 5	チョットグラム WASA キャッチメント 5 の下水処理場 FS

出典：JICA 専門家チーム

1) BEST プロジェクト

BEST プロジェクトは、DoE の能力を強化するために世界銀行により実施される。BEST プロジェクトでは、環境分析ラボの能力強化が計画されていると共に、各部門の環境モニタリング関連機材の調達等が等計画されている。同プロジェクトの概要を表 2-7 に示す。

表 2-7 BEST プロジェクトの概要

項目	内容
目的	Bangladesh 国政府の環境管理能力を強化する 対象分野へのグリーン投資を促進するための新しい資金調達メカニズムを試験的に導入すること。
成果	Bangladesh 国政府の能力強化により、環境管理に関する変革的な発展が達成される。
期間	2023 年 8 月～2028 年 7 月
内容	<p><u>コンポーネント 1: 環境ガバナンスとインフラ (DoE を対象としたコンポーネント)</u></p> <ul style="list-style-type: none"> DoE の新規事務所の建設 (5 ヶ所: Mymensingh, Rangpur, Rajshahi, Khulna 及び Sylhet) DoE の地区事務所を建設 (31 ヶ所) DoE のトレーニング&研究センターの建設 (1 ヶ所) 環境モニタリング車両の導入 (63 台) 自動サンプリングシステム及び X 線蛍光分光計による粒子状物質分析装置を搭載したモニタリング車両の導入 (4 台) 環境モニタリング船の導入 (15 隻) 6 つのディビジョン(Division)で環境分析ラボを整備 32 のディストリクト (District) で環境分析ラボを整備 連続式大気監視システム (CAMS: Continuous Air Monitoring System) に統合された重金属監視システムの整備 地理情報システム(GIS: Geographical Information System)とリモートセンシング(RS)の確立 環境モニタリング用ドローンの導入(75 台)と GIS システムの整備 Web 対応の集中型大気質常時監視システムの整備 大気質予測システムの確立 共同排水処理場及び ETP の自動モニタリングシステムの導入(20 ヶ所) 情報交換のための Web ベースのポータルサイトの確立 <p><u>コンポーネント 2: 大気汚染防止のためのグリーンファイナンスの導入</u></p> <ul style="list-style-type: none"> グリーン信用保証制度(Green Credit Guarantee Schemes)の創設 <p><u>コンポーネント 3: 車両の排出ガス制御</u></p> <ul style="list-style-type: none"> 車両検査施設の整備(4 ヶ所) <p><u>コンポーネント 4: E-waste 管理インフラ</u></p> <ul style="list-style-type: none"> E-waste リサイクルのパイロット施設の整備

出典：DoE

BEST プロジェクトでは複数の分析ラボ、分析機器の調達が計画されている。導入される DoE 側の職員人員数の不足に対する対応と、それらの機器を使用する DoE 職員能力の強化が今後の課題と考えられる。

2) STILE プロジェクト

繊維・皮革産業における持続可能性の促進（STILE）は、ドイツの GIZ によって実施中である。このプロジェクトは、環境にやさしく資源効率の高い生産を促進するため、エネルギー、化学薬品、排水管理における可能な解決策に取り組んでいる。特に DoE に対して以下の支援を実施している。

- ✓ 工場への排出基準遵守のための監視、指導を行う DoE の能力開発
- ✓ 環境基準の遵守を強化するため効果的な監視・検査ツールの提供

STILE プロジェクトはテキスタイル、皮革セクターを対象としている。他の工業セクターの排水管理は対象外である。繊維、皮革セクターは現在の Bangladesh では主要工業であるが、今後経済の成長により増加する他の工業セクターへの適用が今後の課題と考えられる。

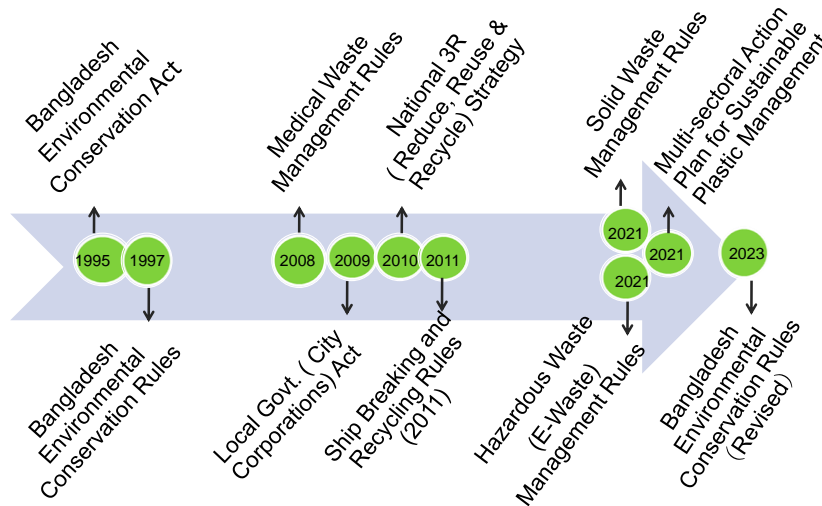
3) 下水処理場整備

ダッカ、チョットグラムの大都市で下水処理場の建設が WASA により進行中である。WASA と DoE の間では水質管理についての定期的な意見交換は行われていない。今後、DoE が流域の水質管理などを行うことが想定されるが、河川水質管理を担当する DoE と都市部の生活排水を管轄する WASA との連携が必要になる。

2.1.5 廃棄物管理分野の現状及び課題

(1) 廃棄物管理に係る法令、ガイドラインの策定、基準の設定や規制遵守に向けた査察・モニタリング体制の構築、各種制度設計に関する課題

Bangladesh では、日本の廃掃法（正式名称：廃棄物の処理及び清掃に関する法律）にあたる廃棄物管理の基本法が制定されていなかったが、2021 年に Bangladesh の廃棄物管理の基本法である SWM Rule が承認された。一方、廃棄物管理に関連する法律として、ECA 及び ECR が制定されており、また、産業廃棄物、特に有害廃棄物や医療系廃棄物の関連法として、Hazardous Waste (E-waste) Management Rule や Medical Waste Management Rule などが制定されている。また、National 3R Strategy は策定されているものの、廃棄物管理に関する技術的なガイドラインは策定されておらず、一部の南北ダッカ市等では廃棄物管理計画は策定されているものの、国家レベルの廃棄物管理計画も策定されていない。そのため、国レベルで、各地方自治体が実施する廃棄物管理の実施状況に対するモニタリングの体制も充分とはいえない。主な廃棄物関連法や戦略策定の変遷について、図 2-4 に示す。



出典：JICA 専門家チーム

図 2-4 廃棄物関連法や戦略についての策定の変遷

廃棄物管理に関連する規則の概要を表 2-8 に示す。

表 2-8 廃棄物管理に係る規則

No.	名称	概要
1	Solid Waste Management Rule (SWM Rule)	本規則は、 Bangladesh における廃棄物管理に係る基本的な要求事項を定めたものであり、製造事業者、輸入事業者等の廃棄物発生者及び地方公共団体等の自治体の役割と責任が規定されている。重要な要求事項としては、廃棄物発生量とその管理活動についての年間報告書の作成が義務付けられたことが挙げられる。また、廃棄物の定義と分類、大気や水質のモニタリング項目に加えて、コンポスト製品の基準や処理浸出水の排出基準、焼却炉の基準等が定められている。
2	Hazardous Waste (E-waste) Management Rule	本規則は、家電製品、医療機器、IT、通信機器などの E-waste に含まれる有害廃棄物の管理に係る要求事項を規定している。製造業者及び組立業者に対する拡大生産者責任の義務を述べており、すべての生産者、取引業者、販売業者、輸送業者、修理業者、回収センター、リサイクル業者、解体業者等に適用される。
3	Medical Waste Management and Processing Rule	本規則は、医療廃棄物の合計 11 のカテゴリおよびそれぞれの処理プロセスを、処理基準とともに定義しており、廃棄物の各クラスまたはカテゴリの例を、処理および処分を選択肢とともに明示している。
10	Hazardous Waste and Ship Breaking Waste Management Rule	本規則は、可燃性、毒性等を考慮して、有害廃棄物の種類を分類している。また、輸出品が禁止されている廃棄物の一覧を示している。加えて、有害廃棄物処理業者がインベントリ、年次報告書、安全手順などを作成する方法を定めている。

出典：JICA 専門家チーム

(2) 廃棄物管理規則の概要

近年の重要な事項としては、2021年にSWM Ruleが公布された事が挙げられる。本規則により、Bangladesh国の廃棄物管理に係る基本的な要求事項が明確となった。同規則の概要は以下に示すとおりである。

1) 国家調整委員会 (National Coordination Committee) の設立

- 国レベルの廃棄物管理機関として、環境・森林・気候変動省長官を議長とした National Coordination Committee を設立する事となっている。
- 廃棄物管理に関する National Coordination Committee を設立し、年2回以上の会合を開催し、議決には1/3以上の出席が必要とされ、会議議事録は、省庁のWebにて公開される。
- 委員会の構成メンバーは、環境・森林・気候変動省長官を議長とし、委員は、Department of Finance、Department of Local Government、MoEFCC、Ministry of Legislative Assembly、Ministry of Housing and Public Works、Ministry of Health、Ministry of Agriculture、Ministry of Water Resources、Ministry of Electricity、Environment Bureau、及び各地方都市、政府が示した廃棄物管理専門家、非政府組織、Federation of Bangladesh Chambers of Commerce and Industryの代表者、プラスチック製造業者または輸入業者の代表者などから構成される。
- 委員会の主な役割は、地方自治体や関係機関が提出する廃棄物管理計画のレビュー・承認、年次報告書のレビュー及び改訂の指示、環境汚染を生じる不適正な廃棄物管理への対応、各種ガイドライン・指針の作成・発出等である。

2) 廃棄物管理の優先順位の方針提示

廃棄物管理の優先順位として、第一に廃棄物の削減が可能なかを考え、削減が困難な廃棄物については、再利用、リサイクル、エネルギー利用の順位付けで可能性を検討するとともに、もしそれらができない場合について、処理・処分を考える、といった廃棄物管理の優先順位の方針を提示している。

3) 排出者責任の明示

廃棄物を発生させる各排出者の責任について以下のとおり記載している。

家庭ごみ排出者の責務

- 発生する廃棄物の保管、分別排出の実施
- 廃棄物の空き地や水路への投棄、野焼きの禁止

事業者の主な責務

- 店舗、市場、レストラン、ホテル、コミュニティセンターおよびその他の住宅、商業または工業施設からの廃棄物について、収集指定場所への排出および発生源での分別
- 道路や排水溝への投棄や野焼きの禁止
- リサイクル可能な廃棄物の認定された廃棄物収集運搬業者やリサイクル業者への業務委託の実施
- 生分解性廃棄物の堆肥化、バイオガス化による減量化促進、リサイクル可能な廃棄物の分別排出、残渣の廃棄物収集運搬業者への業務委託の実施

製造業者、輸入業者の主な責務

- 拡大生産者責任（EPR: Extended Procedure Responsibility）の概念及び作成されるガイドラインに従った、製造業者や輸入業者による、缶、ガラス、プラスチック等製品の回収、適切な資源化又は処分の実施
- プラスチックリサイクル量に関する年次報告書の DoE 局長への提出
- 適切な廃棄物管理実施のため、住民等への啓発活動の実施
- 製造又は輸入する製品の使用後の廃棄方法等を購入者や消費者への告知する方策の検討

地方政府当局等の実施主体の主な責務

- 廃棄物管理に関する国家戦略やガイドラインに従った、固形廃棄物管理の包括的な計画の策定、および委員会への提出
- 住居から輩出される廃棄物の収集運搬、処理処分の実施
- 年次報告書及び事故が発生した場合の事故報告書の提出
- 各家庭や事業系からの廃棄物は、3種類の分別排出に基づいた収集運搬、処理処分の実施
- 建設廃棄物の分別収集、処理処分
- 医療廃棄物処理規則に則った医療廃棄物の管理・処理
- 廃棄物の資源化、バイオガス生成、ごみ固形燃料（RDF: Refuse Derived Fuel）、ごみ由来の代替燃料（SRF: Solid Recovered Fuel）、発電、生分解性肥料の推進
- 資源化できない廃棄物について焼却等の中間処理や衛生処分場にて処理・処分の実施

4) 罰則規定

罰則規定として、禁止項目に違反した場合、2年以下の懲役又は違反金の支払いを命じている。

5) 表彰制度

全国調整委員会と協議の上、廃棄物管理、衛生、環境管理活動についての優良事例についての表彰を促進する。そのために別途指針を策定予定である。

6) その他

以下が別表として規定されている。

- 家庭系有害廃棄物の分類及び項目
- 廃棄物処理指針（堆肥化関連）
- 廃棄物焼却（運転基準、排ガス排出基準等）
- 最終処分場（適地選定、運営維持管理、排水基準、排ガス基準等）
- 廃棄物管理計画で記載される目標の指標
- 年次報告書の記載内容
- 事故報告書の記載内容
- 廃棄物管理規則の概要

(3) 廃棄物管理に係る法制度面の課題

上述のとおり、廃棄物管理規則により、廃棄物管理に係る要求事項が明確となった。しかしながら、その実施に当たっては、今後、技術的・運用的な基準を含めた法制度の整備が必要である。

1) 廃棄物管理規則に沿ったガイドラインが作成されていない

SWM Rule が策定され、地方自治体の廃棄物管理計画策定、年次報告書の提出が義務付けられたが、計画策定や年次報告書策定のガイドラインやマニュアルがない。

また、廃棄物管理規則で求められている各種技術に関するガイドラインとして、収集・運搬、処分場等の技術ガイドライン、EPR ガイドラインの策定がされていない。

2) 産業廃棄物を網羅した法律がなく、制度面で課題がある

廃棄物の実施主体である地方自治体の技術的な実施能力の向上や財政面での課題がある。

産業廃棄物については、法律に排出者責任や汚染者負担の原則に基づいた実施が必要との記載はあるものの、制度が充分でなく、排出者から処理業者までのモニタリングが充分でない。

3) 国家レベルの年次報告書や廃棄物管理計画が作成されていない

廃棄物管理及び 3R 戦略が国家戦略として策定されているが、将来の需要や目標値を反映し、優先的な活動を明示して段階的に廃棄物管理を改善していく国家レベルの廃棄物管理計画はない。また、各地方自治体の廃棄物管理の現況に係る廃棄物発生量、組成、収集運搬、処理・処分に係るデータは、一元化されていない。また、廃棄物管理の各プロセス（収集運搬、3R・中間処理、最終処分等）についての技術指針が充分でない。

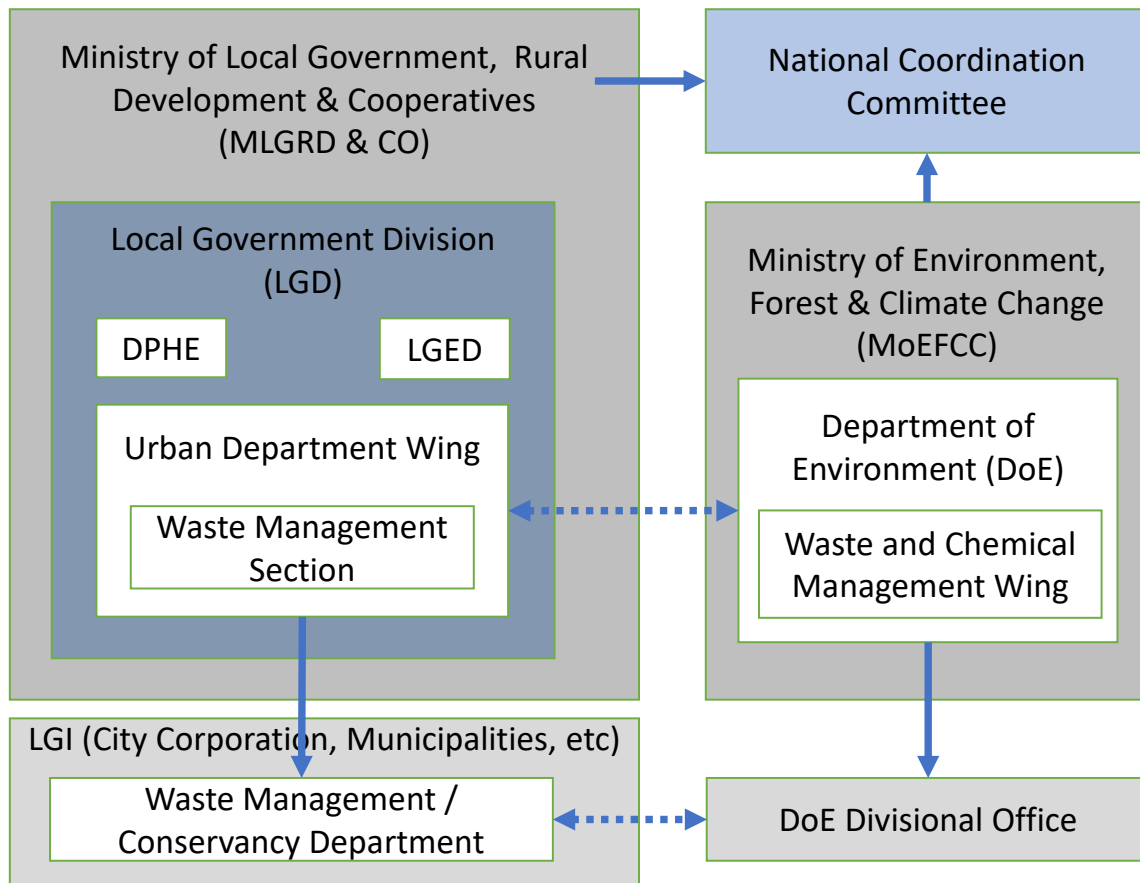
4) 関連法との整合性

廃棄物管理の実施主体である地方自治体の中核都市市役所（City Corporation）や地方都市（Paurashava）では、廃棄物管理の組織は課題があるものの City Corporation Act や Paurashava Act で廃棄物管理の責任が各 City Corporation や Paurashava にあることが定められている。一方で郡（Upazila）においては、Upazila Act に定められておらず、Upazila での廃棄物管理の責任が明記されていない。そのため、Upazila では、廃棄物管理の実施組織がなく、収集が行われていないのが現状である。

(4) 廃棄物管理に係る関係省庁や他のステークホルダー及び他ドナーの取り組み状況と今後の課題

1) 関係省庁の取り組み

廃棄物管理規則が制定され、下図に示すような、関係省庁が毎年定期的に年次会合を開催し、廃棄物管理に関する制度、実施体制等について協議を行い、決議を行うための国家調整会議の仕組みが作られた。図 2-5 に廃棄物管理規則を元に作成した図を示す。



出典：JICA 専門家チーム

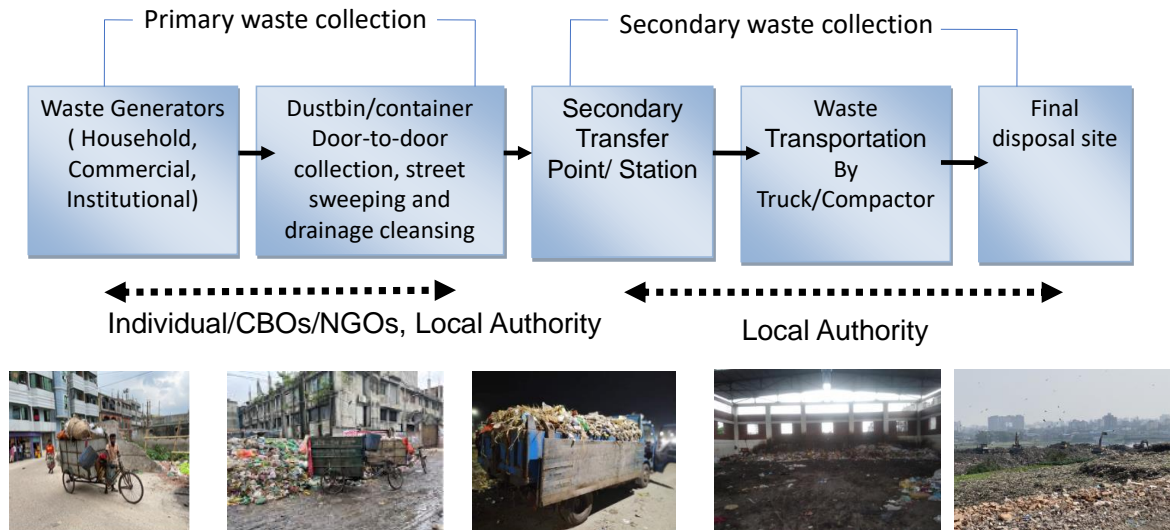
図 2-5 SWM Rule で示された廃棄物管理に係る主な関係省庁及び
地方自治体の関係

DoE が廃棄物管理の法制度の整備を担当し、都市廃棄物については、LGD が、地方自治体が実施する廃棄物管理の監督を担当し、LGD の下で廃棄物管理業務(施設整備、運営維持管理)が実施されている。

また、産業廃棄物に係る省庁は、産業省や電力省、エネルギー・鉱物資源省、農業廃棄物は農業省、医療廃棄物は、保健省である。SWM Rule によれば、National Coordination Committee は設置されているが、定期的な会合は年 2 回のみ開催され、委員会はハイレベル会合であるため、特に非自治体の固形廃棄物を考慮して、省庁間のコミュニケーションをより頻繁に行う必要がある。

2) 地方自治体の取り組み

都市ごみの廃棄物管理の実施主体は、地方自治体 (LGI: Local Government Institute) である。一部の自治体では、コンポストや資源ごみの選別なども試みているが、多くの自治体では、以下のフローに示すように、各家庭や事業者からのごみをリキシャバンなどによる一次収集を行い、集積所や中継所で二次輸送車に積み替えて最終処分場まで運搬し、そこで埋立て処分を行っている。



出典：JICA 専門家チーム

図 2-6 地方自治体における廃棄物管理の流れ

(5) 廃棄物管理に係る環境行政上の課題

地方自治体では、南北ダッカ市においては廃棄物管理部が設置され、比較的優れた計画スキルと技術的専門知識を持つエンジニアを有している。一方、周辺の City Corporation や Paurashava では、清掃部が廃棄物の運営を担当しており、計画策定や設計等は、道路や排水等の他のセクターと共通の技術部門が行っている。その結果、廃棄物管理の計画・設計と運営維持管理を別の部門が実施しているため、それらの計画が運営維持管理上の課題を踏まえたものでなかったり、また運営維持管理者が良く、計画や設計の意図を理解していなかったりという問題がしばしば起こっている。

また、Upazila では、Upazila Act に廃棄物管理の実施主体が明確に記載されておらず、清掃局もないため、廃棄物の収集運搬サービスが地方自治体である Upazila によって提供されていない。一部の市場の組合が 1 次収集を実施して周辺に投棄しているのみで、住民等へは殆ど廃棄物の収集サービスが提供されていない。

主に多くの地方自治体では、以下のような課題を抱えている。

- 地方自治体の組織体制（人数、管理、技術力等）が脆弱であり、予算も充分でない。
- 都市廃棄物のみならず、有害廃棄物を含んだ産業廃棄物の廃棄物管理システムが確立されておらず、収集システムや処理・処分の施設が整備されていない。
- 排出者（住民、事業者）への啓蒙活動や環境教育が充分でなく、排出方法などについて、排出者側と収集・処理処分側での相互理解が不十分である。

(6) 廃棄物管理に係る他ドナーの取り組み状況と今後の課題

1) ドナーの取り組み

WB、ADB、JICA 等を中心に、各省庁及び地方自治体に廃棄物支援を実施している。DoE については、プラスチック廃棄物等は、WB が支援を実施しており、また

E-waste についても実施している。医療系廃棄物については、WB が Medical Waste Management Rule の改訂作業の実施を開始したところである。

現状において、WB は、プラスチック系廃棄物を対象とし、EPR の導入を見込んだ支援や医療系廃棄物等、都市ごみ以外の分野で DoE への支援を実施している。ADB やその他のドナーについては、今のところ DoE への具体的な支援に関する実施情報は、確認できていない。なお、上記以外の海外ドナーの主なプロジェクトは表 2-9 の通りである。

表 2-9 関連する他ドナー案件

プロジェクト	ドナー	C/P 機関	期間	内容	対象地域
Coastal Towns Environmental Infrastructure Project (CTEIP:)	ADB	Local Government Engineering Department (LGED)	2014 年 1 月 ~2022 年 6 月	一次回収、輸送、堆肥化、埋立	11 Paurashava
Third Urban Governance and Infrastructure Improvement Project: UGIIP-III)	ADB	LGED (インフラ全般の主導機関) DPHE(固形廃棄物管理の実施機関のみ)	2014 年 7 月 ~2022 年 6 月	一次収集、運搬、埋立	27 Paurashavas
Second City Region Development Project II (CRDP-II)	ADB	LGED	2019 年 1 月 ~2024 年 6 月	一次回収、輸送、堆肥化、埋立	Khuluna CC, etc
Municipal Governance Service Project (MGSP)	WB	LGED	2014 年 1 月 - 2022 年 6 月	一次回収・輸送・埋立	-
Urban Public and Environmental Health Sector Development Program	ADB	LGD	2010 年-2018 年	一次収集および二次転送ステーション	DSCC、CCC 等
Program Clean Development Mechanism (CDM) projects using municipal organic solid waste in the 64 districts	気候変動信託基金	DoE	2016 年 7 月 ~2021 年 6 月	堆肥化施設	CCC、NCC、DSCC 等
Dhaka and Chittagong 3R Project	気候変動信託基金	DoE	2012 年 12 月 ~2023 年 6 月	分別排出のごみ箱の配布、意識啓発、機械式道路清掃	DNCC、CCC
Medical waste management project	FCDO	NCC	2022 年	廃棄物分別訓練、医療廃棄物輸送車 2 台、焼却施設 1 台	NCC

プロジェクト	ドナー	C/P 機関	期間	内容	対象地域
Sustainable Solutions to Solid Waste: Local Response to Rohinger Crisis in Bangladesh	SIDA (Swedish International Development Cooperation Agency)	UNDP (United Nation Development Programme)	2018 年 9 月 ~2022 年 3 月	廃棄物分別、分別、環境教育、リキシャバン廃棄物収集、二次回収拠点、廃棄物輸送、リサイクル施設、堆肥化、埋立	Teknaf Paurashava、Teknaf Upazila、Ukhia Upazila
BEST Project	World Bank の信託基金 (PROBLUE)	CC/DoE	2021 年 9 月-	環境ガバナンス、大気・水質管理、プラスチック管理・医療廃棄物管理、電子廃棄物等	DNCC、DSCC、CCC

出典：JICA 専門家チーム

2) 今後の課題

上記のように様々なドナーが廃棄物管理に係る法制度面、計画策定や廃棄物管理の実施に係る支援を行っている。SWM Rule が施行されるなど法制度が整いつつある現状を踏まえ、将来は同規則にそって国全体の廃棄物管理が効果的に実施されるようにドナー間、関係省庁間の連携体制の強化が必要になると考える。

2.2 能力開発に係る活動（成果 2）

2.2.1 環境局全体の関わる活動

(1) 研修計画の検討

2023 年 3 月に DoE の Human Resource Development Wing が DoE 職員への聞き取りにより実施した研修ニーズ分析によれば、水質汚濁対策分野及び廃棄物管理分野の技術的な研修について、DoE が重要と考えている内容は以下のとおり。

- 排水処理施設の設計・運用に係る評価能力の強化
- EIA 審査能力の強化
- 訴訟対応の能力の強化
- 廃棄物発生・管理の監視能力の強化

現在実施されている研修は政府職員としての基本的な知識を得る研修、環境に係る基本的な知識の習得に係る研修が主であり、技術的な研修に係る予算の配分は限られている。予算の制約から 2022 年度は技術的な研修(Needs based training)は実施されなかった。今後、技術研修の計画・実施体制の強化が必要である。



注：研修予算の85%が政府職員としての基本的な知識を得る研修、環境に係る基本的な知識の習得に係る研修に充てられている。

出典：DoE

図 2-7 2023-24 年の DoE の予定する研修に係る予算配分計画

2022 年 8 月に DoE 本部の 2 部署(NRM Wing, WCM Wing)、及び 6 つの地方事務所(ダッカ DoE 事務所、Narayanganj DoE 事務所、Munshiganji DoE 事務所、Gazipur DoE 事務所、Narsindgi DoE 事務所、チョットグラム DoE 事務所)、ダッカ及びチョットグラムの環境分析ラボラトリと、本業務による助言/研修ニーズに係る協議を行った。協議の結果、主に以下のような要望が確認された。

[水質汚濁対策]

- ・ ECR(2023)の適切な運用に向けた技術的なアドバイスの提供
- ・ 現在および将来の産業構造に基づく汚濁負荷管理の優先対象業種の選定
- ・ 適切な排水処理施設、汚泥処理施設に係る技術情報の提供
- ・ 標準手順書の作成（ECRにより新規に分析が必要となる項目を含む）
- ・ ラボ認証の取得

[廃棄物管理]

- ・ SWM Rule の実施、固形廃棄物管理行動計画作のための助言
- ・ 有害廃棄物、プラスチック廃棄物の管理・モニタリングに係る助言
- ・ ステークホルダー間の連携・ネットワークの構築
- ・ リサイクル、エネルギー・コンポスト化の推進・啓発

上記協議を元に、2022 年 9 月に、DoE が選定した DoE 本部の 6 部署、6 つの地方事務所、2 つの環境分析ラボに対して、5 段階評価で研修ニーズに係る意見を聴取するための質問票を送付、回収した。研修ニーズに係る質問票の回答結果のうち、特にニーズを求められた内容を以下及び図 2-8 に示す。

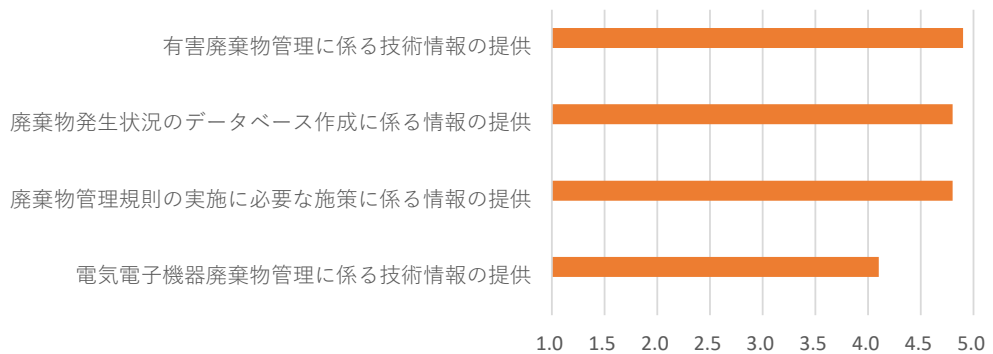
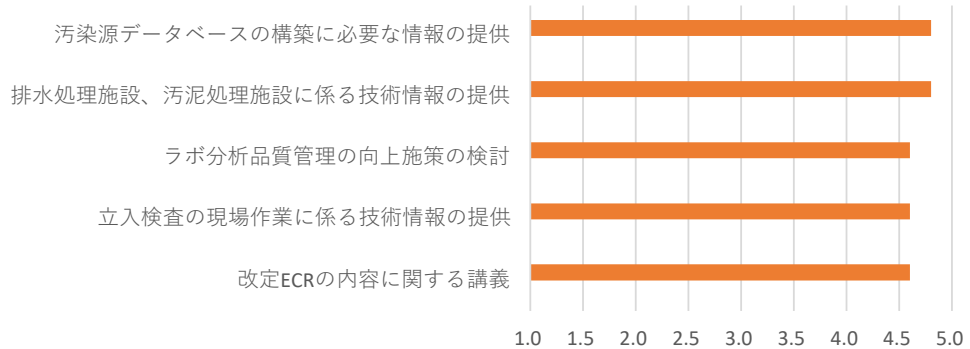
[水質汚濁]

- a) 汚染源データベースの構築に必要な情報の提供
- b) 排水処理施設、汚泥処理施設に係る技術情報の提供
- c) ラボ分析品質管理の向上施策の検討
- d) 立入検査の現場作業に係る技術情報の提供

e) 改定 ECR の内容に関する講義

[廃棄物管理]

- a) 有害廃棄物管理に係る技術情報の提供
- b) 廃棄物発生状況のデータベースの作成に係る情報の提供
- c) SWM Rule の実施に必要な施策に係る情報の提供
- d) 電気電子機器廃棄物管理に係る技術情報の提供



出典：DoE

図 2-8 研修ニーズに係る質問票の回答結果

DoE より研修実施に係る期待が得られたことから、ワークショップの開催を検討することとなった。各分野の内容については、研修ニーズ調査の分析結果を踏まえ、NRM Wing 及び WCM Wing と協議し、設定した。

2.2.2 水質汚濁対策分野の活動

(1) DoE と他省庁の役割分担、及び連携強化に係る支援・助言

水質汚濁管理に関する DoE の対象施設数（工場数）は膨大で、これらをすべて DoE の職員だけで実施するのは現実的ではない。職員へのトレーニングは必要であり、能力向上の余地はあるものの、将来の必要な検査数に対して DoE 職員だけで対応することは不可能である。なお、DoE はオンラインモニタリングの計画を持っているが、オンラインでモニタリングできるパラメーターは限定的であり、その導入方法（費用負担）および維持管理などの課題が多く、現実的ではないことを助言している。

(2) DoE の政策・制度、活動計画、人材育成の検討に資する支援・助言

DoE の水質汚濁対策に関する方針について、JICA 専門家チーム は規制対象となる排水の種類について協議した。現在、DoE は産業排水の管理に重点を置いているが、将来的には水質管理が困難な場合に備えて、WASA などの関係機関と連携し、産業排水だけでなく生活排水等、他の種類の排水も併せ、流域単位レベルで管理を実施する必要がある旨、助言した。

水質汚濁防止の制度体制については、2023 年に改正された ECR を適切に施行するための制度体制を整備することが最も重要な課題である。このような制度体制を整備するために、専門家チーム は、EIA 手続きでの ECC 発行プロセス、ETP の妥当性評価、及び DoE の環境分析ラボラトリでの水質分析を担当する職員に対する技術研修の重要性を指摘した。

(3) ワークショップの開催

水質汚濁対策分野に関し、以下のとおり 2 回のワークショップを開催した。ワークショップでは、水質汚濁対策と排水処理の基礎知識に関する演習を実施した。最新技術の紹介ではなく、EIA やインスペクションにおける ETP 評価に取り組む DoE 職員に対し、水質汚濁のメカニズムや排水処理の基礎的な技術知識の重要性を再認識させた。

第 1 回目

- 1) 開催日：2023 年 2 月 1 日
- 2) 場所：DoE 本部
- 3) 参加者：35 名 (DoE 本部、DoE 地方事務所 (Dhaka, Manikganj, Narayanganj, Barishal, Chattogram)、ダッカ及びチョットグラムの DoE 環境分析ラボ)
- 4) 目的：
 - (a) 水質汚濁対策に係る制度、排水処理技術についてインタラクティブな議論を通じて、関係政府職員の間で知識と経験を共有する。
 - (b) バングラデシュの水質汚濁対策の強化に向けて話し合うべき優先課題を特定し、課題改善に向けた議論を行う。

表 2-10 水質汚濁対策に係る第一回目のワークショップの概要

内容	発表者等
セッション 1/バングラデシュの排水管理法制度、及び水質汚濁の一般的な特徴 - バングラデシュの法制度 - バングラデシュの水質状況 - 水質汚濁の一般的特徴とそのメカニズム - ディスカッション	JICA 専門家チーム NRM Wing, DoE ディスカッション：全参加者
セッション 2/排水処理技術の基礎知識(1) - 物理的処理：スクリーン処理及び沈殿処理 - ディスカッション	JICA 専門家チーム ディスカッション：全参加者
セッション 3/排水処理技術の基礎知識(2) - 生物処理 - ディスカッション	JICA 専門家チーム ディスカッション：全参加者
セッション 4/バングラデシュと日本の水質汚濁対策に関する法制度の比較～排水施設の届出制度の導入～ - 水質汚濁対策に関する法制度の比較 - ディスカッション	JICA 専門家チーム ディスカッション：全参加者

出典：JICA 専門家チーム

第 2 回目

- 1) 開催日：2023 年 7 月 9 日
- 2) 場所：DoE 本部
- 3) 参加者：26 名 (DoE 本部、DoE 地方事務所 (Dhaka 市周辺及び Chattogram 市))
- 4) 目的：2023 年 3 月に施行された改訂 ECR2023 も踏まえ、DoE による水質汚濁対策施策強化に係り優先的に取り組むべき課題について整理すると共に課題解決のために必要な取り組みについて協議する。

表 2-11 水質汚濁対策に係る第二回目のワークショップの概要

内容	発表者等
• プロジェクト活動によって確認された課題に係るディスカッション	DoE 及び専門家チーム
• DoE 職員の技術的能力の課題に係るディスカッション	DoE 及び専門家チーム
• DoE の職員研修制度と Training Needs Analysis の概要の紹介	DoE
• 日本の水質汚濁対策・モニタリング制度の紹介	専門家チーム
• 確認された課題解決のために期待される DoE の活動に係るディスカッション	DoE 及び専門家チーム

出典：JICA 専門家チーム

ワークショップでは、DoE への技術情報の提供として、Bangladesh の ECR と日本の水質汚濁防止法の比較を説明した。ワークショップでは日本の水質汚濁対策に関する法律の概要を説明し、特定施設の申請や許可が地方自治体により行われていることを説明した。図 2-9 から図 2-11 にワークショップで使用したこの部分のスライドの例を示す。なお、ワークショップでは、DoE 職員に排水処理(物理処理、化学処理)に関する基本的な演習問題を提示し、ワークショップ中に演習を実施した。

Notification System of Effluent Generators as “Specified Facilities” by Water Pollution Prevention Act of Japan

Chapter 2-1 Regulations on Discharging Effluent

Article 5

A person that discharges effluent from factories or workplaces into Designated Areas of public waters must, when intending to install a “Specified Facility”, as provided for by order of the Ministry of the Environment, submit a report on the following to local(prefectural) governors.



- (i) name and address of the person, as well as the name of the representative if the person is a corporation;
- (ii) name and location of factories or workplaces;
- (iii) type of Specified Facilities;
- (iv) structure and construction of the Specified Facility;
- (v) equipment of the Specified Facility;
- (vi) use of the Specified Facility;
- (vii) means of Treatment of Polluted Water, etc.;
- (viii) the level of pollution and quantity of the Effluent;
- (ix) other particulars specified by Order of the Ministry of the Environment

34

日本の水質汚濁防止法第 5 条の説明。 地方自治体の関与。

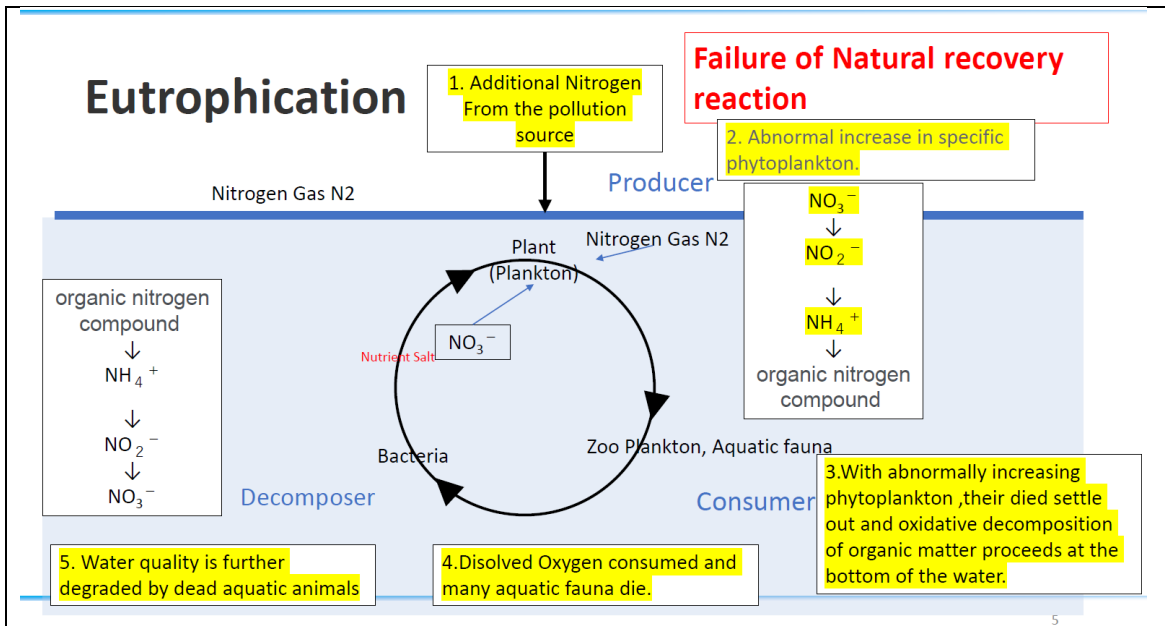
Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (2)

Item	Bangladesh	Japan
Frequency of issuing monitoring report	Once a year	Once a year (COD, N, P in specific area: every day to once a month depend on the quantity)
Manager of ETP	Not mandatory	Need to be dispatched licensed person
Certificate for analytical laboratory	Not mandatory	Mandatory (Need to be analyzed by certificated laboratory)

36

出典：JICA 専門家チーム

図 2-9 水質汚濁対策に係るワークショップで使用したスライドの例
(ECR と水質汚濁防止法の内容の比較)



水質汚濁のメカニズム

Physicochemical Treatment Processes

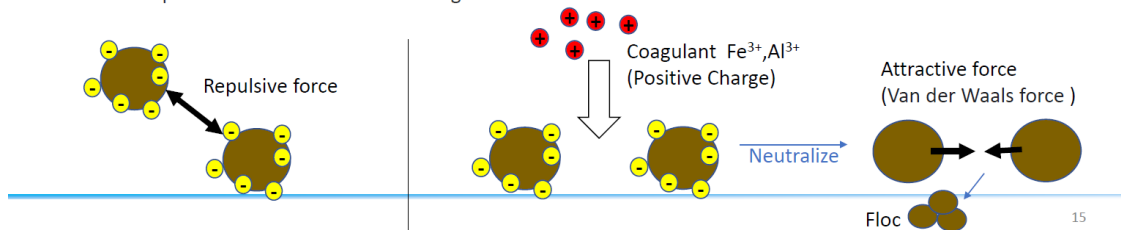
Physicochemical Treatment

Physicochemical treatment involves a set of processes which may be consecutively performed by coagulation, flocculation and sedimentation.

The coagulation, flocculation and sedimentation process is used when the particle size of suspended solids is small, and the natural sedimentation requires a long time.

Coagulation

Generally, the surface of fine particles floating in water is negative charged . When a chemical with the opposite charge is added to this to neutralize the charge of the target particles, the attractive force between the particles exceeds the repulsive force due to surface charge.



出典：JICA 専門家チーム

図 2-10 水質汚濁対策に係るワークショップで使用したスライドの例
(排水処理メカニズム)

Physicochemical Treatment Processes

Sedimentation
Sedimentation is critical for separating liquid from eventual solids that are formed as a result of previous stages of coagulation and flocculation. There are two typical kind of the settling tank.

2. Cross Flow Type

If the sedimentation velocity is V_s [m/d], the water depth H_s [m] at which the particles settle is expressed by the following equation.
 $H_s = V_s \times T$ (T: Retention Time)
 On the other hand, when the inflow rate Q [m³/d] of sewage flows into a settling tank having a depth H [m] and an area A [m²], the relationship with the retention time T is shown by the following equation.
 $T = A \times H / Q \rightarrow H = Q \times T / A$
 If $H_s > H$, the particles settle to the bottom before the wastewater flows out, so the following equation holds.
 $V_s \times T > Q \times T / A \rightarrow V_s > Q / A (=V) \dots \dots$ Equation (2)

For example, when the inflow rate is 10,000 m³/day and the sedimentation velocity of particles is 15 mm/min, the required area of the settling tank is as follows.
 $A > Q [m^3/d] / V_s [mm/min] / 60 [min/hr] / 24 [hr/d] \times 1,000 [mm/m] = 10,000 / 15 / 60 / 24 \times 1,000 = 463 \text{ m}^2$

出典：JICA 専門家チーム

図 2-11 水質汚濁対策に係るワークショップで使用したスライドの例
(排水処理の基礎と練習問題)

本ワークショップにおいて DoE 職員に対して全般的に基本的な排水処理技術の知識の底上げを行っていく必要があることが意見交換で確認された。

また、水質分析に関しては、DoE ラボの採水・分析等の品質管理能力の向上、及びラボ認証システム取得の必要性について意見が出された。

(4) ラボ認証取得に係る支援の実施

DoE の環境分析ラボは立入検査時の排水や環境水(河川、湖沼、地下水等)のモニタリングを実施しているが、現在、ISO 等の認証を取得しているラボがない。ラボ分析値の信頼性を確保するためにもラボ認証は必要である。このような背景を踏まえ、DoE チョットグラム地方事務所の環境分析ラボより ISO 等の認証取得に係る支援依頼があった。上記背景を踏まえ、2022 年 12 月からチョットグラム環境分析ラボの現状について確認、協議を行い、2023 年 3 月に下表に示すラボ認証取得支援の活動を実施した。本活動のうち 2023 年 3 月に実施した内容について、表 2-12 に示す。また、将来的に DoE が取り組むべき活動、スケジュール、予算について取り纏めた文書を添付資料に示す。

表 2-12 ラボ認証取得支援の活動の概要

検討内容	検討結果
1. 実施時期	2023 年 3 月 15 日～16 日
2. 場所	DoE チョットグラム環境分析ラボ
3. 参加者	DoE チョットグラム環境分析ラボ管理職、一般職員：10 名
4. 内容	(a) ラボ管理に係る現状と認定取得のために求められる管理体制のギャップ分析の実施 a) 現地測定：pH、電気伝導度、総溶解固形物(TDS)、溶存酸素(DO)の現場での測定状況の確認 b) 分析：化学的酸素要求量(COD)、生物化学的酸素要求量(BOD)、鉄、ヒ素の分析の確認 c) ラボ管理：ラボ運営規則、分析結果の品質管理システム、分析機

検討内容	検討結果
	器の管理規則、分析結果の監査システム (b)求められるラボ管理システムのオリエンテーション (c)ラボ認証取得までに必要な活動の整理
5. 確認された今後のラボ認証取得のために必要な活動	今回活動を通して、今後以下の活動が必要であることが確認された。 (a)整備の必要な文書及びシステム a) ラボ運営規則 b) 分析結果の品質管理システム c) 分析機器の管理規則 d) 分析結果の監査システム (b)ラボ職員に対する研修の実施 a) 分析結果の認証プロセス・不確実な分析結果の評価手法 b) 分析結果の内部監査活動 c) 機器校正・管理活動

出典：JICA 専門家チーム

本活動の結果、ISO17025 の要求事項と比較してチョットグラム環境分析ラボについて、表 2-13 に示すような要改善事項が確認された。これら改善事項を踏まえ、DoE チョットグラム環境分析ラボに関し、認証取得に必要なプロセス及び想定予算を取り纏めた。本結果を踏まえ、チョットグラム環境分析ラボラトリはラボ認証取得に向けて次年度以降の予算申請、及び必要な外部支援の内容を検討している。

表 2-13 チョットグラム環境分析ラボラトリの ISO 取得に向け必要な作業の整理

ISO 17025:2017 要求事項	ギャップ分析	認証に向けて必要な活動
ラボラトリ要員 研究所・校正機関は、人的資源要件に対処するための方針を文書化し、その方針を遵守する方法に関する指示を提供する手順を確立しなければならない。	9名のスタッフが、検査結果のサンプリング、検査および報告のために検査室に従事してきた。個々の職務記述書、訓練および職員の能力に関する記録は文書化されていない。	研究所の管理者は、個々の研究所スタッフの役割と責任を文書化すべきである。職員の能力要件は、特に、教育、資格、訓練、技術的知識、技能及び経験に関する要件を定める。
施設と環境条件 研究所・校正機関は、施設及び環境の維持管理に対処するための方針を文書化し、遵守方法に関する指示を提供する手順を確立すること。	一般に、実験室区域は清潔であり、安全な方法で試験を実施するのに十分な空間を有していた。	実験室区域の温度基準は、試験パラメータの要求に応じて、標準手順書(SOP: Standard Operation Procedure)または分析結果を記録するために使用されるデータ収集フォームに記載する。温度計は、日常的に校正され、所定の時間枠に対して最小及び最大の読取り値を提供する能力を有するものとする。
機材 試験所は、機器の校正及び保守に対処するための方針を文書化し、その方針を遵守する方法についての指示を提供し、その方針及び手順を遵守する証拠として定期的な記録を維持するための手順を確立すること。	DoE研究所は、環境パラメータのフィールドおよび研究室ベースの化学試験の両方を実施するために必要とされる基本的な機器を有する。提供された機器インベントリで、利用可能な機器が確認された。機器校正記録は文書化されていない。	分析ラボの機器は、認定されたサービスプロバイダを使用して適宜校正され、その後、研究所スタッフの訓練が行われ、一般的な保守および日常的な校正が行われる。さらに有効な校正標準は、現場及び研究所の両方で使用されるすべての機器について入手可能である必要がある。

ISO 17025:2017 要求事項	ギャップ分析	認証に向けて必要な活動
<p>研究所・校正機関は、適切な機能を確保し、汚染又は劣化を防止するため、装置の取扱い、運輸、保管、使用及び計画的な保守に関する手順を有すること</p>	<p>「分析天びん」は校正されておらず、天びんの校正およびモニタリングに使用できる標準分銅はない。</p>	<p>文書化された手順および分析機器の定期的な保守・校正の記録を、ラボらとりが所有する必要がある。</p>
<p>計測トレーサビリティ</p> <p>研究所・校正機関は、測定の不確実性への影響因子を確認し、それらを考慮し適切な基準と結びつける活動のトレーサビリティを、記録された継続的な校正によって確立し、維持すること。</p>	<p>研究所は、分析天秤に係る製造業者からの証明書を有する標準分銅を有する。しかし、日常的な校正手順はトレーサブルではない。</p>	<p>分析天秤を日常的に較正し、分析天秤の性能を毎日監視するために、研究所は、標準質量又は較正質量のセットを入手しなければならない。標準質量のみを調達する場合は、国家計量研究所またはその他の校正研究所から校正する必要がある。</p> <p>校正された温度計を調達し、適宜、環境条件をチェックするために使用する必要がある。</p> <p>容積測定装置(容積測定フラスコ、ピペットビュレットなど)は、少なくとも年に2回較正する必要がある。</p> <p>ラボ内校正手順は、試験所で作成する必要がある。</p>
<p>分析方法の選択、検証及びバリデーション</p> <p>研究所・校正機関は、すべての活動に適切な方法及び手順を使用し、適切な場合には、測定の不確実性の評価及びデータの分析のための統計的手法を使用しなければならない。</p> <p>研究所・校正機関は、適切でないか、又は可能でない場合を除き、最新の有効な方法を使用することを保証しなければならない。</p> <p>国際規格、地域規格、国家規格、または信頼できる技術機関、関連する文書や雑誌、あるいは装置の製造者が指定する方法が推奨される。実験室で開発されたまたは改変された方法も使用することができる。</p> <p>手順及び記録は、最新の状態に保つものとし、かつ、容易に利用可能なものとする。</p>	<p>DoEラボは、利用可能な資源に応じて、必要に応じて、様々な情報源による分析方法に従っている。しかしながら、分析パラメータのバリデーション手順はまだ作成されていない。</p>	<p>ラボは、分析法バリデーションの手順を作成し、対象となるすべてのパラメータについて、バリデーションデータを記録する必要がある。試験所職員は、分析法バリデーション手順およびバリデーションデータの保管と維持方法に関する訓練を受ける必要がある。</p> <p>また、範囲内のすべての分析パラメータのSOPを作成し、文書化する必要がある。全てのバリデーションデータおよびSOPは、試験所職員が利用できるものとする。</p>

出典：JICA 専門家チーム

2.2.3 廃棄物管理分野の活動

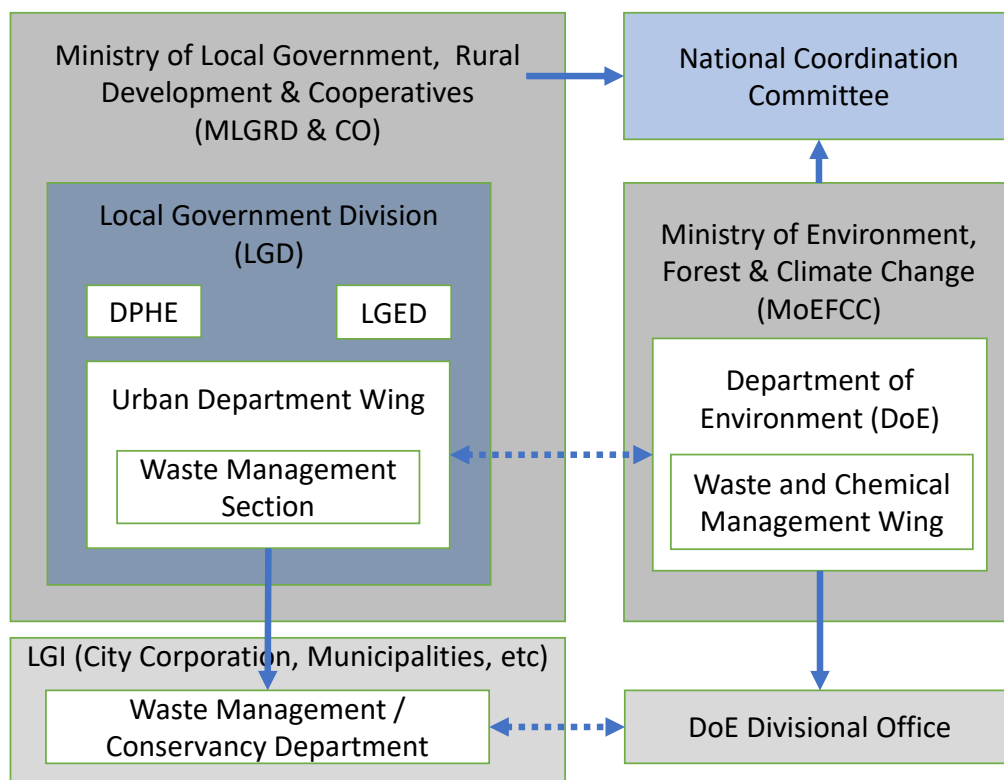
(1) DoE と他省庁の役割分担、及び連携強化に係る支援・助言

DoE は、環境分野に関する規制官庁であり、廃棄物管理の法制度整備及びそれに基づいた監督・モニタリングを実施している。SWM Rule が制定され、National Coordination Committee が設立され、その中で、DoE は、同規則を実施していくため National Coordination Committee の事務局としての機能を求められている。

National Coordination Committee に含まれる各省庁との連携が求められるなかで、連携強化に係る支援、助言を行った。

廃棄物管理の部局 (Wing) が設立されたのは 2020 年で非常に新しい部局であり、職員数も数名であり、化学物質と兼務で実施している。このような組織の現状を考えると。組織の人員の増加と各人員の能力強化が必要である。

上記の規則が制定され、地方自治体との連携が必要となるがこれまで地方自治体との連携は充分に行えていなかった。SWM Rule において、各地方自治体は、DoE に廃棄物管理計画を提出することと、年次報告書の提出が明確に求められている。今後は、DoE の WCM Wing と LGD の廃棄物管理部門、及び DoE の地域事務所と City Corporation や Municipality(Paurashava)等の各 LGI とがそれぞれコミュニケーションを取ることで、LGI と DoE との連携を深めていく必要がある。DoE と LGI との連携のイメージを図 2-12 に示す。

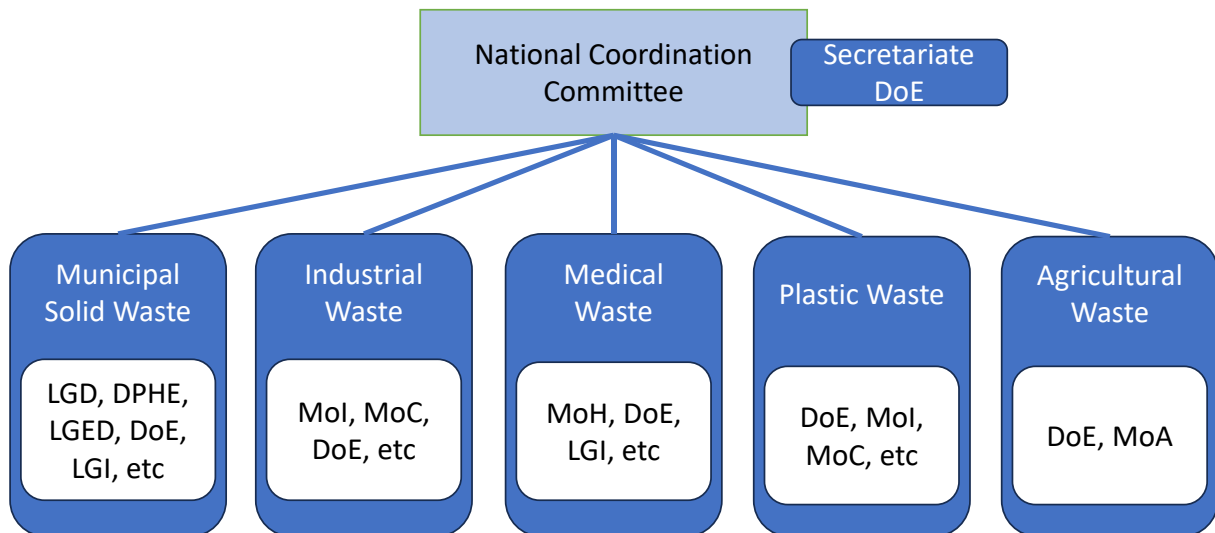


出典：JICA 専門家チーム

図 2-12 DoE と地方自治体 (LGI) との連携のイメージ図 (JICA 専門家チームの提案)

一方、各省庁間との連携については、DoE の WCM Wing は、National Coordination Committee の開催時のみならず、定期的に、National Coordination Committee のメンバーである各省庁と個別に対象となる廃棄物管理について会議を実施し進めていくことが必要である。廃棄物管理については、都市廃棄物、産業廃棄物、医療廃棄物などの多岐の分野にわたり、関連省庁が異なるため、National Coordination Committee の中にワーキンググループを設けて、都市廃棄物、産業廃棄物、医療廃棄物、プラスチック系廃棄物（都市廃棄物、産業廃棄物含む）、農業廃棄物等のそれぞれの対象ごみに特化して、担当省庁や、実施機関をメンバーとしたワーキンググループを作り、制度や基準等を作成することを提案する。各ワーキンググループで議論の上、取り纏められた結果について、年2回開催される National Coordination Committee に提出し、審議を行い、承認を得るといようなプロセスが有効である。以下にワーキンググループのイメージを示す。今後、ワーキンググループでは、それぞれの個別の廃棄物の議題に特化したことについて協議することになるが、これらの設置については、DoE 内での事前協議を踏まえ、今後、National Coordination Committee での協議が必要となる。

なお、本提案は JICA 専門家チームより示したが、DoE の WCM Wing は本提案に同意し最終セミナーでは、DoE 側が本提案を発表した。



出典：JICA 専門家チーム

図 2-13 National Coordination Committee 内のワーキンググループ設置

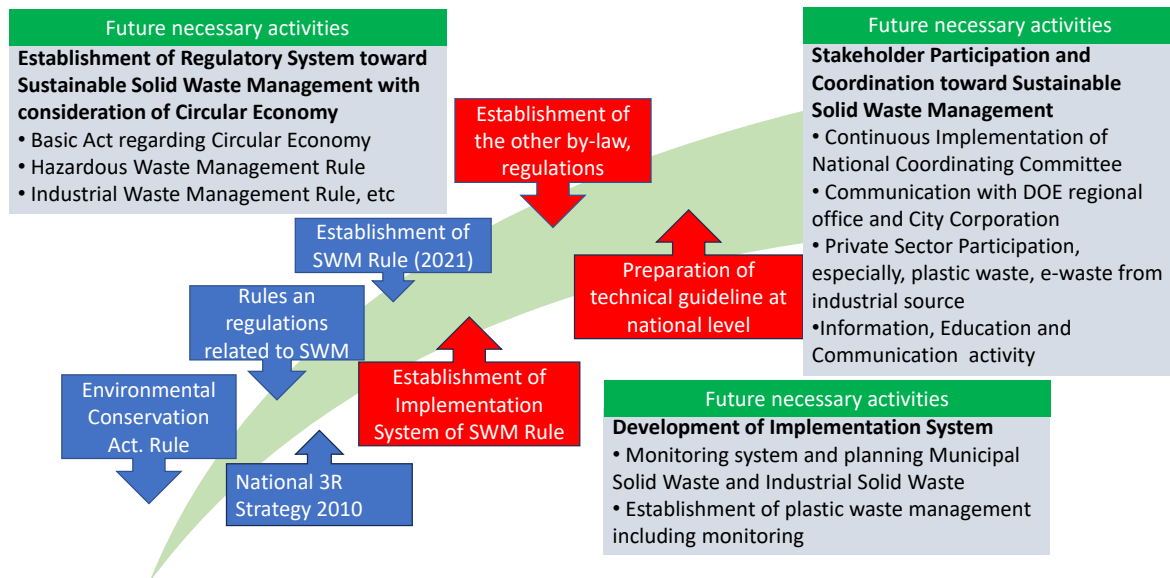
(2) DoE の政策・制度、活動計画、人材育成の検討に資する支援・助言

DoE の政策、制度、活動計画、人材育成の検討については、DoE との協議、ワークショップ等を通じて実施した。以下に主な支援、助言内容を示す。

1) DoE の政策、制度、活動計画に係る助言

DoE の責務である廃棄物管理の政策や制度に係る助言については、主として、ワークショップを中心に実施した。現状の廃棄物管理の政策・制度については、下図の青色の部分が既に整理されており、赤色の部分が SWM Rule や有害廃棄物規則（電気電子機器廃棄物）等の整備を踏まえて、必要な事項となる。また、それぞれ、

法制度、実施体制の整備、ステークホルダーとの関係というところで、各項目の活動が必要と考えられる。



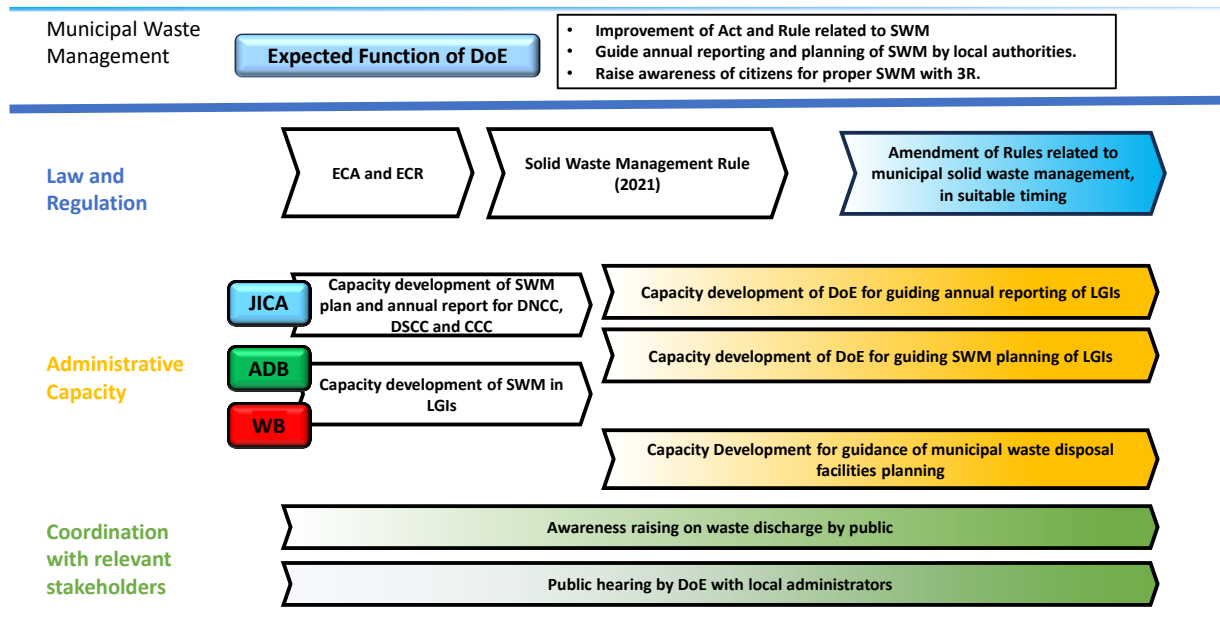
出典：JICA 専門家チーム

図 2-14 廃棄物管理に係る法令、政策の制度整備に係る変遷と必要な今後の改善

以下、都市廃棄物、産業廃棄物、医療廃棄物の3つの区分に分けて、ドナーの支援の概要を含んだ今までの変遷を示し、今後の活動に関する助言を示す。

a) 都市廃棄物

都市廃棄物については、WB、ADB 及び JICA 等の様々なドナーが、主に廃棄物管理の監督省庁である LGD、LGED、DPHE と実施主体である各地方自治体に支援を行ってきている。2021年に SWM Rule が制定されて、各地方自治体が、廃棄物管理計画や年次報告書の提出が求められ、それらの確認や取りまとめが必要となることからその実施方法のガイドライン作成を含めた能力開発が必要となる。そのため、法制度面では、関連法との整合をとるために、関連法のアップデート、行政面の能力向上として、廃棄物管理の技術面のガイドライン作成も含めた能力開発、関係者との協調については、DoE のサイト等を活用した廃棄物管理の情報提供やパブリックヒアリング等が必要であり、それらを提案する。



注：今後の活動としての提案部分は色網掛けで示している。

出典：JICA 専門家チーム

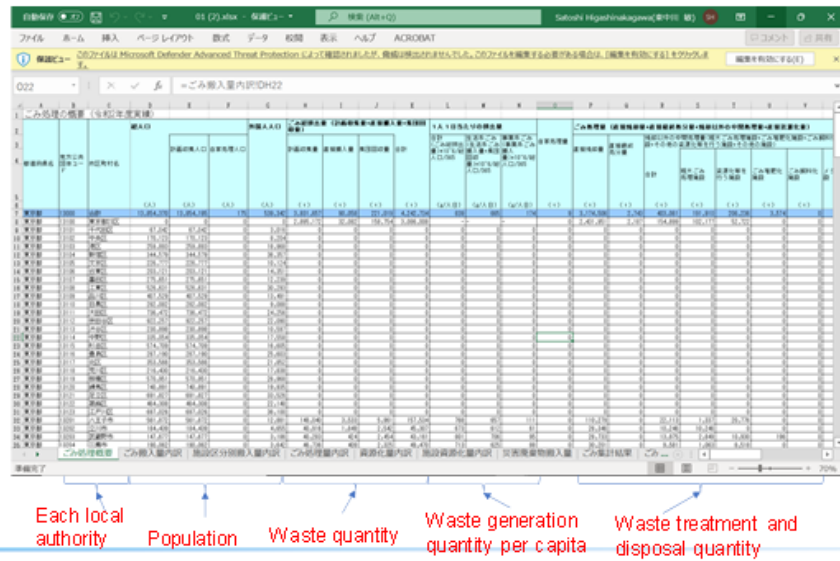
図 2-15 都市廃棄物に関する制度整備及び能力強化、関係者との調整に係る変遷と今後の活動提案

その中で、LGI の廃棄物管理計画の策定や年次報告書の作成及びとりまとめについて、以下のような日本の事例についてのスライドを作成し、ワークショップ等を通じて助言を行った。

年次報告書については、日本の場合、地方自治体が各地域の廃棄物管理の実施状況についてとりまとめ、環境省に提出をするが、そのフォーマットは予め定められており、そのフォーマットに基づいてとりまとめを行い、とりまとめた結果を国レベルの廃棄物管理状況のデータとして公開している。このデータシートの事例やとりまとめたごみフローなどについて、例として提示し、地方自治体からのデータ収集の実施方策についての助言を行った。

Data input and analysis for SWM Annual Report in Japan

- Prepare the data format of excel sheet
- Input the data from each local authorities
- Analyze the data



Source : Based on Ministry of Environment in Japan

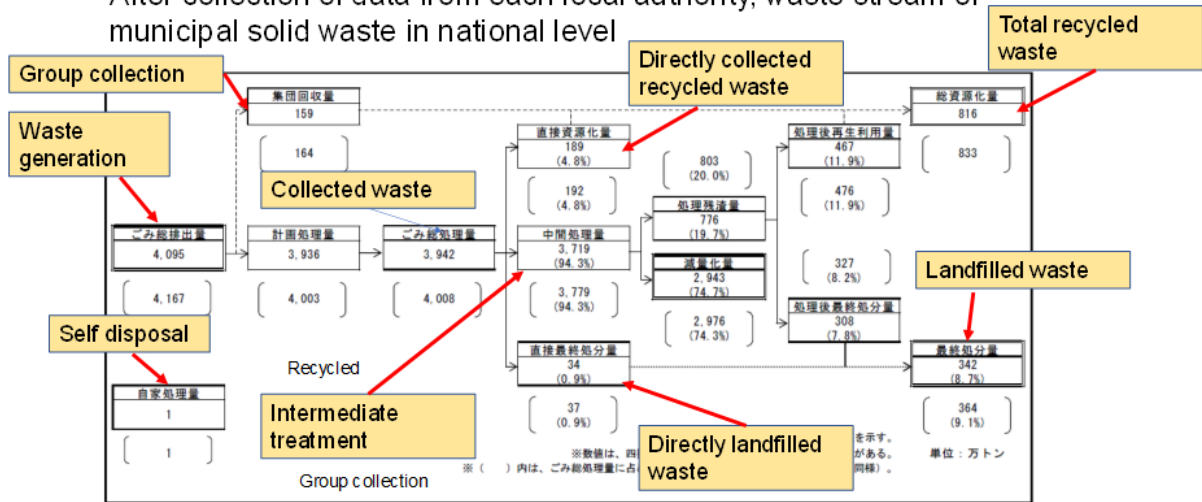
10

出典 : JICA 専門家チーム

図 2-16 日本の地方自治体の廃棄物管理データをとりとまとめたモニタリングシート例

SWM Annual Report (Case in Japan)

- After collection of data from each local authority, waste stream of municipal solid waste in national level



Source : Based on Ministry of Environment in Japan

12

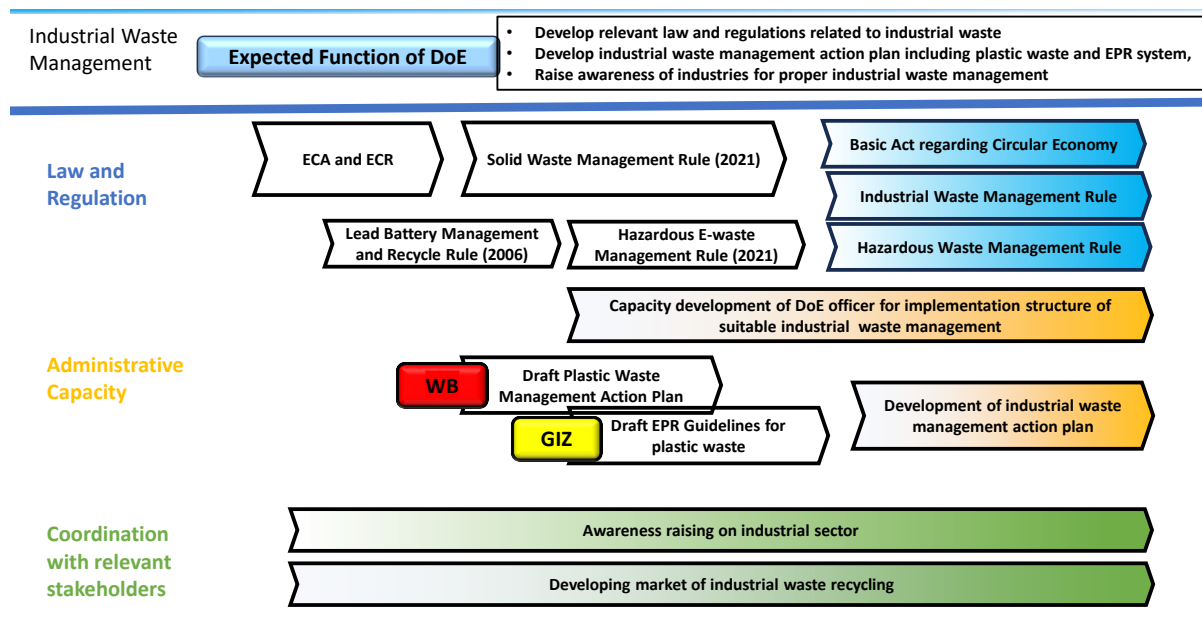
出典 : JICA 専門家チーム

図 2-17 日本の地方自治体の廃棄物管理データをとりとまとめた日本全体のごみフローの事例

b) 産業廃棄物

産業廃棄物については、船舶解体及び E-waste に関する有害廃棄物管理規則が制定され、また廃鉛蓄電池に関する規則が制定されているが、産業廃棄物全体に関する規則は制定されていない。一方、WB がプラスチック廃棄物に関する活動計画策

定や EPR ガイドラインを策定している。また、E-waste に関するプロジェクトも BEST プロジェクトの中で実施中である。このような中で、今後は、法制度面では、産業廃棄物及び有害廃棄物に関する管理規則と循環型社会に向けた基本法の制定とそれに付随する各発生源からに対する規則が必要である。同時にこれらの法制度を実施するための活動計画等が必要となる。関係者との協調については、産業界の各ステークホルダーの協議を通じた意識啓発、またリサイクル可能な廃棄物について、それらの市場の整備・安定化への取り組み等が必要となると考えられ、それらを提案した。

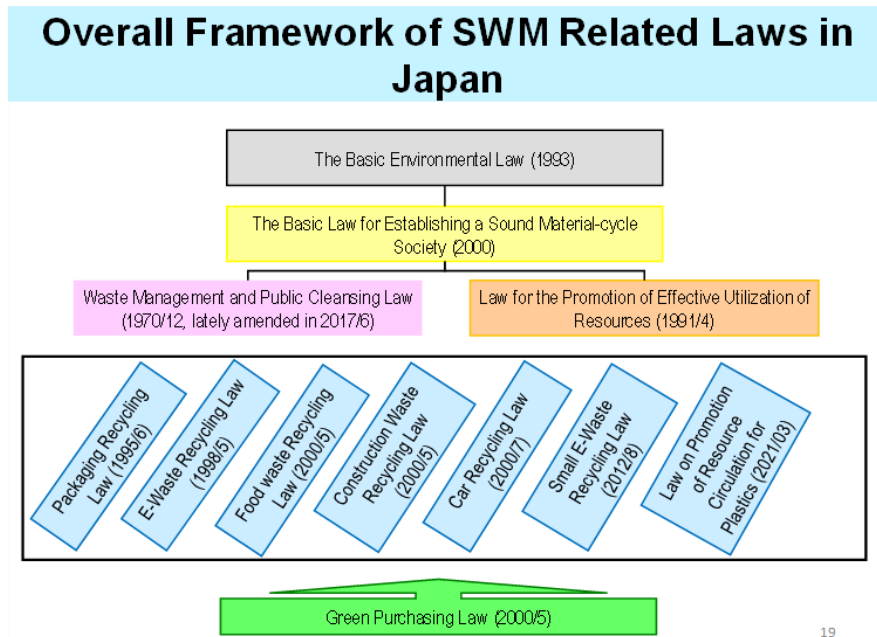


注：今後の活動としての提案部分は色網掛けで示している。

出典：JICA 専門家チーム

図 2-18 産業廃棄物に関する制度整備及び能力強化、関係者との調整に係る変遷と今後の必要な活動

例として、日本の循環型社会基本法に基づいたごみの種別ごとの個別法の体系について例として示し、今後 Bangladesh において、ごみの種別ごとにモニタリング、収集、選別、処理、処分、資源化等を実施していく上で、ごみの種別ごとに適切な制度(例えば EPR システム等)は異なるため、個別の法律が必要であることを、以下のような日本の事例を紹介しつつ助言した。



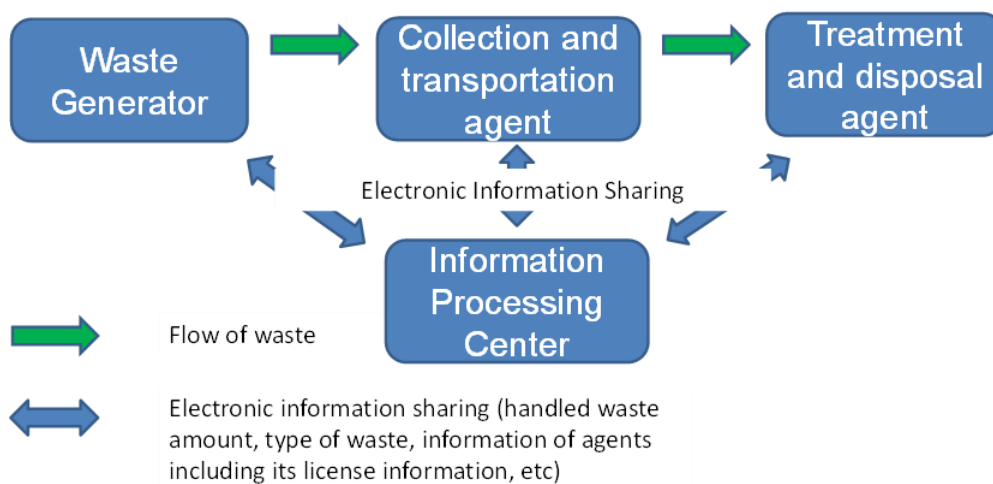
19

出典：JICA 専門家チーム

図 2-19 日本の循環型社会、廃棄物管理に関する関連法

産業廃棄物については、発生源から処分場までのモニタリングシステムとして、日本の事例として、マニフェストシステムを紹介した。マニフェストについては、現在主に実施されている図のような電子マニフェストとともに、以前実施されていた書類ベースでのマニフェストの両方を紹介した。

• Manifest system (Electronic System)

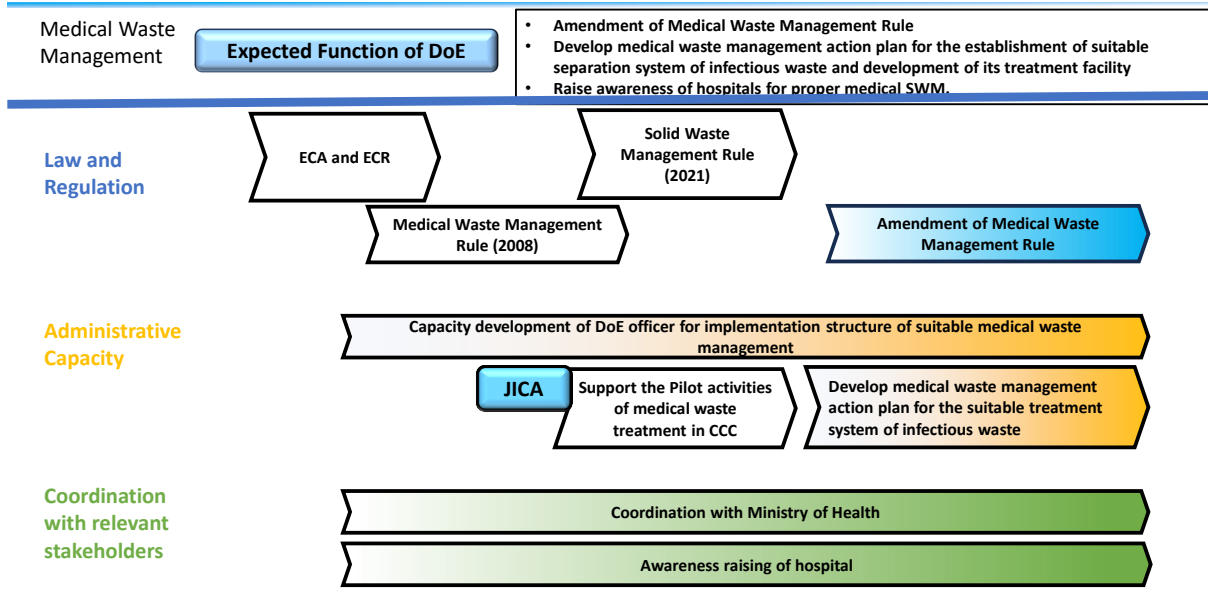


出典：JICA 専門家チーム

図 2-20 産業廃棄物、特に有害廃棄物のモニタリングシステム

c) 医療廃棄物

医療廃棄物については、医療廃棄物管理規則が策定されている。また、JICA がチャットグラムで医療廃棄物焼却施設のパイロットプロジェクトを行っている。今後、医療廃棄物の分別及び処理・処分の運営基準などについて改訂が必要であり、現在、WB の支援の下で改訂作業に着手している。これらの知見を活用しながら、今後、医療廃棄物の処理体制の強化を進めていく必要がある。



注：今後の活動としての提案部分は色網掛けで示している。

出典：JICA 専門家チーム

図 2-21 医療廃棄物に関する制度整備及び能力強化、関係者との調整に係る変遷と今後の活動提案

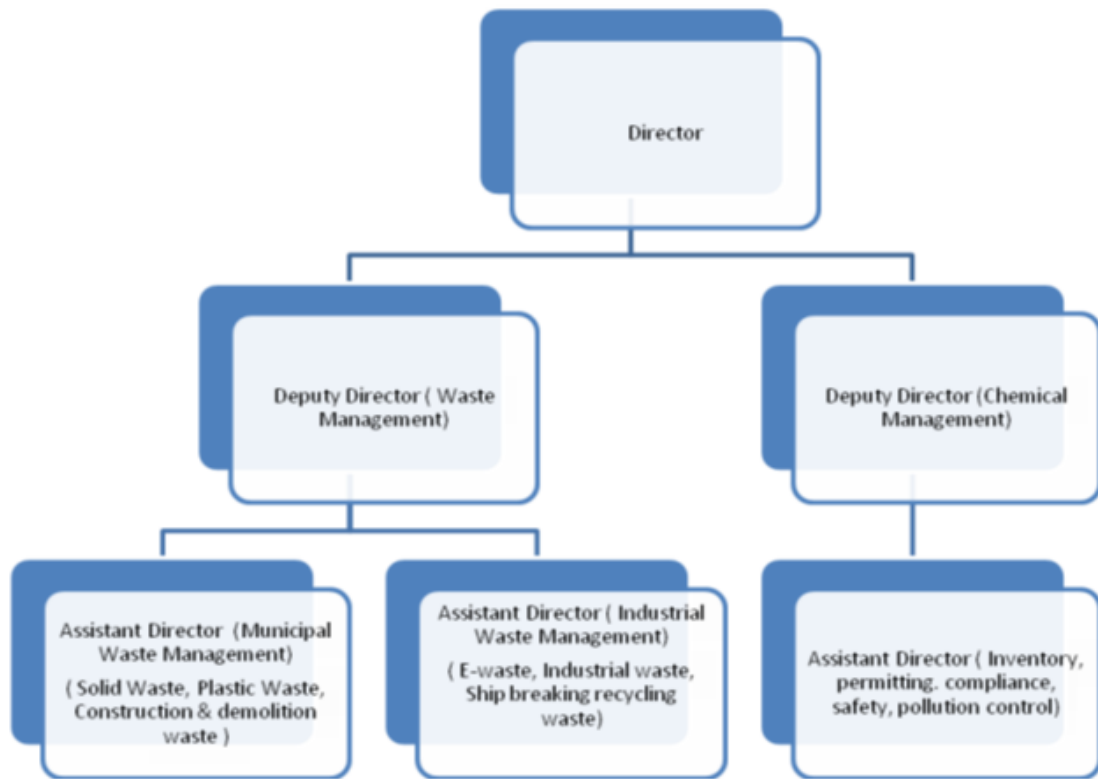
2) 人材育成の検討に資する支援、助言

DoE の責務である廃棄物管理の政策や制度に係る助言については、主として、DoE の担当者との個別協議やワークショップを中心に主に下記の事項について実施した。

- DoE の WCM Wing の各人員と職務内容の把握と将来的に望まれる組織体制に係る意見交換
- ワークショップを通じた能力開発・人材育成の実施
- 個別協議時の課題抽出及びその解決策の示唆と意見交換

現状、DoE の WCM Wing は、廃棄物管理と化学物質管理の責務を有している。また、廃棄物管理については、都市廃棄物と産業廃棄物の担当は区分されていない。今後、廃棄物管理体制のモニタリング等の活動を強化するためには、モニタリング対象を地方自治体と民間企業に分け、それぞれの責任担当者を明確にすることが望ましいと考えられる。WCM Wing の将来的な組織体制の一案を図 2-22 に示す。本

提案は今後 DoE 内部で検討が必要だが、WCM Wing も組織強化が必要である事を理解しており、最終セミナーでは DoE が本提案を説明した。



出典：JICA 専門家チーム

図 2-22 将来的な DoE Waste and Chemical Wing の組織体制の一案

3) 啓発や情報公開について

住民啓発については、廃棄物管理の実施主体である LGI が中心にボトムアップ型で実施しているところが多い。DoE としては、保有している情報が国レベルであり、それらを情報公開することで、住民への啓発活動の一助となると考えられる。

(3) ワークショップの開催

ワークショップについては、参加型のワークショップを 2 回開催した。

1) 第 1 回ワークショップ

a) 目的及び概要

Bangladesh の廃棄物管理は、都市廃棄物については、DoE、LGD、LGED、LGI 等が協力して実施している。近年、SWM Rule が策定され、公布されたが、実施に際し、具体化する必要があるため、ワークショップを実施した。

第 1 回目のワークショップは以下のとおり実施した。 Bangladesh と日本の廃棄物管理の現状、法制度、地方自治体の計画策定、モニタリングデータの共有方法や EPR システムの整備状況等について比較しつつ、説明を行い、意見交換を実施した。なお、プログラム及びプレゼン資料は、添付資料に示す。

- (a) 開催日：2022 年 12 月 21 日
- (b) 場所：DoE 本部
- (c) 参加者：51 名(DoE 本部、DoE 地方事務所)
- (d) 目的：
 - 関係する政府職員に対して知識と経験を共有し議論を行う
 - 廃棄物管理の実施に向けた優先課題を特定し、この中で、 Bangladesh の廃棄物管理システムの改善方法について議論を行う

表 2-14 廃棄物管理に係る第 1 回目のワークショップの概要

内容	演者等
プロジェクト概要の説明	JICA 専門家チーム
廃棄物管理の一般的な概念と Bangladesh での廃棄物管理の現状	JICA 専門家チーム
休憩	
Bangladesh と日本の廃棄物管理政策・制度の紹介と議論	WCM Wing, JICA 専門家チーム
LGI の廃棄物管理計画と年次報告書作成と DoE による促進支援	WCM Wing, JICA 専門家チーム
日本で運用されている EPR 制度の紹介と Bangladesh での導入の可能性の議論	WCM Wing, JICA 専門家チーム
廃棄物処理・処分に係る温室効果ガス排出量のモニタリングに係る Bangladesh での活動の現状	Climate Change Wing

出典：JICA 専門家チーム

b) 結果

DoE と各 LGI との関係強化に係る質問（例えば、廃棄物管理の優良事例共有や優良自治体の Award 等）についての質問、協議がなされた。また、日本事例の紹介の中で、分別収集や廃棄物発生量の減量化等について興味深いようで、多くの質問が寄せられた。

2) 第 2 回ワークショップ

a) 目的及び概要

第 2 回目のワークショップでの議論を踏まえ、第 2 回目のワークショップを以下のとおり実施した。

- (a) 開催日：2023 年 7 月 20 日
- (b) 場所：DoE 本部
- (c) 参加者：38 名(MoEFCC、DoE 本部、DoE 地方事務所(ダッカ市周辺及びチョットグラム市)、ダッカ市（北部及び南部）)
- (d) 目的：
 - 関係する政府職員と対話的な議論を通じて、廃棄物管理計画の作成と実施プロセスに関する知識と経験を共有する
 - このトレーニングを通じて、年次報告書の事例と報告のためのデータを共有する
 - 上記活動を通じて、今後の廃棄物管理の強化のための優先的な取り組みについて協議する。

表 2-15 廃棄物管理に係る第 2 回目のワークショップの概要

内容	発表者等
・ 廃棄物管理計画および年次報告書作成に含めるべき内容及び留意事項	専門家チーム
・ SWM Rule で求められている廃棄物管理計画と年次報告書の解説	DoE
・ 南北ダッカ市の廃棄物管理計画の紹介	南北ダッカ市
・ プロジェクト活動によって確認された課題と課題解決に必要な活動に係るディスカッション	DoE 及び専門家チーム
・ 廃棄物管理計画および年次報告書作成に係るグループディスカッションと発表	DoE 及び南北ダッカ市

出典：JICA 専門家チーム

前回のワークショップでは、特に SWM Rule の実施に際して、各地方自治体当局が作成する廃棄物管理計画や年次報告書などをどのように実施するかが議論された。これを踏まえ、第 2 回ワークショップでは、当該議論をさらに深堀するとともに、今後、DoE にとって今後必要と考えられる支援内容について意見交換を行った。

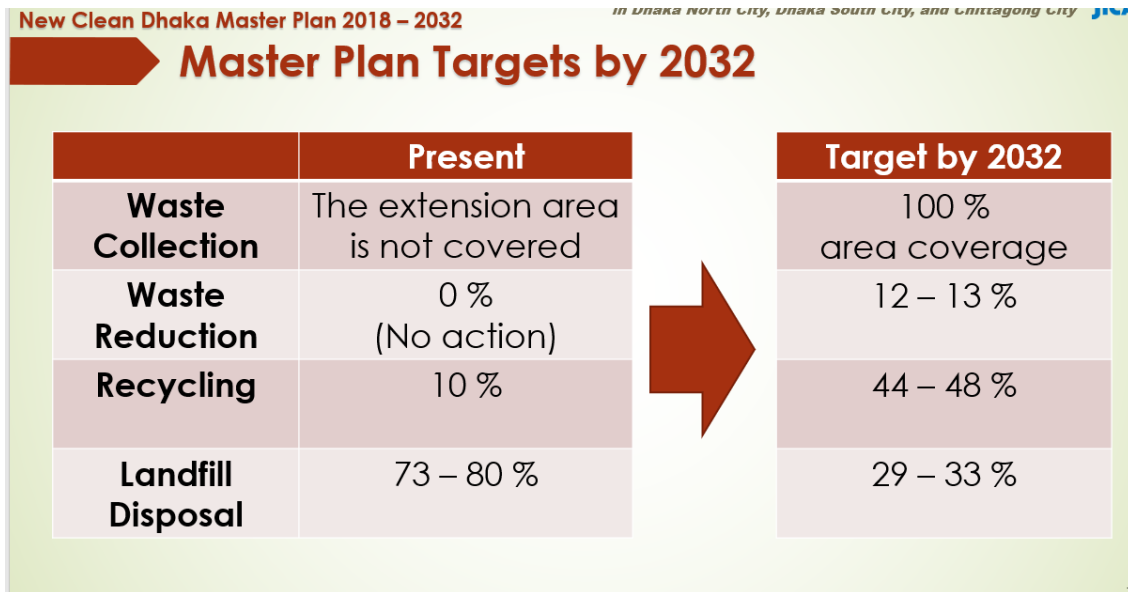
ワークショップでは、前回の議論を踏まえて、廃棄物管理計画の策定やモニタリングの年次報告書の内容など、日本の事例を交えて説明を行った。その後、DoE が SWM Rule に基づいた計画策定と年次報告書作成の必要性について、ワークショップに参加した各自治体に説明した。また、DoE 職員と地方自治体職員の混ざったグループを 2 つ作成し、廃棄物管理計画や年次報告書を作成の際に留意すべき事項を議論し、グループ発表を行った。発表内容に対しては専門家チームが、各グループが着目した留意事項についてコメントし、意見交換を行った。また、DoE より今後の廃棄物管理の推進に際してドナー等への支援を期待する内容について説明があった。

b) 結果

今回のワークショップについて、SWM Rule の制定後の実施についての課題、今後すべき活動について、関係者間で協議ができた。これを踏まえ、今後 DoE が実施すべき活動について、DoE より最終セミナーで発表を依頼する方向で協議した。これにより最終セミナーに向けての布石が出来たと考えられた。

c) 協議内容

北ダッカ市職員がワークショップに参加し、2005 年に策定されたクリーンダッカマスタープランについて説明し、南北ダッカ市が、現在、その目標をほぼ達成し、廃棄物管理を継続的に改善して、実施しているとの報告を行った。また、「新クリーンダッカマスタープラン 2018-2032」の内容を説明した。同マスタープランは、2032 年までに 100% の廃棄物収集率等の目標値を設定し活動を開始しているとの説明があった。課題として、職員不足、中間処理施設の適切な運営の必要性、および最終処分場の拡張等が挙げられた。また、将来のビジョンとして、街路清掃の効率化、エネルギー回収を伴う中間処理の実施、およびリサイクル・資源回収施策の活発な実施な重点施策として含まれることが説明された。



出典：北ダッカ市

図 2-23 新クリーンダッカマスタープラン 2018-2032 の目標

DoE 職員及び北ダッカ市職員等の混成グループによって廃棄物管理計画策定の際に留意すべき事項等について、ディスカッションを行った。ディスカッションによって廃棄物管理計画策定に関する課題を確認した。

- グループ 1：廃棄物管理の計画策定段階において、技術開発や必要な設備の配置、また住民参加の重要性について議論が行われた。設備の適切な運用と、現場での知見を活かした廃棄物減量化、分別、資源化の検討の重要性も指摘された。活動を行っていくうえで重要な点として、実施状況の定期的なモニタリングと評価の実施が重要であり、それらを元に継続的かつ戦略的に計画を改善していくことが重要である、との指摘がなされた。
- グループ 2：本グループはリサイクル活動を主な議題として取り上げて、議論を行った。生分解性廃棄物について、堆肥化の活動を Ward レベルで実施し、それを横展開していくことの重要性が指摘された。進捗状況のモニタリングと報告には、LGI を巻き込んだシステムの策定が必要であり、管理部門である LGD に半年ごとの報告を提供するとともに、National Coordination Committee は年次報告書を受け取り、廃棄物管理の進捗に基づいて政策策定に活用することを提案した。

DoE からは廃棄物管理強化のため、今後、以下のような活動が必要であり、その能力強化のための支援についても期待が示された。

- 地方自治体の年次報告書作成、廃棄物データベース構築、廃棄物管理計画作成の技術指導に係る能力強化
- マニフェスト制度や有害廃棄物の輸出入規制制度の強化
- SWM Rule 及び有害廃棄物管理規則の実施
- 焼却発電施設の整備や廃棄物発電、資源回収、堆肥化に関する研修の実施
- EPR を導入したプラスチック廃棄物管理の体制整備
-

ワークショップでは、EPR システムや分別排出についても活発な議論が行われた。主な論点は、以下の通り。

- バングラデシュでは、人口増加や経済成長によって、廃棄物の発生量や原単位も増加傾向にあるが、法制度の規制や経済的なインセンティブ等により、減量化を推進しようとしている。
- 日本では、ごみ発生量の増加傾向に歯止めがかかり、近年はごみ発生量原単位も減少傾向にある。その一つの理由として、国及び実施主体である地方自治体の住民意識啓発やごみ分別、減量化施策の実施により増加傾向を抑えていった。
- DoE は、EPR を促進するためにガイドラインの策定に取り組んでいるが、それらの策定については、国、自治体、産業界等の様々なステークホルダーを交えて協議しつつ進めていくのが良い、との意見が出た。
- 日本での曜日別の分別収集やインドでの Conservancy Inspector への違反金徴収の権限移譲などの事例が上げられ、これらの優良事例について議論がなされた。
- 廃棄物管理の National Coordination Committee は、地方自治体が作成する廃棄物管理計画や廃棄物管理の年次報告をレビュー・評価し、計画や報告書の内容を段階的に改善する事を考えており、各自治体の表彰システム等も検討したいとのことであった。これらの活動に DoE が果たす役割は重要であると考えられた。

2.3 最終セミナー

2.3.1 目的及び概要

本業務の成果の共有、及び DoE と関係政府機関との間で、今後、環境管理強化に係り必要となる活動について意見交換を行うことを目的として、最終セミナーを実施した。

- (a) 開催日：2023 年 11 月 21 日
- (b) 場所：DoE 本部
- (c) 参加者 64 名 (MoEFCC、DoE 本部、DoE 地方事務所、DPHE、LGED、DNCC、DSCC、CCC、ドナー (JICA、WB、GIZ) 等)
- (d) 目的：
 - 本業務の成果、特に優先的に取り組むべき課題と DoE が今後行うべき活動の検討結果を共有する。
 - DoE が今後行うべき活動に係る提言について、関係機関と意見交換を行う。

表 2-16 最終セミナーの概要

内容	発表者等
• 本業務の活動の概要	JICA 専門家チーム
• 本業務により得られたファインディング及び提言 (水質汚濁対策及び廃棄物管理)	JICA 専門家チーム
• 環境管理の強化のために DoE が今後行うべき活動に係る提言	DoE
• DoE が今後行うべき活動に係る意見交換	全参加者

出典：JICA 専門家チーム

2.3.2 結果

セミナーでは、本業務を通じた検討で得られたファインディングを踏まえ整理した DoE が今後行うべき活動について、DoE 及び JICA 専門家チームが表 2-17 に示す内容を発表した。

表 2-17 DoE が今後行うべき活動

分野	制度面での現況	DoE が行うべき活動
水質汚濁対策	ECR が 2023 年に改訂され、河川、湖沼、沿岸域の水質モニタリング、及び排水モニタリングに係る要求が強化された。	(短期的に求められる活動) ・ 産業排水発生源に対するインスペクション、及び ECC の発行、更新作業を適切に実施するための技術研修の継続的な実施 ・ 環境分析ラボラトリの機材を適切に運用し分析結果の品質を確保するための研修の実施、及びラボラトリ認証制度取得のための活動の実施 (長期的に求められる活動) ・ 産業排水以外の排水も含めた汚濁負荷検討のための関連省庁・機関との連携強化 ・ 流域単位での排水管理を実現するための制度の検討、関係機関との連携 ・ 国際河川等に係る越境汚染問題への取り組み
廃棄物管理	SWM Rule が 2021 年に制定され、廃棄物の発生・処理状況の報告、及び管理計画策定の義務が明確となった。	(短期的に求められる活動) ・ SWM Rule で求められる活動を地方自治体を実施できない要因の確認、及び優良事例の収集 ・ 地方自治体によるモニタリング及び管理計画策定の確実な実施を促すための指導能力強化に係る研修の実施、及び指導のためのツールの作成 ・ 産業廃棄物管理に係るモニタリングのパイロット活動の実施と民間を含めた関係者との協議の実施 ・ 廃棄物管理に係る体制強化 (DoE、National Coordination Committee) (長期的に求められる活動) ・ 総合的な産業廃棄物の発生・処理状況のモニタリングシステムの構築

出典：DoE 及び JICA 専門家チーム

2.3.3 協議内容

セミナーでは、DoE が今後行うべき活動に係る内容を含め、以下のような協議が実施された。

[全般]

- JICA 本部より、環境管理は人とのコミュニケーションが重要であり、環境管理活動を強化するためには、どのように関連する住民や事業者を巻き込み啓蒙するかが重要である、との指摘があった。現状では、実際に DoE 職員の活動が住民や事業者へ浸透が充分していないところも見られた。今後、DoE 本部と Divisional Office が連携して、

環境教育・住民啓発活動を実施していくことが重要になる。本セミナーの意見交換の中で、DoE 管理職から JICA 本部の指摘を十分に理解した旨の発言があった。今後、住民や事業者とのコミュニケーション改善が期待される（JICA 本部、DoE）。

- 今回のアドバイザー業務が有益であったとの表明とともに、DoE の今後の研修活動について、トレーニングニーズ分析結果の活用を積極的に活用する方針が示された。（DoE）。
- 他ドナーに本業務の活動が認知され、ドナー間での協力の協調について、前向きな意見交換があった（WB、GIZ）。

[水質分析]

- 科学的根拠に基づいた環境管理体制の強化の提案に賛同があった。また水質汚濁対策に係り、本態勢を強化するためには、環境分析ラボラトリの体制強化が必要であるとの意見があった（DoE、DPHE）。
- 低コストで有効な排水処理技術導入の必要性が指摘された（DoE）。
- 環境分析ラボラトリの分析活動の連携の可能性が示された（DPHE）。
- 将来的には流域単位での排水管理能力の強化が必要との JICA 専門家チームの提案について、DoE も同様の考えであることが示された（DoE）。

[廃棄物管理]

- JICA 本部より指摘のあった一般国民とのコミュニケーション促進に関する提案について、特に廃棄物管理分野での重要性が指摘され、地域社会を巻き込んだ廃棄物管理活動を積極的に行う事が重要である、との見解が示された（DoE、LGI）
- 地方自治体を実施するワークショップ等に DoE も参加し、DoE の責務の観点から地方自治体に情報提供していく旨の意志が示された（DoE）。

3. 業務実施運営上の工夫

3.1 全体面での運営上の工夫

3.1.1 プロジェクト全体に関する事項

(1) プロジェクト開始時点での JICA 技術協力に対する理解の醸成の必要性

1) 状況

本プロジェクトの初期段階で、DoE の管理職上層部に本業務を十分に周知する必要がある。特に JICA の技術協力の方針について Director General(DG)に理解、認識してもらう事が本業務を開始する段階で重要であった。

2) 工夫

DoE の DG は多忙であったが、プロジェクト開始時に DG へのレター送付及び面談を積極的に実施すると共に DG のプロジェクト理解が十分となるまで、プロジェクトの Kick-off Meeting の実施を待つこととした。その結果、Kick-off Meeting の開催は 2022 年 3 月となったが、DG の呼びかけにより、DoE の関連する主要部署の Director もしくは Deputy Director が参加し Kick-off Meeting を開催する事が出来、プロジェクトを本格的に開始する事ができた。

3) 教訓

技術協力を実施する際には、事前に関係するステークホルダーを把握し DG とのコンセンサスを十分にとったうえで活動を実施する必要がある、そのためには事前準備の時間を考えておく必要がある。

(2) COVID-19 下での活動の実施

1) 状況

本プロジェクトの開始時は COVID-19 が流行していた時期だった。リモート会議が推奨されると共に流行による行動制限もあった。

2) 工夫

幸いな事に DoE の関係部署の幹部は Zoom を主としたリモート会議に慣れており、主要な会議はリモートでの開催が可能だったことから、プロジェクト開始時は必要に応じて Zoom での会議を行った。また、大人数での会議は避ける必要があったことから、ハイブリットでの会議も実施した。但し、ネット環境により会議に支障があるケースもあったがチーム専用のルーターを購入、使用する等して対応した。

3) 教訓

COVID-19 の流行の有無にかかわらず安全面から移動が制限されるケースもあることから、リモート会議が実施可能な体制を有しておくべきである。

(3) ローカルエキスパートの有効活用

1) 状況

Bangladesh では法律等の文書がベンガル語のみであるケースも多い。また、地方事務所には英語が十分に話せない職員もあり、英語に限らず円滑に文書の確認やコミュニケーションを図れる体制の構築が必要だった。

2) 工夫

水質汚濁対策、廃棄物管理の双方の分野で現地での作業時はローカルエキスパートを雇用し、ベンガル語の文書の確認や地方事務所の職員とのコミュニケーションが円滑に図れる体制を常に保持して活動を行った。

3) 教訓

Bangladesh 国で技術協力を行う際には、ローカルエキスパートの雇用は必須である。ダッカ市を中心として環境分野も専門家を確保し技術協力を行うことが望ましい。大学の教授との連携も有効である。

3.2 水質汚濁対策分野

1) 状況

DoE の水質汚濁対策に関連する部署は複数あり、技術協力の期間中、それぞれの部署と継続的にコミュニケーションを図る必要があった。

2) 工夫

DoE の NRM Wing が主なカウンターパートであるが、関連する Environmental Clearance Wing, Monitoring & Enforcement Wing の職員との連絡や議論を重ねて業務を実施した。特に Bangladesh の水質管理は工業セクターに対する ECC 制度で構築されているので、これらの関連部署の意見は重要であった。

3) 教訓

Environmental Clearance Wing, Monitoring & Enforcement Wing は工業セクターに対する規制に関心が集中しているため、結果としては工業以外の排水や生物多様性の保全の観点からの水質保全も担当している NRM Wing を主なカウンターパートとすることでバランスが取れた。なお、業務の実質的な協議は Director ではなく実務を担当している各 Wing の Deputy Director, Assistant Director を対象に行った。

3.3 廃棄物管理分野

(1) DoE の WCM Wing との関係構築

1) 状況

技術協力の主な対象であった WCM Wing は設立されて数年しかたっていないかった。併せて JICA 専門家として DoE に対してはじめての支援業務であったこともあり、当初、小規模な打合せも困難な状態であった。

2) 工夫

今までの JICA の南北ダッカ市での技術支援の実績や日本の廃棄物行政を紹介することにより、DoE 側の技術協力への理解が少しずつ深まっていった。また、DoE からのいくつかの依頼事項（National Coordination Committee の会議開催時の委員会の役割や今後協議事項の説明資料の作成や日本の廃棄物法令の事例紹介等）への対応をタイムリーに実施し、信頼を得た。

その結果、信頼関係が構築され、2回のワークショップを開催し、意見交換、情報共有、助言の提供を行うことができた。

3) 教訓

性急にならずある程度時間をかけて相手の理解を得ていく実施体制が重要と考える。

(2) 廃棄物管理に係る関係者を巻き込んだ技術協力の実施

1) 状況

廃棄物管理に係る政府関係者は DoE のみならず地方自治体等も含まれ、それら関係者も巻き込んだ形での技術協力が必要であった。

2) 工夫

廃棄物管理を実施している地方自治体やそれを統括する LGD や DPHE、南北ダッカ市等は、JICA をはじめとした各ドナーの支援も受けつつ廃棄物の実施案件を既に実施してきており、実務面での経験が高いと考えられた。これらの関係者をワークショップに招聘し、あるいは個別の打ち合わせを行うことによって、規制官庁である DoE との意見交換の場を設けて、課題抽出や今後必要な活動の検討を行った。

3) 教訓

南北ダッカ市をはじめとする地方自治体は、既に長い期間、JICA の技術協力を受けており、技術協力に対する理解が高かった。一方、他の地域については、準好気性埋立やワードベースストアプローチに関する理解も浅いことから、地方都市の実施事例というのを如何に、DoE や LGD 等を通じて他の都市に普及する体制を構築することが必要である。。

4. 成果の達成度

本アドバイザー業務のプロジェクト目標は、“環境管理行政（主に水質汚濁・廃棄物管理）の改善のための課題が整理され、包括的な環境管理を行うための DoE の能力強化に向けた方向性が示される”であり、期待される成果としては“成果 1：DoE の環境管理行政を行う際の水質汚濁・廃棄物管理における法規制、制度上の課題が明らかになる。”と“成果 2：DoE の包括的な環境管理を行うために必要な能力向上に向けた分析・検討が行われる”ことである。

以下に成果 1 と成果 2 の成果の達成度について記載する。

4.1 成果 1：DoE の環境管理行政を行う際の水質汚濁対策、廃棄物管理における法規制、制度上の課題の明確化

DoE の環境管理行政を行う際の水質汚濁対策及び物管理における法規制制度上の課題は、DoE との協議、関係省庁や現場の各地方自治体などの関係者との個別協議及びワークショップでの意見交換を通じて本アドバイザー業務の中で明らかにされた。達成度としては、成果 1 で期待されていることについては、達成できたと思料する。

水質汚濁については、2.1.4 や次の表 4-1 に示すように、ECR の改訂により管理体制の強化の必要性、排水処理施設の運用改善に係る行政指導の必要性とその規定の欠如、ラボの分析承認制度の必要性、インスペクションやモニタリングの実施の人的資源不足等がある。

廃棄物については、2.1.5 や次の表 4.2 に示すように、SWM Rule の公布に伴う実施体制の強化や既存関連法の改訂と各種ガイドラインの整備、産業廃棄物については、関する関連法制度の整備やモニタリング体制の強化等が課題と想定された。これに対して、Bangladesh 側の理解を深めるため、日本での関連法制度やモニタリング体制を紹介し、それらをもとに議論を行い、Bangladesh での今後の改善についての話題提供を行い、課題についての認識を深めってもらうようにつとめた。

また、2.1.1～2.1.3 に示すように、環境管理基本法令及び DoE の組織及び職務の分析を通じて、DoE の環境管理行政に関する制度上や組織面での課題も明らかになった。

4.2 成果 2：DoE が包括的な環境管理を行うために必要な能力向上に向けた分析・検討の実施

成果 2 としては、DoE の課題についての分析を踏まえ、今後必要な活動の分析、検討を DoE と共同で実施した。検討結果の大枠については、図 4-1、及び表 4-1、表 4-2 に示すとおりである。本技術協力を実施した期間は、改正 ECR の施行、SWM Rule の運用開始といった水質汚濁対策、廃棄物管理の双方で科学的根拠に基づいた環境管理を行うために必要な法制度の強化が図られた期間であった。併せて、各ドナーによる両分野に対する継続的な支援が環境管理能力の向上に寄与している。これらを考慮し、DoE の環境管理能力強化に関し、今後 DoE が行うべき活動についての提案を DoE と協働して取り纏めた。

取り纏めた提案は、表 1-4 及び表 2-17 に示すとおり、最終セミナーで DoE 及び JICA 専門家チームから水質汚濁対策、廃棄物管理に係る関係機関に対して提示した。同セミナーでは関係機関から DoE 及び JICA 専門家チームの提案に賛同のコメントが得られた。これらを踏まえ、本成果は達成されたと考えられる。

なお、本プロジェクトで実施したワークショップの中で、今までの JICA 支援や Bangladesh でも適用が可能と考えられる技術・制度を紹介した。これらの活動は DoE が今後必要と考

えられる活動を整理すると共に各ドナーに求める支援内容の具体化にもある程度寄与したと考えられる。最終セミナーでは複数のドナーが参加し、本業務での活動、成果が認知されると共に、ドナー間での活動の協調についても積極的な提案がなされた。

表 4-1 水質汚濁対策分野の現状と課題、及び今後の活動案

項目	法制度面			DoE の行政能力・計画策定能力、技術力			DoE の実施体制/他省庁との関係		
	現状	課題	今後の活動案/関連ドナー支援	現状	課題	今後の活動案/関連ドナー支援	現状	課題	今後の活動案/関連ドナー支援
排水管理	<ul style="list-style-type: none"> - Bangladesh Environment Conservation Act (1995, 2010 改訂) - Environmental Conservation Rules (1997) - ECR(1997) は本年改訂予定。 	<ul style="list-style-type: none"> - ECR の改訂により、規制項目数が増加すると共に一部項目の基準値が厳しくなるが、それによる管理体制強化の必要性の理解度が不足している。 	<ul style="list-style-type: none"> - ECR 改訂後の同規則の運用細則の整備 	<ul style="list-style-type: none"> - ECR に定められた産業分野の排水のみが管理されている。 	<ul style="list-style-type: none"> - 産業排水以外の汚染源は管轄外(生活排水、農業排水等)。 - 特に浄化槽管理に係る計画が無く、生活排水の負荷に影響している。 	<ul style="list-style-type: none"> - 産業排水の汚濁負荷量の把握 - 生活排水等、産業排水以外を含めた排水管理体制の強化 	<ul style="list-style-type: none"> - 水資源管理(BWDB)、衛生管理(DPHE)、下水道整備・運用(WASA)等を担当する関連省庁・部局と不定期に会合を持っている。 	<ul style="list-style-type: none"> - 総合的な排水管理に係る関連省庁・部局との連携強化が必要 	<ul style="list-style-type: none"> - 総合的な排水管理に係る関連省庁・部局との連携強化
排出源への立入検査	<ul style="list-style-type: none"> - 立入検査は ECR に則り実施 - Environmental Court Act (2000, 2002 及び 2010 改訂) 	<ul style="list-style-type: none"> - 立入検査による罰金付与に係る規則はあるが、排水処理施設の運用改善に係る行政指導に係る規定はない。 - 規定により罰金付与のための排水分析検査は政府ラボのみ分析可能 	<ul style="list-style-type: none"> - 立入検査結果を効果的に運用するための制度改善 	<ul style="list-style-type: none"> - 地方部も含め、産業排水排出源の立入検査は DoE 職員が実施している。 - 検査結果として用いる事が可能な分析結果は政府のラボによる分析結果のみ。 	<ul style="list-style-type: none"> - 立入検査担当者の排水処理施設に係る知見の向上が必要。 - 政府の分析ラボは認証未取得 	<ul style="list-style-type: none"> - 立入検査担当者の研修の強化 - 政府分析ラボの認証取得手続きの実施 (関連ドナー支援) GIZ: ダッカ分析ラボ支援: (a)試験所認定支援、(b)標準業務手順書(SOP)作成支援、及び(c)試験所パフォーマンスチェック (関連ドナー支援) WB: BEST プロジェクトで分析ラボを整理 (中央 1, Division 4, District 30)また、排水排出源の自動モニタリング PP を実施。 	<ul style="list-style-type: none"> - 地方の排水排出源も DoE の地方事務所の職員が立入検査を担当しているが、各事務所に DD が 1 人、AD が 1~2 人、検査官が数名配置されているのみ、といった状態。 	<ul style="list-style-type: none"> - インспекションは人的資源の不足のために十分に実施されていない。(例: Gazipur では担当地域に 3,000 程度の排水排出源があるが立ち居検査の実施がおいついていないとのこと) 	<ul style="list-style-type: none"> - DoE の立入検査強化 - 地方自治体を巻き込んだ排水管理体制の構築の提案
EIA	<ul style="list-style-type: none"> - EIA Guidelines for Industries (1997, 現在改訂中) 	-	-	<ul style="list-style-type: none"> - ECA, ECR の規定に則り EIA を実施 	<ul style="list-style-type: none"> - EIA 審査時及び許認可更新時に排水処理施設の妥当性を評価するための知識が不足している職員がいる。 	<ul style="list-style-type: none"> - 排水処理施設に関する知識・経験の強化に係る助言・支援 (関連ドナー支援) GIZ: EIA 承認審査時に用いる排水処理施設設計ガイドラインの作成 	<ul style="list-style-type: none"> - 地方事務所で ECC 更新に従事する担当者は数名。 	<ul style="list-style-type: none"> - ECC 更新に従事する担当者が不足している。(例: Narayanganj では、1 日に 10 件程度の ECC の更新申請を処理する必要がある場合があるとのこと) 	<ul style="list-style-type: none"> - ECC 更新に係る地方事務所の体制強化

項目	法制度面			DoE の行政能力・計画策定能力、技術力			DoE の実施体制/他省庁との関係		
	現状	課題	今後の活動案/関連ドナー支援	現状	課題	今後の活動案/関連ドナー支援	現状	課題	今後の活動案/関連ドナー支援
環境水管理（河川管理、湖沼管理、流域管理）	<ul style="list-style-type: none"> - Water Act (2013) - Water Resource Planning Act (1992) - National Water Policy (1999) - Bangladesh Water Rules (2018) - WARPO Union Parishad Guideline (2020) - WARPO District Guideline (2020) - WARPO Upazila Guideline (2020) 	<ul style="list-style-type: none"> - 流域の水質管理に係る規則が明確でない（水資源管理を重視している）。 - 保護区に係る規制はあるものの河川水質を流域で上流～下流で区別し管理するための制度がない。 	流域の水質管理に係る制度強化	<ul style="list-style-type: none"> - 河川環境回復に係る計画の策定を検討している。 	<ul style="list-style-type: none"> - 河川環境回復に係る計画の立案は不十分。 	<ul style="list-style-type: none"> - 河川環境管理に係る計画の策定・実施 	<ul style="list-style-type: none"> - BWDBは水資源管理を重視。今後、水質管理について体制強化を図る予定（水質モニタリング地点を18カ所から357カ所に増設する計画） 	<ul style="list-style-type: none"> - モニタリングの実施体制の強化が必要(全てのパラメータを試験するのに十分な試薬がない、等をヒアリングで確認) 	<ul style="list-style-type: none"> - 水環境管理に係る政策検討のための関係者の定期的な連絡体制の構築

出典：JICA 専門家チーム

表 4-2 廃棄物管理分野の現状と課題、及び今後の活動案

環境管理の対象	アドバイスの分野			環境管理の対象			アドバイスの分野		
	法制度			管理・技術力			DoEの実施体制/他省との関係		
	状況	課題	活動提案 (関連ドナー支援)	状況	課題	活動提案 (関連ドナー支援)	状況	課題	活動提案 (関連ドナー支援)
都市固形廃棄物	<p>-固形廃棄物管理規則は、地方公共団体が現状を報告し、経営計画を策定する法的義務を明確にするために制定された。</p>	<p>-廃棄物管理基本法である廃棄物管理規則が制定されたが、廃棄物の種類を明確にする上で不確実性があるため、改善が必要である。</p> <p>-計画・報告書作成の様式はあるが、作成方法についてのガイドラインはない。</p> <p>-基本法はあるが、地方自治体に必要な廃棄物管理を実施するための収集、運搬、処分場等の技術的指針はない。</p>	<p>-次回の固形廃棄物管理規則改正に向けて改善すべき事項の整理</p> <p>-年次報告書の計画策定・ガイドライン作成に係る地方自治体への支援</p>	<p>-現在の現状把握と計画策定のためのデータは、ダッカやチッタゴンなどの大都市のドナーの支援を得て蓄積されているが、シティコーポレーションやウパジラの現状把握には不十分である。</p> <p>-国家 3R 戦略策定</p> <p>-WB 支援によるプラスチック廃棄物管理のための行動計画を策定した</p>	<p>-現状把握のためのモニタリングシステムが不十分である。</p> <p>-廃棄物の発生、組成、収集、運輸、廃棄に関するデータはまだまとめていない。</p> <p>-将来の需要や目標値を反映した国家レベルの廃棄物管理計画はない。</p> <p>-プラスチック廃棄物管理の行動計画を実現するための実施体制を確立する必要がある。</p>	<p>-年次報告書策定支援のためのガイドライン作成</p> <p>-地方公共団体が提出する年次報告書の作成方法に関する助言</p> <p>-国レベルでの廃棄物管理計画策定の検討</p> <p>(関係援助国への支援)</p> <p>-WB:「プラスチック廃棄物管理行動計画」実施体制構築検討支援</p>	<p>-DoEには廃棄物管理担当者5名がおり、化学物質の輸出入の監視と並行して取り組んでいる。</p> <p>-DoEは廃棄物管理の規制機関である</p> <p>-実施機関は、地方自治体機関及び技術援助機関(LGD、DPHE、LGED)である。</p> <p>-SWM Ruleに基づき、省庁と地方自治体との第1回調整会合が開催された。</p>	<p>-DoEの廃棄物管理担当者不足。</p> <p>-DoEとLGD、LGED、DPHEの協力関係は弱い。</p>	<p>-本作業における省庁間調整会議の資料作成</p> <p>-関係省庁間の連携強化のための定期的な会合の実施</p> <p>(関係援助国への支援)</p> <p>-JICA「DNCC・DSCCにおける固形廃棄物管理技術協力プロジェクト」:LGDと関係機関との情報共有会議を実施。また、ダッカ市に対する広報・啓発活動、処分場支援、チョットグラム市における収集運搬システムの整備等を実施した。</p> <p>-JICA、WB、ADB等:廃棄物の収集・運搬・処理体制強化のための地方公共団体への支援</p> <p>-WB: BESTプロジェクトがDoEの組織体制強化を支援</p> <p>-GIZ: 国家化学DBの開発支援</p>

環境管理の対象	アドバイスの分野			環境管理の対象			アドバイスの分野		
	法制度			管理・技術力			DoEの実施体制/他省との関係		
	状況	課題	活動提案 (関連ドナー支援)	状況	課題	活動提案 (関連ドナー支援)	状況	課題	活動提案 (関連ドナー支援)
産業廃棄物処理	-排出者責任の原則と汚染者負担の原則に基づいて廃棄物管理を実施する必要があるという記載が ECA にある。	-排出者責任の原則と汚染者負担の原則に基づいて廃棄物管理を実施する必要があるとの記載があるが、具体的な規則はない。 -EPR 関連の法律やガイドラインは策定されていない。	-排出責任者のマニフェスト、汚染者の負担などの措置採用の検討 (関係援助国への支援) -WB は EPR ガイドラインを作成中である。	-産業廃棄物の管理・監視は責任を持っているが、発生源・排出量の監視はできない。	-効率的なモニタリングシステムを確立する必要がある。	-排出者からの情報収集、廃棄物の発生から処理までのモニタリングの手段として、マニフェスト制度の導入	-産業廃棄物の年間排出量や排出者・廃棄物の情報を把握することはできない。	-排出者から廃棄物までの産業廃棄物が適正に処理されているかどうかを監視するシステムが確立されていない。	-発生源から適正処理までのモニタリングシステムの確立
有害廃棄物	- 有害廃棄物(E-waste)管理規則(2021年) - 鉛蓄電池リサイクル・管理規則(2006年)	- 有害廃棄物をカバーするルールはない。	-	-電子廃棄物・鉛蓄電池については規定があるが、適正な処理・処分を行う設備はない	- 今後、有害廃棄物の処理・処分施設の整備が必要である。	-施設整備に係る戦略の検討	-有害廃棄物の管理・モニタリングを専門とする部署はなく、二重の任務を持つ部署で実施されている。	-有害廃棄物の管理・モニタリングを専門とする部署を整備する必要がある。	-地方公共団体のモニタリングシステムに関する指導の実施
電子廃棄物	- 有害廃棄物(E-waste)管理規則(2021年)	-	-	- 規則はあるが、適切な処理および処分のための施設は存在しない。	- 今後、有害廃棄物の処理・処分施設の整備が必要である。	- 施設整備に係る戦略の検討	-処理の実施体制は、E-wasteでは整備されていない。-	-実施体制を整備するには、他省庁や民間団体との連携が必要である。	-
医療廃棄物	医療廃棄物管理規則(2008年)	-	-	- 規則はあるが、適切な処分が行われる施設は少なく、感染性と非感染性の分離は不十分である。	- 病院を運営する MoHFW との協力体制を強化する必要がある。	-	-MoHFW は医療関連廃棄物を社内管理し、LGD、CC の LGED とその上位組織が管理している。	-LGD、LGED と連携し、医療廃棄物管理を強化する必要がある	(関係援助国への支援) JICA:技術協力プロジェクトは、チョットグラム市が医療廃棄物管理の最適化に寄与する。

出典：JICA 専門家チーム

5. 今後の提言

5.1 プロジェクト上位目標達成に向けた提言

プロジェクト上位目標は、「 Bangladesh 国における環境管理能力強化が図られる」である。本上位目標の達成に向けて、現在は以下の点に留意する必要があると考えられる。

(1) 科学的根拠に基づいた環境管理の実施体制の強化・継続

本技術協力を実施した期間は、水質汚濁対策、廃棄物管理の双方で科学的根拠に基づいた環境管理を行うために必要な法制度の強化が図られた期間であった。

- 水質汚濁対策： ECR の改訂によるモニタリング・汚染監視項目の追加
- 廃棄物管理： SWM Rule の施行による廃棄物発生量・管理体制のモニタリングの義務化

本プロジェクトを通し、 JICA 専門家チームは信頼性のあるモニタリングデータによる科学的根拠に基づいた管理計画策定の重要性について意見交換を行ってきた。 DoE が信頼性のあるモニタリングデータの確保の重要性をより認識することにより、上位目標の達成に向けた道筋が開くと考えられる。

(2) DoE と関連機関の業務分掌を念頭においた連携の強化

Bangladesh 国における環境管理強化を実現するためには、地方機関を含めたステークホルダーをリードする国家戦略が示され、明確に共有されることが必要である。そのため、 DoE と環境管理に関係する各機関は、必要な活動の線引きや情報及び経験の共有のため、密接に協力する必要がある。

ダッカ市やチョットグラム市及びその周辺の地方自治体は、既に環境管理に係る活動を開始している。それらの自治体は、 Bangladesh 国の環境管理に係るフロントランナーであり、経験を他の地方機関と共有する事が期待される。 DoE は、各地方機関が実施・計画している Bangladesh 国での先進的な経験について情報収集し、それらを共有する機会を提供することが期待される。

5.1.2 水質管理

(1) 今後導入される設備・機器の有効活用によるモニタリング体制の強化

WB の BEST プロジェクトが本年から開始されている。同プロジェクトでは新規環境分析ラボの整備や既存の分析ラボへの分析機器の調達等、 DoE の環境モニタリング体制の強化に係り特に施設・機器面での支援が予定されている。また、これに合わせ、 DoE は新規職員の雇用に注力する予定である。モニタリング体制の強化は施設・機器の整備とそれらを運用する人材・組織の能力の確保が一体となって実現する。予定される設備・機器を有効活用するための継続的な技術研修の計画・実施や環境分析ラボの分析品質を担保する分析ラボ認証の取得といった活動を行っていく必要がある。

5.1.3 廃棄物管理分野

(1) SWM Rule の実施体制の確立

SWM Rule が制定され、地方自治体が策定した廃棄物管理計画の確認、年次報告書の確認及び取りまとめなどの業務が必要となり、ガイドライン策定や担当者等の実施体制の確立が必要となる。2023 年は同活動の開始年であるが、現状、報告書の提出状況は十分ではない。DoE による地方自治体への継続的な働きかけ、年次報告書を作成するためのモニタリング体制が構築されていない自治体の洗い出し、ダッカ市等フロントランナーとなり得る自治体の経験を活用した地方自治体への年次報告書・廃棄物管理計画策定に係る指導・助言能力の強化を図っていく必要がある。

(2) 産業廃棄物のモニタリング体制の確立

有害廃棄物を含んだ産業廃棄物の排出源から処理・処分までのモニタリング体制の確立が必要である。専門家チームとしては、日本のマニフェストシステムを参照し、バングラデシュ版に改訂して体制確立をすることを提案する。マニフェストシステムの導入に際しては、日本でもその制度運用開始から産業廃棄物全般への適用まで 8 年程度を有していることから、段階的な導入計画の検討が必要となる。また、関連他省庁や民間事業者との連携が必要となることから、2.2.3 に記載したような National Coordination Committee 内で設置される個別のワーキンググループを通じた協議や、民間事業者との会議の実施により、制度の構築・運用に向けた関係者の合意形成を図っていく必要がある。

(3) 人員の増加と組織改革

他のセクターでもいえることではあるが、特に廃棄物セクターは、SWM Rule が整備され、実施に向けた人員の増強と人材の育成が喫緊の課題である。人員の増強には時間がかかることであるが、DoE 職員、特に地方職員に対する能力開発のプログラムを組んで、トレーニングを受けることで、新規人材が確保された段階で Training of Trainer (TOT)等によるトレーニングが必要となる。

(4) 他省庁との密な連携

廃棄物管理の法整備、制度設計においては、関連する他省庁と連携し、計画策定、実施を行っていくことが重要となる。National Coordination Committee の機能をうまく活用し、個別に担当省庁と打ち合わせを行って、制度整備ができる体制になることが望ましい。そのためには DoE が、地方自治体が提出する年次報告書等から得られる情報から廃棄物の発生・管理状況を把握し、National Coordination Committee に適切な助言を行える能力を強化していく必要がある。

添付資料：技術協力成果品
(ワークショップ資料、助言関連資料)

添付資料目次

添付資料 1 : 水質汚濁対策_第 1 回ワークショップ資料

添付資料 2 : 水質汚濁対策_第 2 回ワークショップ資料

添付資料 3 : 廃棄物管理_第 1 回ワークショップ資料

添付資料 4 : 廃棄物管理_第 2 回ワークショップ資料

添付資料 5 : 最終セミナー資料

添付資料 6 : 廃棄物管理に関する国家調整委員会へ向けた
ワーキングペーパー

添付資料 7 : チャットグラム DoE 環境分析ラボラトリ
認証取得支援報告書

添付資料 1

水質汚濁対策

第 1 回ワークショップ資料

Agenda of Interactive Training Workshop on Water Pollution Control in “Advisor on Environmental Management in Bangladesh”

1. Background

DoE conducts water pollution control activities such as issuing license for operation of ETP, ETP performance evaluation and monitoring etc. For enhancing the effectiveness of such activities, it is required to identify the actions to be done considering priority issues to be addressed. In this interactive training WS, information on the Japanese water pollution control system and basic information on ETP with viewpoints to be checked for confirming their proper operation will be provided, and have a discussion for identifying priority issues and required future actions.

2. Objectives

The main objectives of the meeting are as follows;

- (1) To review Bangladesh water pollution control legislative systems with introduction of Japanese legislative systems and examine actions to be adopted, and
- (2) To identify priority issues on ETP inspection and monitoring with introduction of basic information on wastewater treatment system.

3. Participants

(1) Bangladesh Side

DOE (Natural Resource Management Wing), DOE (Monitoring & Enforcement wing), DoE (Environmental Clearance Wing), DoE (Waste & Chemical Management wing), DOE (Dhaka Metropolitan), DOE (Dhaka District), DOE (Chattogram Metropolitan), DOE (Chattogram district), Narayanganj DOE, Gazipur DOE, Munshiganj DOE, Narsingdi DOE, Manikganj DoE, Tangail DOE.

Note: This will be basic training in the Wastewater Treatment Process as well as the legal systems of Bangladesh and Japan. As a result, Deputy Directors, Assistant Directors, and Inspectors involved in inspection and water pollution control are expected to attend.

(2) Japanese Side

JICA Bangladesh Office

1. Shin Murakami, Representative at JICA Bangladesh Office
2. Abdullah Hossain Bin Shawon, Senior Program Officer, JICA Bangladesh Office

JICA Expert Team

1. Kengo Naganuma, Team Leader
2. Shinji Tanaka, Water Pollution Control Expert (International)
3. ABM Sadiqur Rahman, Water Pollution Control Expert (National)
4. Md. AL Mussabbir Hossen, Junior Water Pollution Control Expert and Project Coordinator

**Schedule of Interactive Training Workshop on Water Pollution Control under
“Advisor on Environmental Management in Bangladesh” Project**

Time: 9:30 am

Date: 1st February 2023

Venue: DoE head office (a hybrid of a face-to-face meeting in 2nd floor conference room of DoE and a remote meeting by Zoom)

Time	Content	Speaker	Time expected
9:30-10:00	Registration	-	-
10:00-10:05	Welcome Speech	Shin Murakami, Representative at JICA Bangladesh Office	5 min.
10:05-10:15	Project Brief	Kengo Naganuma, Team Leader, JICA Study Team (over Zoom)	10 min.
10:15-10:20	Speech of Special Guest	ADG, DoE	5 min.
10:20-10:25	Speech of Chief Guest	DG, DoE	5 min.
10:25-10:30	Coffee break		5 min
10:30-11:40	Session 1/ General concept of the wastewater treatment - Legal system of Bangladesh - Status of water quality of Bangladesh - General characteristics of water pollution and its mechanism - Discussion	Shinji Tanaka, Water Pollution Control Expert, JICA Expert Team Md. AKM Rafiqul Islam, Deputy Director, NRM Wing, DOE	60 min.
11:40-12:40	Session 2/ Basics of a wastewater treatment (ETP) technique 1 - Screen and physical treatment Note: The information provided is basically basic information of the wastewater treatment process - Discussion	Shinji Tanaka, Water Pollution Control Expert, JICA Expert Team	60 min.
12:40-13:40	Lunch		60 min.
13:40-14:40	Session 3/ Basics of a wastewater treatment (ETP) technique 2 - Biological treatment Note: The information provided is basically basic information of the wastewater treatment process - Discussion	Shinji Tanaka, Water Pollution Control Expert, JICA Expert Team	60 min.
14:40-15:40	Session 4/ Comparison of Legislative System on Water Pollution Control between Bangladesh and Japan – Introduction of Notification System of Effluent Discharge Facilities - Comparison of the legal system on water pollution management - Discussion	Kengo Naganuma, Team Leader, JICA Expert Team & Shinji Tanaka, Water Pollution Control Expert, JICA Expert Team (Over Zoom)	60 min.
15:40-15:45	Speech of Chair of the Programme	Director, NRM, DoE	5 min.
15:45-16:00	Closing & Refreshment		15 min

End of document

**Advisor on Environment Management
in Bangladesh**

Training Workshop on Water Pollution Control

Session-1
General Concept of Wastewater Treatment

1st February 2023
JICA Expert Team

1

Program of Workshop

- Session 1 General Concept of Wastewater Treatment
- Session 2 Basics of Wastewater Treatment (ETP) Technique 1
Coagulation/ Flocculation / Settling (Physicochemical Treatment)
- Session 3 Basics of Wastewater Treatment (ETP) Technique 2
Biological Treatment
- Session 4 Comparison of Legislative System on Water Pollution
Control between Bangladesh and Japan

2

General Water Pollution Mechanism

3

What is Water Pollution?

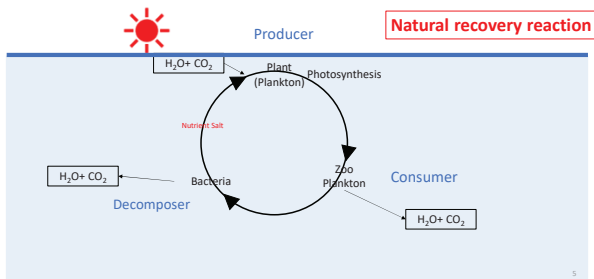
- Water pollution is the discharge of **toxic substances** and **organic matter** into rivers, lakes, ponds, oceans, etc. due to human activities and industrial development.
- Sources include domestic wastewater, industrial wastewater, agricultural/pastoral wastewater.

The toxic substances will affect the health and safety of human or other lives directly.

Pollution by organic matter such as food and animal and plant carcass.
If the amount of organic matter flowing into the water is large, the pollution will progress rapidly, and the organic matter that cannot be fully decomposed will accumulate as sludge. Since oxygen is consumed when organic matter is decomposed, it will result in anoxic conditions due to the loss of oxygen in the water.

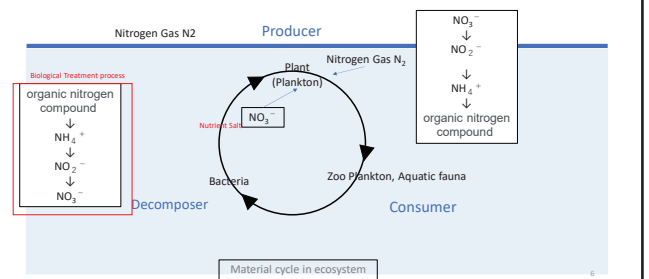
4

Material Cycle and Biological Action

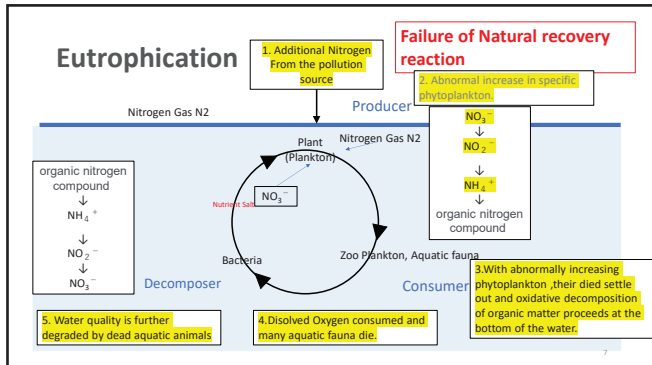


5

Nitrogen Cycle



6



7

What is the source of pollution?

- The main sources of water pollution are considered as below.

Category	Detailed sector
Multiple effluent in urban area	Domestic wastewater form Households, Commercials, Hotels, Schools, Hospitals and Restaurants
Industrial effluent	Industrial park, Factories, Power plants
Agricultural wastewater	Irrigation farmland, Poultry farm, Livestock farm
Others	Ship transportation, Dumping site, Construction site

8

What is the source of pollution?

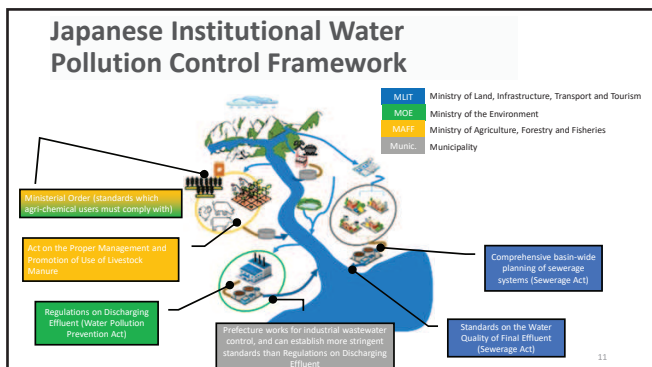
- The main sources of water pollution are considered as below.

Category	Detailed sector	Major pollutant
Multiple effluent in urban area	Domestic wastewater form Households, Commercials, Hotels, Schools, Hospitals and Restaurants	Organic matter (OC, N, P)
Industrial effluent	Industrial park, Factories, Power plants	Heavy metals, Acidic /alkaline effluent, Organic matter, Oils
Agricultural wastewater	Irrigation farmland, Poultry farm, Livestock farm	Organic matter (OC, N, P)
Others	Ship transportation, Dumping site, Construction site	Heavy metals, Acidic /alkaline effluent, Organic matter, Oils

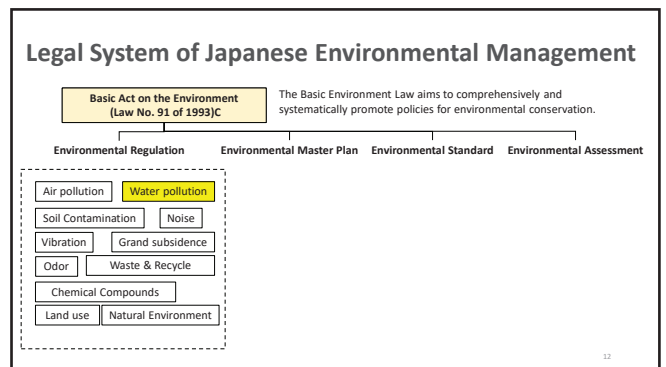
9

Industrial Pollution Control Administrative Measures – Japanese example -

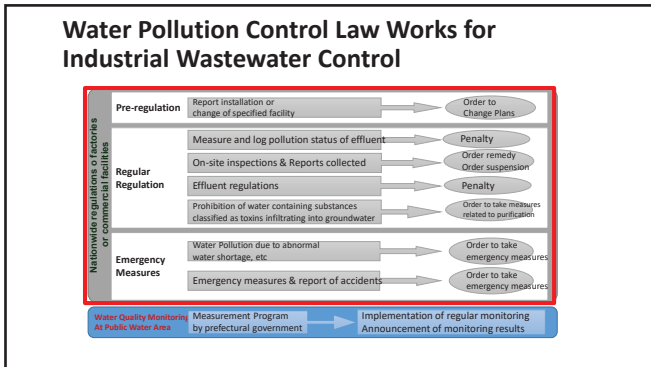
10



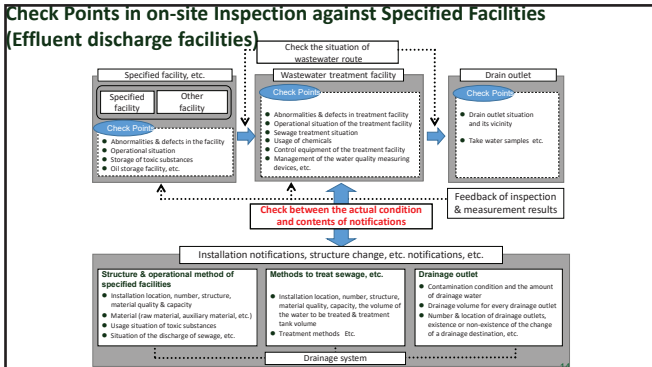
11



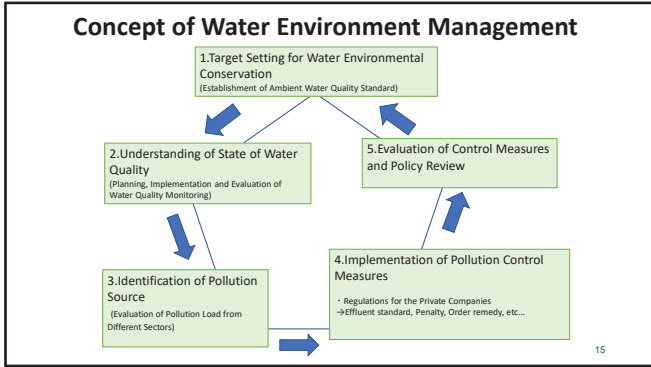
12



13



14



15

Points of Discussion

- 1. Major water pollution source in Bangladesh**
Do you think which discharge sources are affecting the water environment?
- 2. Current legislative system for water quality conservation**
Are there any problems with the current water conservation legislative system in Bangladesh?
If the issue is existing in the system, what is the that?
- 3. Wastewater discharge sources to be targeted (factory only or other pollution sources to be controlled seriously?)**

16

**Advisor on Environment Management
in Bangladesh**

Training Workshop on Water Pollution Control

Session-2

Basics of a Wastewater Treatment (ETP) Technique 1
Coagulation/ Flocculation / Settling (Physicochemical Treatment)

1st February 2023
JICA Expert Team

1

Basics of a Wastewater Treatment (ETP) Technique

- In general, there are many kind of technology for wastewater treatment. However, it is possible to categorized into two major groups; the first is Physico-Chemical treatment and other is biological treatment.
- These two processing methods are usually used in combination.

2

Physicochemical Treatment Processes

Physicochemical Treatment
Physicochemical treatment involves a set of processes which may be consecutively performed by coagulation, flocculation and sedimentation.

The coagulation, flocculation and sedimentation process is used when the particle size of suspended solids is small, and the natural sedimentation requires a long time.

Coagulation
Generally, the surface of fine particles floating in water is negative charged . When a chemical with the opposite charge is added to this to neutralize the charge of the target particles, the attractive force between the particles exceeds the repulsive force due to surface charge.

3

Physicochemical Treatment Processes

Physicochemical Treatment
Physicochemical treatment involves a set of processes which may be consecutively performed by coagulation, flocculation and sedimentation.

Flocculation

4

Physicochemical Treatment Processes

<https://youtu.be/hp97IGbrlOI>

5

Physicochemical Treatment Processes

Sedimentation

The rising speed V [m/d] of wastewater is expressed by the following equation.

$$V = Q/A \quad \dots \dots \text{Equation (1)}$$

$$Q: \text{Inflow of sewage [m}^3/\text{d]}, A: \text{Area of settling basin [m}^2]$$

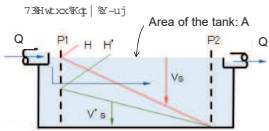
In the design of the settling tank, the area A of the settling tank is set so that $V_s > V$. V_s is the sedimentation velocity . The required area A of the settling tank with the inflow rate Q and the settling velocity V_s of the particles is $A > Q/V_s$ from Eq.(1).

6

Physicochemical Treatment Processes

Sedimentation

Xjim jayfyt...
tkuwj (stzx xyfl jxkldnt fl zqfyt s fesi wq hhzdfyts...)



If the sedimentation velocity is V_s (m/d), the water depth H (m) at which the particles settle is expressed by the following equation.
 $H_s = V_s \times T$ (T: Retention Time)
 On the other hand, when the inflow rate Q (m³/d) of sewage flows into a settling tank having a depth H (m) and an area A (m²), the relationship with the retention time T is shown by the following equation.
 $T = A \times H / Q \rightarrow H = Q \times T / A$
 If $H_s > H$, the particles settle to the bottom before the wastewater flows out, so the following equation holds.
 $V_s \times T > Q \times T / A \rightarrow V_s > Q / A$ (= V) Equation (2)

For example, when the inflow rate is 10,000 m³/day and the sedimentation velocity of particles is 15 mm/min, the required area of the settling tank is as follows.
 $A > Q [m^3/d] / V_s [mm/min] / 60 [min/hr] / 24 [hr/d] \times 1,000 [mm/m] = 10,000 / 15 / 60 / 24 \times 1,000 = 463 \text{ m}^2$

7

Physicochemical Treatment Processes

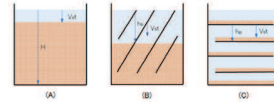
Sedimentation

Xjim jayfyt...
tkuwj (stzx xyfl jxkldnt fl zqfyt s fesi wq hhzdfyts...)

Efficiency with inclined plates

Previous discussions have shown that increasing the surface area A of the settling tank increases the efficiency of the settling process.

If the area of the facility is limited, the effective separation area can be increased by implementing multiple plate in the settling tank.



(A) Ordinary settling tank, (B) Settling tank with parallel inclined plates, (C) Settling tank with parallel horizontal plates

8

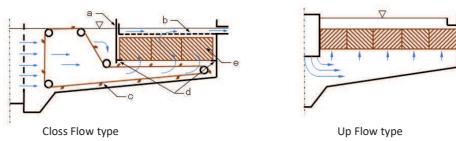
Physicochemical Treatment Processes

Sedimentation

Xjim jayfyt...
tkuwj (stzx xyfl jxkldnt fl zqfyt s fesi wq hhzdfyts...)

Efficiency with inclined plates

I j u j s i n e l e a b m j k c j y g e l k a t e s i q u j z m j w j f e j k i d j w j e y a u j k i d m j k e b a g e j i k u f y j z



9

Points of Discussion

1. Have you observed sedimentation facility?
2. How about sedimentation facility operation condition in Bangladesh?
3. Let us discuss on how to check the necessary capacity of sedimentation facility at the site.
4. Which points should be focus on checking operation condition of sedimentation facilities?

10

**Advisor on Environment Management
in Bangladesh**

Training Workshop on Water Pollution Control

Session-3

Basics of Wastewater Treatment (ETP) Technique 2

Biological Treatment

1st February 2023

JICA Expert Team

1

Biological Treatment

It is divided into **aerobic biological** treatment using microorganisms that require oxygen for the decomposition of organic matters and the growth, and **anaerobic biological** treatment using microorganisms that do not require oxygen.

In addition, it is divided into a **suspended type** treatment method in which the applied microorganisms are maintained in a suspended state in water in the biological reaction tank, and a **biofilm type** treatment method in which the microorganisms are adhered in a medium.

Types of the microorganism	Bacterial growth condition	Living type	Applied Treatment system
Aerobic Microorganism	Aerobic condition	Suspended (Free floating)	Conventional Activated Sludge Method
		Biofilm (Adherence)	Trickling filter
Anaerobic Microorganism	Anaerobic or Facultative anaerobic	Suspended	Up-flow Anaerobic Sludge Blanket(UASB)
		Biofilm	Anaerobic filter(Anaerobic digestion)

2

Activated Sludge Method (1)

The **activated sludge method** which is widely used for treating sewage and industrial wastewater. Wastewater from which contains large solid such as sand and is sent to the **first settling basin**, where solid substances and oils are removed. Then wastewater is sent into a biological reaction tank (**aeration tank**) and contacted with microbial flocs (activated sludge) under aeration and stirring (**Hydraulic retention time (HRT)** is 4 to 24 hours). The organic matter in wastewater is decomposed by activated sludge. The activated sludge mixture is separated into activated sludge and treated water by gravity settling (settling time 2 to 3 hours) in the next final settling tank. Then treated water is chlorinated and discharged.

The activated sludge treatment removes 95% or more of BOD from wastewater.

3

Activated Sludge Method (2)

In general, aerobic biological treatment can decomposes efficiently with highly concentrated sewage by microorganisms which are increased in the blowing air into the sewage. The activated sludge method is a typical example of aerobic treatment.

4

Nitrogen Cycle

Material cycle in ecosystem

5

Hydraulic Retention Time (HRT)

HRT is called the hydraulic retention time, which indicates the average time [h] that the inflow water stays in the treatment tank. HRT is an important item in facility design.

$$HRT(hr) = \frac{\text{Total Volume of the reaction tank}(m^3)}{\text{Flow Rate of Effluent}(m^3/hr)}$$

$$HRT(hr) = \frac{\text{Total Volume of the reaction tank}(m^3)}{\text{Flow Rate of Effluent}(m^3/day)} \times 24$$

Example

If the daily effluent volume is 1,000m³/day, and the capacity of the aeration tank is 900m³. Then the HRT is calculated as below.

$$HRT = \text{Volume of the reaction tank}(m^3) / \text{Flow Rate of Effluent}(m^3/day) \times 24 = 900 / 1,000 \times 24 = 21.6 \text{ hr}$$

6

Volumetric BOD Loading or Volumetric Organic Loading

The amount of organic matter (BOD equivalent) that flows into the aeration tank is an empirical parameter of the treatment tank. The **volumetric BOD loading** is as the BOD applied per unit volume of aeration tank, per day. If the S is BOD concentration of the effluent in mg/L, Q is effluent flowrate in m^3/day , and V is volume of aeration tank in m^3 then,

$$\text{Volumetric BOD loading in mg/L per day} = Q \times 10^3 \times S / (V \times 10^3) = Q \times S / V.$$

This parameter is used for the estimation of the required volume of aeration tank.

On conventional activated sludge process, the normal value of **volumetric BOD loading** shows 500 to 1,500 mg/L/day .

Example -1

The daily effluent volume is $1,000 \text{ m}^3/\text{day}$, and its average BOD concentration is 400 mg/L .

If the volumetric BOD loading = $600(\text{mg/L/day})$ as the conventional activated sludge, then the required aeration tank volume is calculated as below.

$$V = Q \times S / \text{volumetric BOD loading} = 1,000 \times 400 / 600 = 667 \text{ m}^3$$

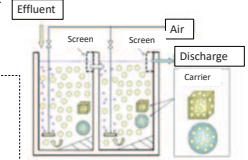
7

Moving Bed Biofilm Reactor (MBBR)

The MBBR system consists of an aeration tank with special plastic carriers that provide a surface where a biofilm can grow. The carriers are made of a material with a density close to the density of water (1 g/cm^3). Organic matter in the wastewater is removed by forming a biofilm on the surface of carriers. The reaction bed is equipped with a screen designed to prevent the carriers from flowing out, and the carriers continue to circulate in the reaction tank.

This method can increase the **volumetric BOD loading** around 2,000 to 3,000. The features of the MBBR are as follows

- (1) The return sludge is not required and the amount of sludge is small.
- (2) The filling ratio should be 50-70% because dense carrier may cause blockage.
- (3) High BOD load can be taken, so the aeration tank is small.



Example -2

Moving Bed Biofilm Reactor (MBBR) system has the high **volumetric BOD loading** in general. If the value is $2,000 \text{ mg/m}^3/\text{day}$, then the required capacity of the aeration tank is calculated as below.

$$V = Q \times S / \text{volumetric BOD loading} = 1,000 \times 400 / 2,000 = 200 \text{ m}^3$$

8

Moving Bed Biofilm Reactor (MBBR)



<https://www.youtube.com/watch?v=hNUdq50QBGM>

9

Points of Discussion

1. Have you observed any aerobic biological treatment facilities?
2. What types of technology was used by the observed treatment facilities?
3. Let us discuss on how to check/ confirm the capacity of the bioreactor tank.
4. Which points should be focus on checking operation of biological treatment facilities?

10

**Advisor on Environment Management
in Bangladesh**

Training Workshop on Water Pollution Control

Session-4

**Comparison of Legislative System on Water Pollution Control
between Bangladesh and Japan – Introduction of Notification System
of Effluent Discharge Facilities**

1st February 2023

JICA Expert Team

1

**Introduction of Japanese Water Pollution Control System and
Comparing with Bangladesh Legislative System**

On technical session-4, we will introduce the legal system of water pollution control in Japan as a reference. You can compare the legal and implementing system of both countries.

Japan has the different system from Bangladesh on water pollution management. The legal system of Japan had been developed through the experience of highly polluted history in past Japan. After the enforcement of this legal system, the water quality has been improved drastically in Japan.




Water pollution condition at Kitakyusyu in 1960s
Current condition

2

**Water Pollution Prevention Act
(Act No. 138 of 1970)**

The purpose of this Act is to prevent the pollution of water in the Designated Areas of Public Waters and in groundwater by regulating effluent discharged by factories and workplaces into the Designated Areas of Public Waters.

This Act is a specific law for water pollution control, different from the general regulations of ECC or EIA system in Bangladesh.

Water Pollution Prevention Act (Act No. 138 of 1970)

Chapter 1 General Provisions

Chapter 2-1 Regulations on Discharging Effluent

Chapter 2-2 Promotion of Domestic Wastewater Measures

Chapter 3 Monitoring the Status of Water Pollution

Chapter 4 Compensation for Loss or Damage

Chapter V Miscellaneous Provisions

Chapter VI Penal Provisions

3

Notification System of Effluent Generators as “Specified Facilities” by Water Pollution Prevention Act of Japan

Chapter 2-1 Regulations on Discharging Effluent

Article 5

A person that discharges effluent from factories or workplaces into Designated Areas of public waters must, when intending to install a “Specified Facility”, as provided for by order of the Ministry of the Environment, submit a report on the following to local (prefectural) governors.

(i) name and address of the person, as well as the name of the representative if the person is a corporation;

(ii) name and location of factories or workplaces;

(iii) type of Specified Facilities;

(iv) structure and construction of the Specified Facility;

(v) equipment of the Specified Facility;

(vi) use of the Specified Facility;

(vii) means of Treatment of Polluted Water, etc.;

(viii) the level of pollution and quantity of the Effluent;

(ix) other particulars specified by Order of the Ministry of the Environment

4

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (1)

Item	Bangladesh	Japan
Law	The Environmental Conservation Rules 1997	Water Pollution Prevention Act (Act No. 138 of 1970)
Enforcement agency	Department of Environment (DoE)	Local government
Target facility	Orange-B, Red categorized facilities	<ul style="list-style-type: none"> The facilities discharging effluent equal or more than 50m³/day Not only the industrial facility but all facilities discharging effluent

5

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (2)

Item	Bangladesh	Japan
Frequency of issuing monitoring report	Once a year	Once a year (COD, N, P in specific area: every day to once a month depend on the quantity)
Manager of ETP	Not mandatory	Need to be dispatched licensed person
Certificate for analytical laboratory	Not mandatory	Mandatory (Need to be analyzed by certificated laboratory)

6

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (3)

Item	Bangladesh	Japan
Required period of monitoring data storing	Not mandatory	3 years
Necessary action in case of accidental case (e.g., Spilling of harmful effluent)	Not mentioned in ECR	<ul style="list-style-type: none"> • Need to take necessary measures immediately • Need to report status of accident and measure taken to provincial governor

7

The points for the discussion

1. What is the major difference between the legal system of both countries? And is there any Japanese measure which can be referenced for Bangladesh?
2. How do you manage all the effluent discharge by DoE in feature? (Is it possible to increase the number of DoE officers to manage all the effluent generators by DoE?)
3. Do you have any idea on future industrial wastewater control in Bangladesh?

8

添付資料 2

水質汚濁対策

第 2 回ワークショップ資料

**Agenda of 2nd Interactive Training Workshop on WPC in
“Advisor on Environmental Management in Bangladesh”**

Time: 9:30 am

Date: 9th of July 2023

Venue: DoE head office (a hybrid of a face-to-face meeting in the 2nd-floor auditorium room of DoE and a remote meeting by Zoom)

1. Background

Through the 1st workshop and interviews to the DoE officials, JICA Expert Team (JET) team identifies the current issues on water pollution control and management in Bangladesh. Based on that, JET holds a training session on the basics of the ETP for the junior level staffs of the DoE. On continuation of that JET would like to continue the discussion sessions with the senior officials related to the identified issues and possible upcoming assistance for the DoE. Considering that JET requests the DoE to hold a 2nd Workshop to discuss the issues and its solutions for the next activities should be taken by DoE.

2. Objectives

- I. Through the discussion in the Workshop, DoE officials know the issues pointed out by foreign advisors and they can show their own opinion for those issues.
- II. If the issues which identified by JET are acceptable for DoE officials, they should discuss the solutions for that for the next action-plan should be taken by DoE.

3. Draft Agenda of the Training Program

Time	Content	Speaker	Time expected
9.30 – 10:00	Registration		15 min
10:00 – 10:05	Welcome speech	JICA Representative, JICA Bangladesh Office	5 min.
10:05 – 10:10	Welcome speech	Director, NRM of DoE	5 min.
10:10 – 10:15	Inaugural Speech	1 st preference: Add. Sec., Development Wing 2 nd Preference: DG	5 min.
10:15 – 10:25	Summary of Previous Training Workshop and Purpose of Training Workshop	Shinji Tanaka, Water Pollution Control Expert JICA Advisory Team	10 min.
10.25 – 10:45	Snacks Break		20 min
10:45 - 11:05	Summary of the identified issues by JET	Kengo Naganuma, Chief Advisor, JICA Expert Team	20 min.

Time	Content	Speaker	Time expected
11:05 - 11:25	Introduction of the training system of junior officials in DoE	Mr. Md. Mohiuddin Manik, DD, Coordination, DOE	20 min.
11:25 - 11:45	Discussion of the Issues on Technical Capacity of DoE Officials	Shinji Tanaka, Water Pollution Control Expert, JICA Expert Team	20 min.
11:05 - 11:25	Introduction of the environmental pollution control and monitoring system in Japan (by JET)	Shinji Tanaka, Water Pollution Control Expert, JICA Expert Team	20 min.
11:25 - 11:45	Presentation on the new proposals based on the identified issues (by JET)	Kengo Naganuma, Chief Advisor, JICA Expert Team	20 min.
11:45 - 12:15	Open discussion on the new proposals (by JET and DoE)	JET and DoE	30 min.
12:15 - 12:30	Proposal for further assistance from international donor	Mr. Md. Hasan Habibur Rahman, DD, Planning, DoE	15 min.
12:30 - 12:40	Comments from JICA Representative	JICA Representative, JICA Head Quarter	10 min.
12:40 - 12:55	Comments on Chief Guest	1 st preference: DG 2 nd Preference: Add. Sec., Development Wing	15 min.
12:55 - 13:00	Closing Remarks	Project Focal Person	10 min.
13:00 - 14:00	Lunch	All participants	

4. Participants

I. Bangladesh Side

The tentatively expected participants are described in Attachment-1.

II. Japanese Side

JICA Senior Advisor, JICA Expert Team, JICA Bangladesh Office, JET

Attachment-1

Expected Participants:

Main Target participant

DOE (Natural Resource Management Wing)- 5, DOE (Waste & Chemical Management wing)- 2, DOE (Monitoring & Enforcement wing)-2, DoE (Planning Wing)- 2, DoE (Climate Change and International Convention Wing) - 2, DoE (Environmental Clearance Wing) – 3,

DOE (Dhaka Metropolitan)-2, DoE (Dhaka Laboratory) – 2, DoE (Dhaka Region) – 2, DOE (Dhaka District)-1, DOE (Chattogram Metropolitan)-2, DOE (Chattogram district)-1, Narayanganj DOE - 1, Gazipur DOE -1, Munshigonj DOE - 1, Narshindi DOE 1, Manikganj DOE 1, Tangail DOE 1.

**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Water Pollution Control

Summary of Previous Training Workshop
and Purpose of Training Workshop

9th July 2023

JICA Expert Team

1

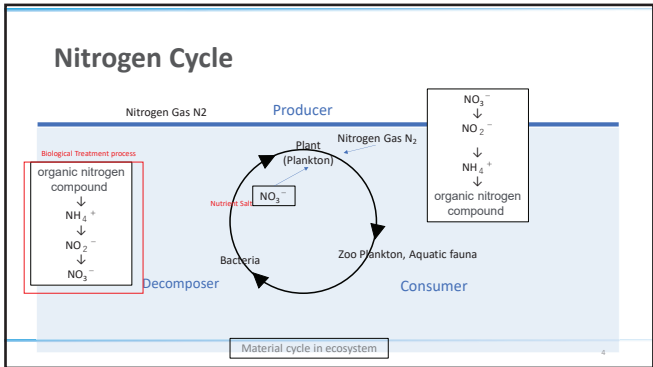
Program of Workshop

- Session 1 General Concept of Wastewater Treatment
- Session 2 Basics of Wastewater Treatment (ETP) Technique 1
Coagulation/ Flocculation / Settling (Physicochemical Treatment)
- Session 3 Basics of Wastewater Treatment (ETP) Technique 2
Biological Treatment
- Session 4 Comparison of Legislative System on Water Pollution
Control between Bangladesh and Japan

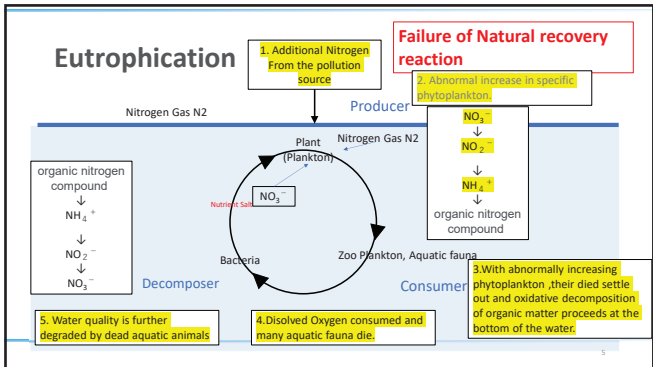
2

Session-1
General Concept of Wastewater Treatment

3



4



5

What is the source of pollution?

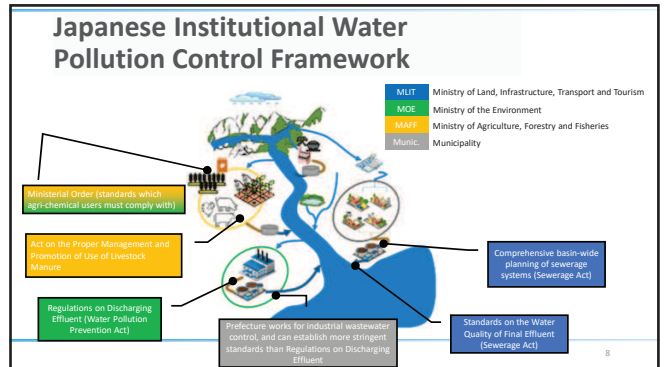
• The main sources of water pollution are considered as below.

Category	Detailed sector	Major pollutant
Multiple effluent in urban area	Domestic wastewater from Households, Commercials, Hotels, Schools, Hospitals and Restaurants	Organic matter (OC, N, P)
Industrial effluent	Industrial park, Factories, Power plants	Heavy metals, Acidic /alkaline effluent, Organic matter, Oils
Agricultural wastewater	Irrigation farmland, Poultry farm, Livestock farm	Organic matter (OC, N, P)
Others	Ship transportation, Dumping site, Construction site	Heavy metals, Acidic /alkaline effluent, Organic matter, Oils

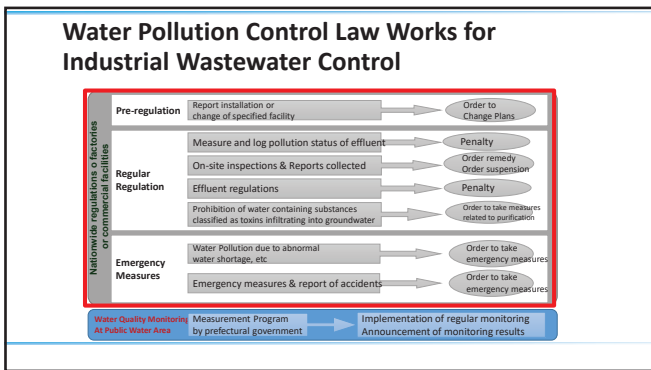
6

Industrial Pollution Control Administrative Measures – Japanese example -

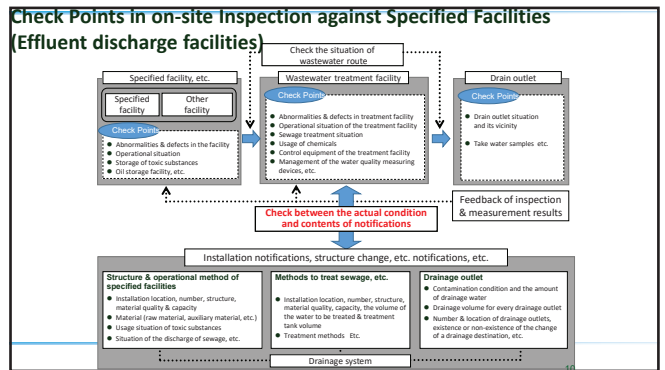
7



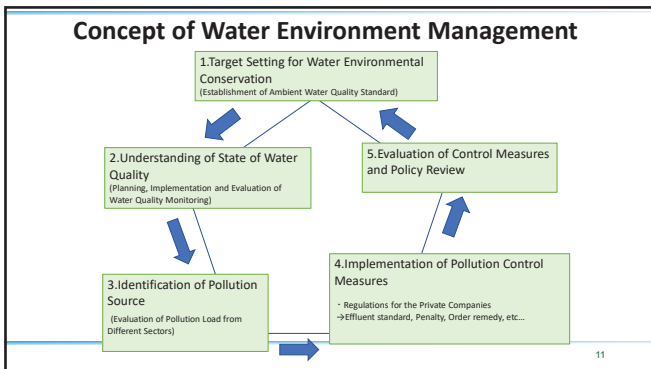
8



9



10



11

Points of Discussion

- Major water pollution source in Bangladesh
Do you think which discharge sources are affecting the water environment?
- Current legislative system for water quality conservation
Are there any problems with the current water conservation legislative system in Bangladesh?
If the issue is existing in the system, what is the that?
- Wastewater discharge sources to be targeted (factory only or other pollution sources to be controlled seriously?)

12

Session-2
Basics of a Wastewater Treatment (ETP) Technique 1
Coagulation/ Flocculation / Settling (Physicochemical Treatment)

13

Basics of a Wastewater Treatment (ETP) Technique

- In general, there are many kind of technology for wastewater treatment. However, it is possible to categorized into two major groups; the first is Physico-Chemical treatment and other is biological treatment.
- These two processing methods are usually used in combination.

14

Physicochemical Treatment Processes

Physicochemical Treatment
 Physicochemical treatment involves a set of processes which may be consecutively performed by coagulation, flocculation and sedimentation.

The coagulation, flocculation and sedimentation process is used when the particle size of suspended solids is small, and the natural sedimentation requires a long time.

Coagulation
 Generally, the surface of fine particles floating in water is negative charged . When a chemical with the opposite charge is added to this to neutralize the charge of the target particles, the attractive force between the particles exceeds the repulsive force due to surface charge.

15

Physicochemical Treatment Processes

Physicochemical Treatment
 Physicochemical treatment involves a set of processes which may be consecutively performed by coagulation, flocculation and sedimentation.

Flocculation

16

Physicochemical Treatment Processes

Sedimentation

The rising speed V [m/d] of wastewater is expressed by the following equation.
 $V = Q/A$ Equation (1)
 Q : Inflow of sewage [m³/d], A : Area of settling basin [m²]

In the design of the settling tank, the area A of the settling tank is set so that $V_s > V$. V_s is the sedimentation velocity . The required area A of the settling tank with the inflow rate Q and the settling velocity V_s of the particles is $A > Q/V_s$ from Eq.(1).

17

Physicochemical Treatment Processes

Sedimentation

If the sedimentation velocity is V_s [m/d], the water depth H [m] at which the particles settle is expressed by the following equation.
 $H_s = V_s \times T$ (T: Retention Time)
 On the other hand, when the inflow rate Q [m³/d] of sewage flows into a settling tank having a depth H [m] and an area A [m²], the relationship with the retention time T is shown by the following equation.
 $T = A \times H / Q \rightarrow H = Q \times T / A$
 If $H_s > H$, the particles settle to the bottom before the wastewater flows out, so the following equation holds.
 $V_s \times T > Q \times T / A \rightarrow V_s > Q / A$ (= V) Equation (2)

For example, when the inflow rate is 10,000 m³/day and the sedimentation velocity of particles is 15 mm/min, the required area of the settling tank is as follows.
 $A > Q$ [m³/d] / V_s [mm/min] / 60 [min/hr] / 24 [hr/d] × 1,000 [mm/m] = 10,000 / 15 / 60 / 24 × 1,000 = 463 m²

18

Physicochemical Treatment Processes

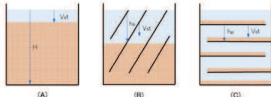
Sedimentation

Xjint jayfyt... (Bengali text)

Efficiency with inclined plates

Previous discussions have shown that increasing the surface area A of the settling tank increases the efficiency of the settling process.

If the area of the facility is limited, the effective separation area can be increased by implementing multiple plate in the settling tank.



(A) Ordinary settling tank, (B) Settling tank with parallel inclined plates, (C) Settling tank with parallel horizontal plates

19

19

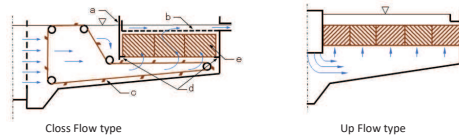
Physicochemical Treatment Processes

Sedimentation

Xjint jayfyt... (Bengali text)

Efficiency with inclined plates

I jujas... (Bengali text)



Cross Flow type

Up Flow type

20

20

Points of Discussion

1. Have you observed sedimentation facility?
2. How about sedimentation facility operation condition in Bangladesh?
3. Let us discuss on how to check the necessary capacity of sedimentation facility at the site.
4. Which points should be focus on checking operation condition of sedimentation facilities?

21

21

Session-3

Basics of Wastewater Treatment (ETP) Technique 2 Biological Treatment

22

Biological Treatment

It is divided into **aerobic biological** treatment using microorganisms that require oxygen for the decomposition of organic matters and the growth, and **anaerobic biological** treatment using microorganisms that do not require oxygen.

In addition, it is divided into a **suspended type** treatment method in which the applied microorganisms are maintained in a suspended state in water in the biological reaction tank, and a **biofilm type** treatment method in which the microorganisms are adhered in a medium.

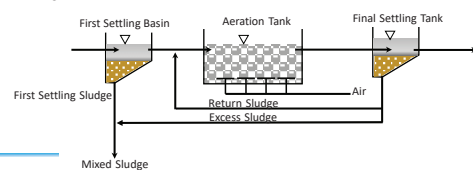
Types of the microorganism	Bacterial growth condition	Living type	Applied Treatment system
Aerobic Microorganism	Aerobic condition	Suspended (Free floating)	Conventional Activated Sludge Method
		Biofilm (Adherence)	Trickling filter
Anaerobic Microorganism	Anaerobic or Facultative anaerobic	Suspended	Up-flow Anaerobic Sludge Blanket(UASB)
		Biofilm	Anaerobic filter(Anaerobic digestion)

23

23

Activated Sludge Method (1)

The **activated sludge method** which is widely used for treating sewage and industrial wastewater. Wastewater from which contains large solid such as sand and is sent to the **first settling basin**, where solid substances and oils are removed. Then wastewater is sent into a biological reaction tank (**aeration tank**) and contacted with microbial flocs (activated sludge) under aeration and stirring (**Hydraulic retention time (HRT)** is 4 to 24 hours). The organic matter in wastewater is decomposed by activated sludge. The activated sludge mixture is separated into activated sludge and treated water by gravity settling (settling time 2 to 3 hours) in the next final settling tank. Then treated water is chlorinated and discharged. The activated sludge treatment removes 95% or more of BOD from wastewater.



24

24

Activated Sludge Method (2)

In general, aerobic biological treatment can decomposes efficiently with highly concentrated sewage by microorganisms which are increased in the blowing air into the sewage. The activated sludge method is a typical example of aerobic treatment.

Microorganisms: Carobacterium, Zooplankton

25

Nitrogen Cycle

Biological treatment: organic nitrogen compound → NH₄⁺ → NO₂⁻ → NO₃⁻

Material cycle in ecosystem: Nitrogen Gas N₂, Producer (Plant), Consumer (Zoo Plankton, Aquatic fauna), Decomposer (Bacteria)

26

Hydraulic Retention Time (HRT)

HRT is called the hydraulic retention time, which indicates the average time [h] that the inflow water stays in the treatment tank. HRT is an important item in facility design.

$$HRT(hr) = \frac{\text{Total Volume of the reaction tank}(m^3)}{\text{Flow Rate of Effluent}(m^3/hr)}$$

$$HRT(hr) = \frac{\text{Total Volume of the reaction tank}(m^3)}{\text{Flow Rate of Effluent}(m^3/day)} \times 24$$

Example

If the daily effluent volume is 1,000m³/day, and the capacity of the aeration tank is 900m³. Then the HRT is calculated as below.

$$HRT = \text{Volume of the reaction tank}(m^3) / \text{Flow Rate of Effluent}(m^3/day) \times 24 = 900 / 1,000 \times 24 = 21.6 \text{ hr}$$

27

Volumetric BOD Loading or Volumetric Organic Loading

The amount of organic matter (BOD equivalent) that flows into the aeration tank is an empirical parameter of the treatment tank. The **volumetric BOD loading** is as the BOD applied per unit volume of aeration tank, per day. If the S is BOD concentration of the effluent in mg/L, Q is effluent flowrate in m³/day, and V is volume of aeration tank in m³ then,

$$\text{Volumetric BOD loading in mg/L per day} = Q \times 10^3 \times S / (V \times 10^3) = Q \times S / V$$

This parameter is used for the estimation of the required volume of aeration tank.

On conventional activated sludge process, the normal value of **volumetric BOD loading** shows 500 to 1,500 mg/L/day.

Example -1

The daily effluent volume is 1,000 m³/day, and its average BOD concentration is 400 mg/L.

If the volumetric BOD loading is 600(mg/L/day) as the conventional activated sludge, then the required aeration tank volume is calculated as below.

$$V = Q \times S / \text{volumetric BOD loading} = 1,000 \times 400 / 600 = 667 \text{ m}^3$$

28

Moving Bed Biofilm Reactor (MBBR)

The MBBR system consists of an aeration tank with special plastic carriers that provide a surface where a biofilm can grow. The carriers are made of a material with a density close to the density of water (1 g/cm³). Organic matter in the wastewater is removed by forming a biofilm on the surface of carriers. The reaction bed is equipped with a screen designed to prevent the carriers from flowing out, and the carriers continue to circulate in the reaction tank.

This method can increase the **volumetric BOD loading** around 2,000 to 3,000. The features of the MBBR are as follows

- (1) The return sludge is not required and the amount of sludge is small.
- (2) The filling ratio should be 50-70% because dense carrier may cause blockage.
- (3) High BOD load can be taken, so the aeration tank is small.

Example -2

Moving Bed Biofilm Reactor (MBBR) system has the high **volumetric BOD loading** in general. If the value is 2,000 mg/m³/day, then the required capacity of the aeration tank is calculated as below.

$$V = Q \times S / \text{volumetric BOD loading} = 1,000 \times 400 / 2,000 = 200 \text{ m}^3$$

29

Points of Discussion

1. Have you observed any aerobic biological treatment facilities?
2. What types of technology was used by the observed treatment facilities?
3. Let us discuss on how to check/ confirm the capacity of the bioreactor tank.
4. Which points should be focus on checking operation of biological treatment facilities?

30

Session-4

Comparison of Legislative System on Water Pollution Control between Bangladesh and Japan – Introduction of Notification System of Effluent Discharge Facilities

31

Introduction of Japanese Water Pollution Control System and Comparing with Bangladesh Legislative System

On technical session-4, we will introduce the legal system of water pollution control in Japan as a reference. You can compare the legal and implementing system of both countries.

Japan has the different system from Bangladesh on water pollution management. The legal system of Japan had been developed through the experience of highly polluted history in past Japan. After the enforcement of this legal system, the water quality has been improved drastically in Japan.

Water pollution condition at Kitakyusyu in 1960s Current condition

32

Water Pollution Prevention Act (Act No. 138 of 1970)

The purpose of this Act is to prevent the pollution of water in the Designated Areas of Public Waters and in groundwater by regulating effluent discharged by factories and workplaces into the Designated Areas of Public Waters.

This Act is a specific law for water pollution control, different from the general regulations of ECC or EIA system in Bangladesh.

Water Pollution Prevention Act (Act No. 138 of 1970)
 Chapter 1 General Provisions
Chapter 2-1 Regulations on Discharging Effluent
 Chapter 2-2 Promotion of Domestic Wastewater Measures
 Chapter 3 Monitoring the Status of Water Pollution
 Chapter 4 Compensation for Loss or Damage
 Chapter V Miscellaneous Provisions
 Chapter VI Penal Provisions

33

Notification System of Effluent Generators as “Specified Facilities” by Water Pollution Prevention Act of Japan

Chapter 2-1 Regulations on Discharging Effluent

Article 5
 A person that discharges effluent from factories or workplaces into Designated Areas of public waters must, when intending to install a “Specified Facility”, as provided for by order of the Ministry of the Environment, submit a report on the following to local (prefectural) governors.

(i) name and address of the person, as well as the name of the representative if the person is a corporation;
 (ii) name and location of factories or workplaces;
 (iii) type of Specified Facilities;
 (iv) structure and construction of the Specified Facility;
 (v) equipment of the Specified Facility;
 (vi) use of the Specified Facility;
 (vii) means of Treatment of Polluted Water, etc.;
 (viii) the level of pollution and quantity of the Effluent;
 (ix) other particulars specified by Order of the Ministry of the Environment

34

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (1)

Item	Bangladesh	Japan
Law	The Environmental Conservation Rules 1997	Water Pollution Prevention Act (Act No. 138 of 1970)
Enforcement agency	Department of Environment (DoE)	Local government
Target facility	Orange-B, Red categorized facilities	<ul style="list-style-type: none"> The facilities discharging effluent equal or more than 50m³/day Not only the industrial facility but all facilities discharging effluent

35

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (2)

Item	Bangladesh	Japan
Frequency of issuing monitoring report	Once a year	Once a year (COD, N, P in specific area: every day to once a month depend on the quantity)
Manager of ETP	Not mandatory	Need to be dispatched licensed person
Certificate for analytical laboratory	Not mandatory	Mandatory (Need to be analyzed by certificated laboratory)

36

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (3)

Item	Bangladesh	Japan
Required period of monitoring data storing	Not mandatory	3 years
Necessary action in case of accidental case (e.g., Spilling of harmful effluent)	Not mentioned in ECR	<ul style="list-style-type: none"> • Need to take necessary measures immediately • Need to report status of accident and measure taken to provincial governor

37

37

The points for the discussion

1. What is the major difference between the legal system of both countries? And is there any Japanese measure which can be referenced for Bangladesh?
2. How do you manage all the effluent discharge by DoE in feature? (Is it possible to increase the number of DoE officers to manage all the effluent generators by DoE?)
3. Do you have any idea on future industrial wastewater control in Bangladesh?

38

38

**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Water Pollution Control

Session 2: Summary of Identified Issues by JET and DoE

9th July 2023

JICA Expert Team

1

1. Measures for Identifying Issues on Water Pollution Control

(1) Setting target items for identifying issues

- (a) Legal system
- (b) Administrative and technical capacity
- (c) Cooperation with relevant organizations

↓

(2) Collecting information on current status and discuss on challenges

- (a) Meeting with DoE relevant wings and local offices
- (b) Field survey
- (c) Questionnaires survey with DoE officers
- (d) Laboratory capacity assessment (Chattogram laboratory)
- (e) Training workshop

2

2. Identified Issues (1) – Regal System

Item	Current Status	Challenges
Water Pollution Control	- Bangladesh Environment Conservation Act (ECA) 1995, 2010 revision - Environmental Conservation Rules (ECR), 2023	• To monitor newly regulated parameters, e.g. nutrients and heavy metals • To guide pollution control with severer standard values on N (nitrogen) and P (phosphorous)
On-site Inspection	- On-site inspections is conducted in accordance with ECR. - Environmental Court Act (2000, 2002 and 2010 revisions)	• To enhance capacity on administrative guidance for improvement of operation of ETP
EIA	Currently being revised EIA Guidelines for Industries (1997)	• To issue and update ECC based on the revised ECR
River, Lake and Watershed Management	- Water Act (2013) - Water Resource Planning Act (1992) - National Water Policy (1999) - Bangladesh Water Rules (2018) - WARPO Guidelines (2020)	• To enhance capacity to manage water resource with adopting watershed management concept

3

2. Identified Issues (2) – Administrative and Technical Capacity

Item	Current Status	Challenges
Water Pollution Control	- DoE concentrates to control industrial wastewater, especially specified in the revised ECR.	• To grasp impact on water pollution load by wastewater discharged from various sectors, e.g. domestic sector, agriculture sector, etc.)
On-site Inspection	- DoE is in charge of on-site inspection in nationwide by limited number of local officers. - DoE laboratories analytical capacities are insufficient, and has no their accredited system.	• To develop a system for identifying priority targets to be inspected and controlled. • To enhance DoE laboratories capacities for improving credibility of wastewater analysis for granting fines based on the analytical results under the revised ECR. • To adopt laboratory accrediting system for DoE laboratories
EIA	- DoE conducts EIA and issue ECC in accordance with ECA and the revised ECR.	• To enhance capacity of DoE officers (especially local officers) for assessing validity of ETP at the timing of EIA review and renewal of ECC.
River, Lake and Watershed Management	- Preparation of plans for river environment restoration are being considered.	• To enhance capacity for planning water pollution control in watershed level

4

2. Identified Issues (3) – Cooperation with Relevant Organizations

Item	Current Status	Challenges
Water Pollution Control	- The meetings are held on an irregular basis with related ministries and agencies responsible for water resource management (BWDB), sanitation (DPHE), sewerage development and operation (WASA), and etc.	• To strengthen necessary cooperation with related ministries, agencies and bureaus for comprehensive wastewater management.
On-site Inspection	- Local industrial pollution source control is conducted by limited DoE local officers, such as dispatched one DD, one or two AD, with several inspectors only in each DoE local office.	• To examine the way of enhancing local pollution source control capacities by cooperating with local administrative bodies, especially at the cities/areas having large number of industrial wastewater sources to be controlled.
River, Lake and Watershed Management	- BWDB emphasizes water resource management as watershed level with planning to increase the number of monitoring sites from 18 to 357 for .	• To enhance water monitoring data sharing mechanism with relevant ministries and agencies • To improve water quality monitoring capacity of relevant ministries and agencies with solving existing issues such as lack of equipment and reagents

5

3. Items to be discussed

- ✓ Is there any other serious issues to be raised for improvement of water pollution control capacity of DoE?
- ✓ Among the identified issues, which ones are considered as priority ones?

6

**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Water Pollution Control

Discussion on the Issues on Technical
Capacity of DoE officers

9th July 2023
JICA Expert Team

1

**Discussion of the Issues on Technical
Capacity of DoE Officials**

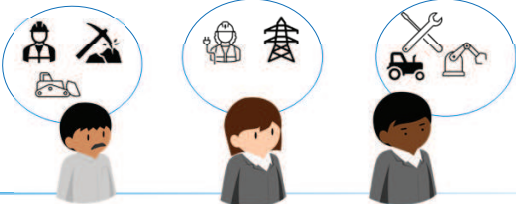
- In addition, Monitoring & Enforcement officials must find whether the STP is functioning properly and conduct monitoring sampling.



4

**Discussion of the Issues on Technical
Capacity of DoE Officials**

- Junior DoE officials come from a variety of backgrounds and need to be trained in environmental administration.



2

Points of Discussion

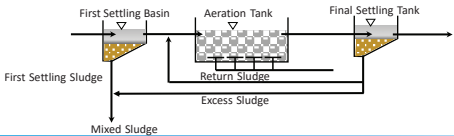
From the last Workshop, there are few opportunities for systematic education throughout the DoE on such basic knowledge.

Field	Issues on training for DoE Junior officials	Assumed Countermeasures
Water quality management		
ECC assessment		
Monitoring Enforcement		

5

**Discussion of the Issues on Technical
Capacity of DoE Officials**

- In particular, staff involved in ECC assessment need to know the basic functions of a wastewater treatment. For example, they need to know these basics because they need to confirm whether the tanks have sufficient.



3

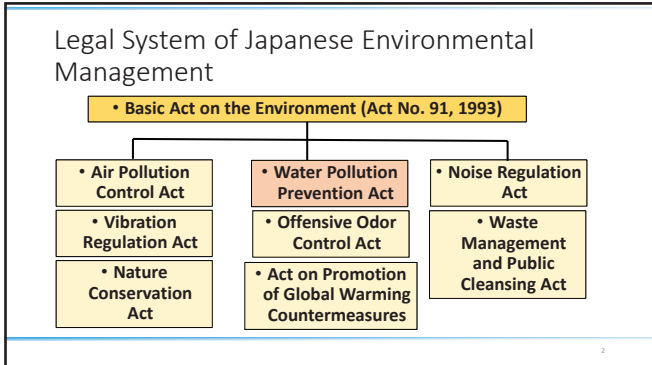
**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Water Pollution Control

Introduction of Environmental Pollution
Control and Monitoring System in Japan

9th July 2023
JICA Expert Team

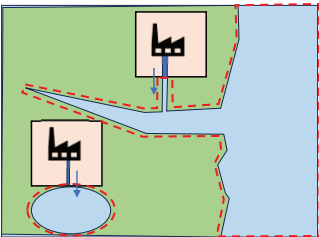
1



2

Introduction of the environmental pollution control and monitoring system in Japan

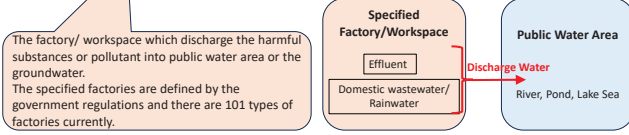
- The purpose of this Act is to prevent the pollution of water in Areas of Public Waters and in groundwater by regulating Effluent discharged by factories and workplaces.



3

Introduction of the environmental pollution control and monitoring system in Japan

- The purpose of this Act is to prevent the pollution of water in Areas of Public Waters and in groundwater by regulating Effluent discharged by **Specified factories and workplaces**.



4

Introduction of the environmental pollution control and monitoring system in Japan

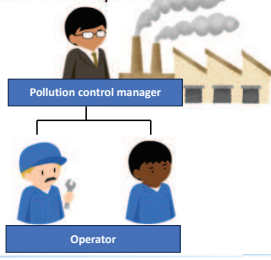
- The Entrepreneur of a Specified Factory must submit a document to the Governor at least 60 days prior to the construction of the factory.

<ul style="list-style-type: none"> (i) Name and address, and in the case of a juridical person, name of its representative (ii) Name and location of the factory or workplace (iii) Type of specified facility (iv) Structure of the specified facility (v) Equipment of the specified facility (vi) Method of using the specified facilities (Process flow diagram, Raw material, Operation time, Quality & Amount of the Effluent) (vii) Method of treatment of sewage, etc. (Types of the treatment method, System diagram treatment operation time, amount of the agent, Sediment discharge method) (viii) Pollution status and amount of effluent water (ix) Others
--

5

Introduction of the environmental pollution control and monitoring system in Japan

- Another law, Act on Improvement of Pollution Prevention Systems in Specified Factories, requires the installation of a **pollution control manager**. He/ She is the holder of a state license and is not an equipment operator. He is a professional manager with responsibility for pollution control.



6

Introduction of the environmental pollution control and monitoring system in Japan

- Monitoring of wastewater quality is mandatory to ensure that wastewater standards are being followed **by the entrepreneur**.
- The law requires that measurements be taken at least once a year, and that the results be recorded and stored.
- The analysis of water quality can be outsourced to a **qualified laboratory** as required by another law.



7

7

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (1)

Item	Bangladesh	Japan
Law	The Environmental Conservation Rules 1997	Water Pollution Prevention Act (Act No. 138 of 1970)
Enforcement agency	Department of Environment (DoE)	Local government
Target facility	Orange-B, Red categorized facilities	<ul style="list-style-type: none"> The facilities discharging effluent equal or more than 50m³/day Not only the industrial facility but all facilities discharging effluent

8

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (2)

Item	Bangladesh	Japan
Frequency of issuing monitoring report	Once a year	Once a year (COD, N, P in specific area: every day to once a month depend on the quantity)
Manager of ETP	Not mandatory	Need to be dispatched licensed person
Certificate for analytical laboratory	Not mandatory	Mandatory (Need to be analyzed by certificated laboratory)

9

9

Comparison of the Legislative System on Water Pollution Control between Bangladesh and Japan (3)

Item	Bangladesh	Japan
Required period of monitoring data storing	Not mandatory	3 years
Necessary action in case of accidental case (e.g., Spilling of harmful effluent)	Not mentioned in ECR	<ul style="list-style-type: none"> Need to take necessary measures immediately Need to report status of accident and measure taken to provincial governor

10

10

The major differences in laws between the two countries

- (1) The local government is the law enforcement agency
- (2) The law requires the establishment of a supervising engineer for ETP
- (3) In Japan, the analysis can be performed by a qualified laboratory.

11

11

The outcome of this Act

- Water Pollution Prevention Act was enacted in 1970. Since the enactment of this law, significant results have been achieved in preventing and improving water pollution, especially that caused by factories.



Water pollution condition at Kitakyusyu in 1960s

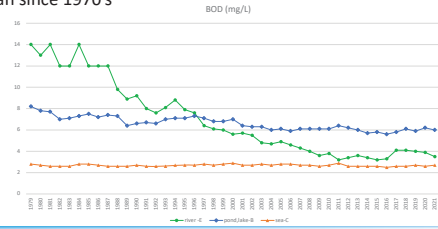
Current condition

12

12

The outcome of this Act

- Changes in average of BOD value in public water monitoring point in Japan since 1970's



13

**Advisor on Environment Management
in Bangladesh**

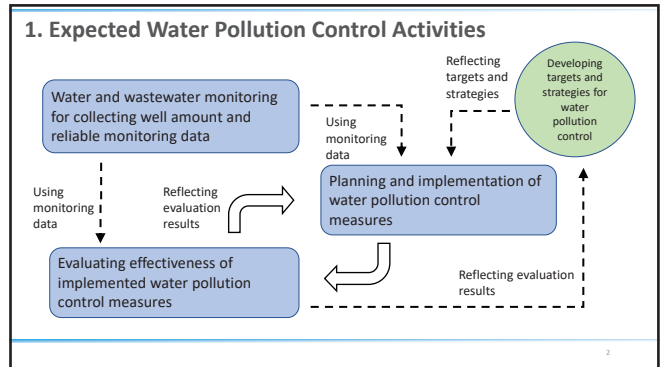
2nd Interactive Training Workshop on Water Pollution Control

**Session 5: Proposal on Expected Activities
based on the Identified Issues by JET**

9th July 2023

JICA Expert Team

1



2

2. Proposed Activities (1) – Regal System

Item	Challenges	Possible Proposed Activities
Water Pollution Control	<ul style="list-style-type: none"> To monitor newly regulated parameters, e.g. nutrients and heavy metals To guide pollution control with severer standard values on N (nitrogen) and P (phosphorous) 	<ul style="list-style-type: none"> Prepare water quality monitoring and water pollution control strategies Develop mechanism for preparation of periodical white book on water quality status with pollution load information Prepare guidelines for step-by-step adaptation and practical operation on the requirement of the revised ECR Develop a mechanism to review the revised ECR implementation periodically and update as necessary
On-site Inspection	<ul style="list-style-type: none"> To enhance capacity on administrative guidance for improvement of operation of ETP 	<ul style="list-style-type: none"> Prepare guidelines for on-site inspection to conduct active administrative guidance for improvement of operation of ETP
EIA	<ul style="list-style-type: none"> To issue and update ECC based on the revised ECR 	<ul style="list-style-type: none"> Prepare guidelines describing the items to be checked for evaluating proper ETP operation during issuing and updating process of ECC <p>(Note) GIZ supports DoE to prepare the guidelines.</p>
River, Lake and Watershed Management	<ul style="list-style-type: none"> To enhance capacity to manage water resource with watershed management concept 	<ul style="list-style-type: none"> Prepare guidelines for water pollution control planning in watershed level

3

2. Proposed Activities (2) – Administrative and Technical Capacity

Item	Challenges	Possible Proposed Activities
Water Pollution Control	<ul style="list-style-type: none"> To grasp impact on water pollution load by wastewater discharged from various sectors, e.g. domestic sector, agriculture sector, etc.) 	<ul style="list-style-type: none"> Conduct trial pollution load analysis for understanding impact of wastewater discharged from various type of sources, cooperating with relevant ministries and agencies Develop water pollution control capacity enhancement plan of DoE
On-site Inspection	<ul style="list-style-type: none"> To develop a system for identifying priority targets to be inspected and controlled. To enhance DoE laboratories capacities for improving credibility of wastewater analysis. 	<ul style="list-style-type: none"> Develop on-site inspection capacity development plan including human resource development plan with training program Plan and conduct required activities for obtaining laboratory accreditation for DoE laboratory <p>(Note) WB supports to develop and upgrade DoE laboratories. GIZ supports DoE Dhaka Lab. for obtaining accreditation.</p>
EIA	<ul style="list-style-type: none"> To enhance capacity of DoE officers (especially local officers) for assessing validity of ETP at the timing of EIA review and renewal of ECC. 	<ul style="list-style-type: none"> Provide training for officers in charge of issuing and updating ECC
River, Lake and Watershed Management	<ul style="list-style-type: none"> To enhance capacity for water pollution control planning in watershed level 	<ul style="list-style-type: none"> Prepare capacity development plan for water pollution control planning and implementation in watershed level

4

2. Proposed Activities (3) – Cooperation with Relevant Organizations

Item	Challenges	Possible Proposed Activities
Water Pollution Control	<ul style="list-style-type: none"> To strengthen necessary cooperation with related ministries, agencies and bureaus for comprehensive wastewater management. 	<ul style="list-style-type: none"> Prepare recommendation and develop a mechanism for enhancing cooperation of relevant organization for water pollution control led by DoE
On-site Inspection	<ul style="list-style-type: none"> To examine the way of enhancing local pollution source control capacities by cooperating with local administrative bodies. 	<ul style="list-style-type: none"> Examine possibility to handover on-site inspection mandate to local administrative bodies with MoEFCC Discuss for capacity development of local administrative bodies with sharing on-site inspection skills and experiences by DoE
River, Lake and Watershed Management	<ul style="list-style-type: none"> To enhance water quality monitoring data sharing mechanism with relevant ministries and agencies To improve water quality monitoring capacity of relevant ministries and agencies 	<ul style="list-style-type: none"> Prepare recommendation and develop a mechanism for sharing water quality monitoring data led by DoE Develop national capacity development plan on water quality monitoring for not only DoE but also other ministries and agencies

5

3. Items to be discussed

- ✓ Is there any other new activities to be conducted for improvement of water pollution control capacity of DoE?
- ✓ How do you consider on timeline for implementing the proposed activities
- ✓ What kinds of external support do you need?

6

添付資料 3

廃棄物管理

第1回ワークショップ資料

**Agenda of Interactive Training Workshop on SWM in
“Advisor on Environmental Management in Bangladesh”**

Time: 9:00 am

Date: 21 December 2022

Venue: DoE head office (a hybrid of a face-to-face meeting in 2nd floor auditorium room of DoE and a remote meeting by Zoom)

1. Background

DoE continuously tries to improve the SWM in Bangladesh through cooperation with LGDs, LGEDs and/or LGIs. As basic action, SWM Rule (2021) has been formulated and promulgated last year. It is necessary to actualize the concept of the rule. To do so, this training program is initiated.

2. Objectives

The main objectives of the meeting are as follows;

- (1) To share the knowledge and experience for the concerned governmental officers through interactive discussion, and
- (2) To identify priority issues to be talked for SWM implementation and discuss how to improve the SWM system in Bangladesh together through this training.

3. Draft Agenda of the Training Program

Time	Content	Speaker	Time expected
8:45 – 9:00	Registration		15 min
9:00 - 9:05	Welcome speech	Director, NRM and Focal Person of the DoE Advisory Project	5 min.
9:05 - 9.15	Project Brief	Team Leader, JICA Study Team	10 min.
9:15 - 9.25	Inauguration speech	Additional Director General, Department of Environment	10 min
9:25 - 9:30	Coffee break		5 min.
9:30 - 10:25	General Concept of the SWM and Introduction of the current situation in Bangladesh (including the brief introduction of SWM Rule)	JICA Expert Team	55 min.
10:25 - 10:30	Coffee break		5 min.
10:30 - 11:25	Introduction of policy & institutional system of SWM in Bangladesh & Japan.	DOE WCM Wing, JICA Expert Team	55 min.
11:25 - 11:30	Coffee break		5 min.
11:30 - 12:25	Preparation of SWM plan and annual report by LGI and facilitation by DOE	DOE WCM Wing, JICA Expert Team	55 min.
12:25 - 12:30	Coffee break		5 min.
12:30 - 13:30	Introduction of EPR system of container and packaging waste in Japan and how it can be introduced in Bangladesh	DOE WCM Wing, JICA Expert Team	60 min.
13:30 - 14:30	Lunch	All participants	60 min.

Time	Content	Speaker	Time expected
14:30 - 15:30	Capacity Building on the emission monitoring (land, water & air) for Waste Treatment and Disposal and feedback of all the session.	DOE Climate Change Wing, JICA Expert Team, all participants	60 min.
15:30 - 16:00	Closing Remarks	Director General/Additional Director General, DoE	10 min.

4. Participants

(1) Bangladesh Side

The tentatively expected participants are described in Attachment-1.

(2) Japanese Side

JICA Senior Advisor, JICA Expert Team

Attachment-1

Expected Participants:

Main Target participant

DOE (Waste & Chemical Management wing)- 5, DOE (Natural Resource Management Wing)- 1 or 2,

DOE (Monitoring & Enforcement wing)-1, DoE (Planning Wing)- 1, DoE (Climate Change and

International Convention Wing) - 1, DoE (Air Quality Management) – 1,

DOE (Dhaka Metropolitan)-1, DOE (Dhaka District)-1, DOE (Chattogram Metropolitan)-1, DOE

(Chattogram district)-1, Narayanganj DOE/NCC- 1+1, Gazipur DOE/GCC-1+1, Munshigonj DOE/

Paurashava- 1+1, Narshindi DOE/ Paurashava 1+1,

DNCC/DSCC -1+1, CCC-1,

Ministry of Environment, Forest & Climate Change (MOEF&CC) -1, Local Government Division

(LGD)-1, Local Government Engineering Department (LGED)-1, Department of Public Health

Engineering (DPHE)-1,

End of Document

**Advisor on Environment Management
in Bangladesh**

Training Workshop on SWM

**General Concept of the SWM
and Introduction of Current Situation
in Bangladesh**

**21st December 2022
JICA Expert Team**

1

Why we do SWM?

Overall objectives
Minimization of hazardous impact of domestic solid waste on human health and environment
Specific objectives
Reduction of waste generation
Minimization of need for safe disposal (through waste avoidance, reuse & recycling)
Safe disposal of residual waste in sanitary landfill
Awareness raising and behaviour change towards adequate waste handling

4

Table of Contents

- What is Solid Waste Management?
- Current SWM Situation in Bangladesh
- Current SWM Situation in Japan
- How to Improve the situation in Bangladesh ?

2

Waste Hierarchy

Most favoured option
Reduce (lowering the amount of waste produced)
Reuse (using materials repeatedly)
Recycle (using materials to make new products)
Recovery (releasing energy from waste)
Landfill (safe disposal of waste to landfill)
Least favoured option

Working principles (in order of priority)
1) Avoidance of waste generation (especially inorganic and non-recyclable waste)
2) Establishment of a complete SWM system (for waste which cannot be avoided, as proposed under 1.): waste segregation > collection > transport > value recovery > safe disposal
3) Ensuring adequate waste handling (through awareness raising and behaviour change)
4) Source segregation of waste (and maintaining of segregation throughout SWM system)
5) Reuse of segregated waste
6) Recycling of segregated waste
7) Safe disposal of residual waste (which cannot be avoided, reused or recycled)

5

What is Solid Waste Management ?

According to SWM Rules 2021:

"Solid Waste Management" defines the functions related to reduction of waste at source, source segregation, separate collection, recovery, reuse, control, transfer, transport, processing, and disposal in accordance with the best principle of public health and environmental considerations.

Why Solid Waste Management (SWM) is important?

Protection of Public health
Protection of Environment
Reduction of Green house gas emission
.....

3

Why waste segregation is Important?

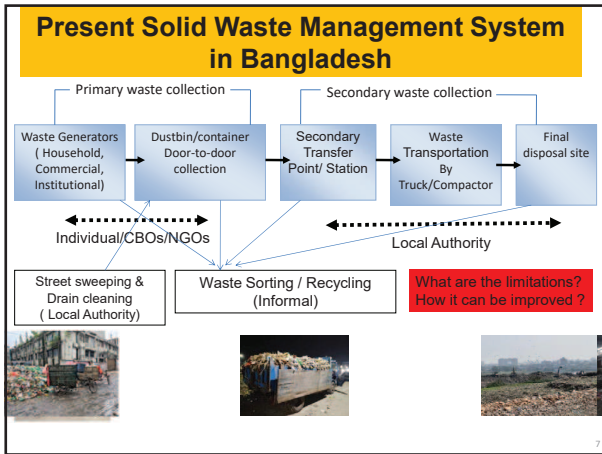
Importance of Waste Segregation	If waste is segregated...	...waste becomes a valuable resource!
		...SWM becomes a business opportunity!
	If waste is not segregated...	...waste remains waste, and needs to be disposed
		...unsafe waste disposal is the easiest and cheapest approach!
		...very likely, waste becomes a threat to human health and environment!

Waste Segregation at Source

Waste segregation at source is the most effective approach...

- ...recyclables are not soiled, and can easily be recovered
- ...organic material is not contaminated with plastics etc.

6



7



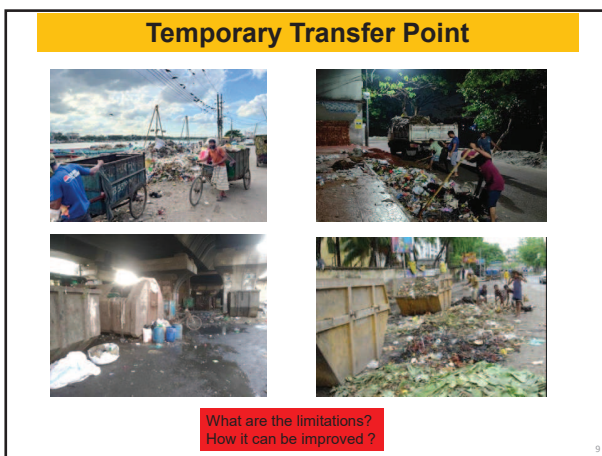
10



8



11



9



12

Improvement of Waste transfer



What is your Opinion?

13

Sanitary Landfill Construction & Operation



16

Waste Disposal



Is this common problem with the landfill sites?
What are the basic requirements of a controlled landfill site ?

14

Leachate Treatment at DNCC



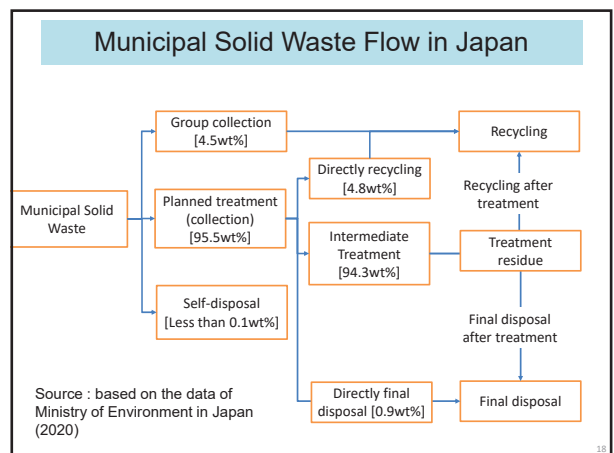
17

Facilities to be considered in Sanitary Landfill (SWM Rules 2021)

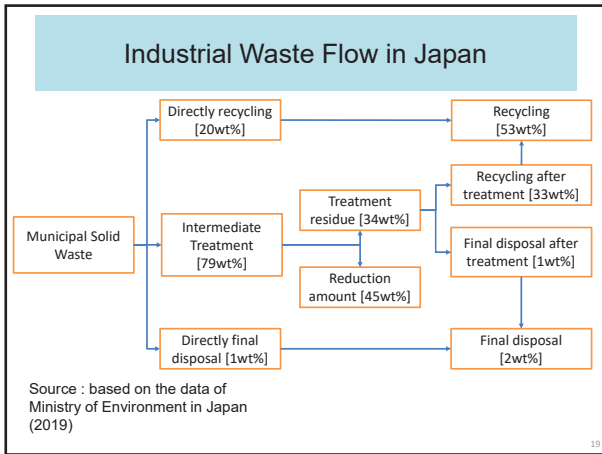
- (A) Walls and appropriate gates (**Security & access control**)
- (B) Landfill access and internal roads shall be paved or concrete (**Truck movement**).
- (C) Office shall be kept for keeping waste records and sheds for keeping machineries and equipment (**Control building and Equipment shed**)
- (D) Weigh bridges for measuring waste and appropriate fire protection measures (**Weighbridge and Emergency Management**)
- (E) Provision of drinking water, sanitary facilities, adequate lighting for the workers working in the landfill and routine health check up facilities of the workers (**Health & Safety Issue**).
- (F) Adequate arrangements shall be made for vehicle parking, cleaning and washing facilities of waste carrying vehicles. (**Car washing Facility**)
- (G) Waste storage facilities if it is not possible to process the waste due to natural calamity or any other reason (**Waste storage facility**)

What are the gaps in SWM Rules for Sanitary Landfill facilities construction & operation?

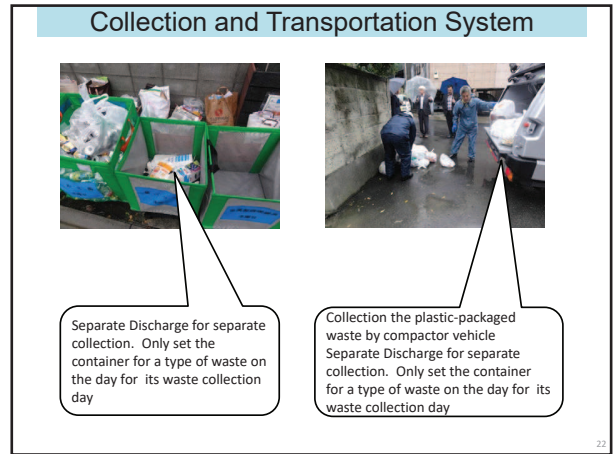
15



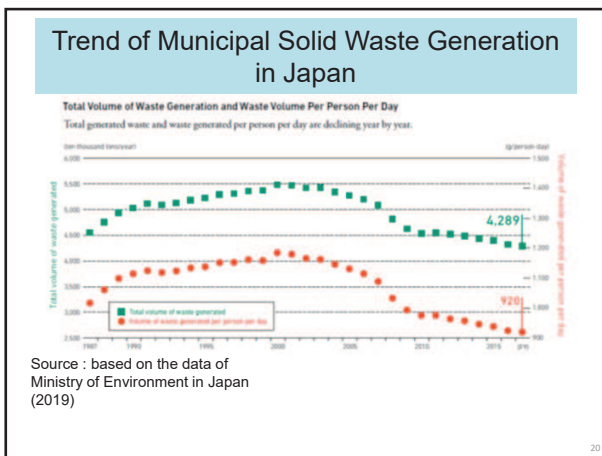
18



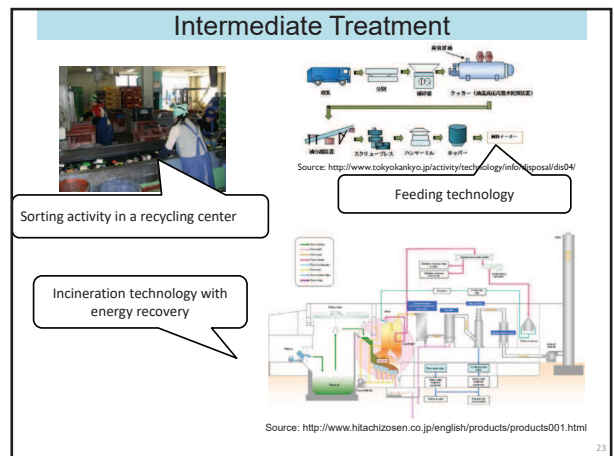
19



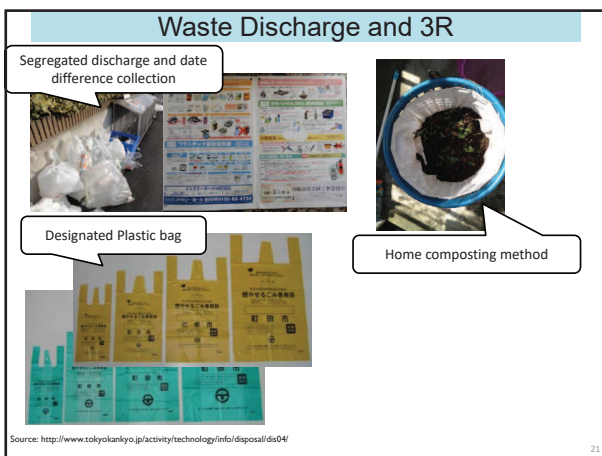
22



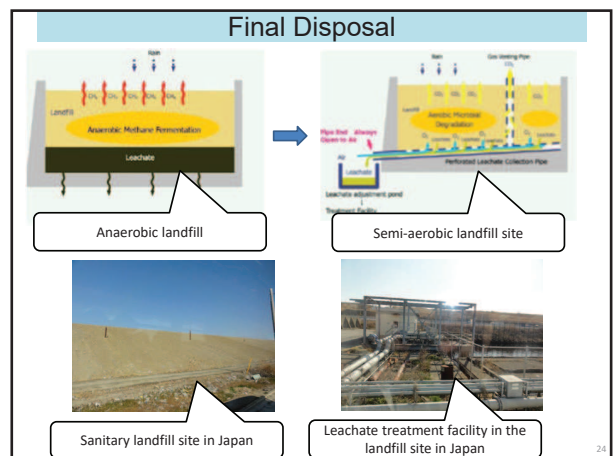
20



23



21



24

How to improve the situation in Bangladesh

Fundamental law has been established.

- Establishment of Fundamental Law for SWM : SWM Rule (2021)

Participants Opinions

- (1)
- (2)
- (3)

[I Got Garbage - a Mindtree initiative.mp4](#)

25

**Advisor on Environment Management
in Bangladesh**

Training Workshop on SWM

**Policy & Institutional System of SWM
in Bangladesh & Japan**

21st December 2022

DOE Waste and Chemical Management Wing

/JICA Expert Team

1

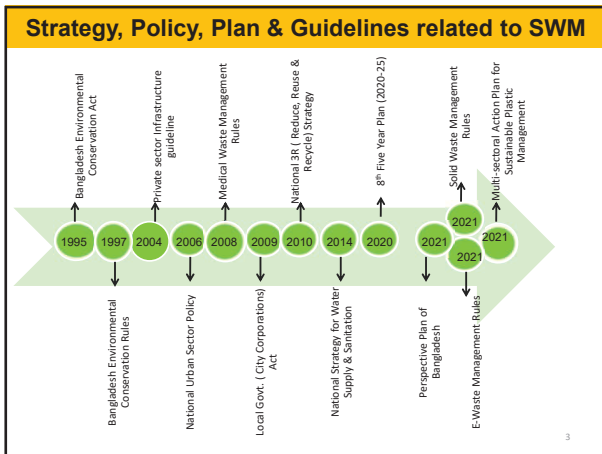
1

Contents

- SWM Rules 2021
- Current Institutional System of SWM in Bangladesh
- Historical Trend and Current Institutional System in Japan
- How to improve the Institutional & Regulatory System in Bangladesh?

2

2



3

Constitutional Declaration on Protection of the Environment

- Article 18A of “The Constitution Of The People’s Republic of Bangladesh” states:-
- **Protection and improvement of environment and biodiversity:#**
- *The State shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, bio-diversity, wetlands, forests and wild life for the present and future citizens.*

Is it Possible Without Environmentally Sound Solid Waste Management?

4

4

Background of Formulation of SWM Rules

- ❖ According to the projection, by 2041, the urban population will **increase to 80%**. Safe waste management will be **raised to 100%** (Bangladesh Perspective Plan, 2021-2041).
- ❖ According to the projection, **the city is expected to generate 47,000 tons per day in 2025**, which could increase to 17.2 million tons per year (Eighth Five Year Plan, 2020-2025).
- ❖ In big cities of the country, **44-76% of the total waste can be collected**. Waste that is not collected or mismanagement a threat to human health (Eighth Five Year Plan)
- ❖ About **10 percent** of the total waste is mixed plastic. 40% of plastic is recycled. The remaining 40% is landfilled and 20% is discharged in water. Single use plastics are not usually reused or recycled. Moreover, modern management of **medical waste** in a scientific manner is becoming challenging. (Eighth Five Year Plan)

5

5

Formulation of Solid Waste Management Rules 2021

Solid Waste Management Rules 2021 has been formulated by the Ministry of Environment, Forest & Climate Change in its authority under Section 20 of the Bangladesh Environmental Conservation Act, 1995 and is enacted on 9th December 2021.

6

6

Contents of SWM Rules 2021

- Source reduction, source segregation, segregated collection, transportation, proper treatment and final disposal of waste are part of SWM system
- Waste should be segregated into three categories and deposited in three different color bins Green (Wet), Yellow (Dry) and household hazardous waste (Red)
- Create awareness among the people on waste reduction and segregation of waste at source
- Prepare Action plan for proper management of solid waste
- Annual Waste Report based on the prescribed format (Table-2) and submit it by 30 September
- Medical Waste should be managed according to the provisions stipulated in Medical Waste (Management and Processing) Rules 2008
- The producers/ manufacturer should take responsibility of management and disposal of non-degradable materials such as Single use plastic (SUP) and the Multiple Layer Plastic (MLP) through adopting Extended Producers Responsibility (EPR)

7

The responsibilities of the LGAs as prescribed in Rule 10 & 12 of the SWM Rules, 2021 includes-

- Environment-friendly and hygienic management of solid waste;
- Preparation of comprehensive plans for solid waste management in line with the strategies of 3Rs;
- Collection, transportation, and management of solid waste separately in 3 different categories; arrange for separate collection facilities for 3 types of wastes in dustbins, containers, secondary transfer stations
- Initiate waste recycling and final disposal in compliance with standards prescribed in Schedule 2 and 3;
- Comply with Medical Waste (Management and Processing) Rules, 2008
- Take measures for converting wastes to energy and refuse derive fuel (RDF);
- Take joint projects with government and non-government agencies (PPP);
- Prepare framework for implementing joint projects in line EPR guidelines/directives and so on.

8

National Coordinating Committee (Rule-3)

- ❖ In order to fulfill the objectives of these rules, there are representatives of various ministries / departments, departments/agencies in the National Coordinating Committee on Solid Waste Management. In addition, the committee has representatives from waste management experts, NGO representatives, FBCCI representatives and representatives of plastic manufacturers or importers.
- ❖ The Government, in consultation with the National Coordinating Committee, may, if necessary, form a **supervisory committee** at the divisional and district level, consisting of persons concerned with local **administration, local government authorities** and solid waste management department.

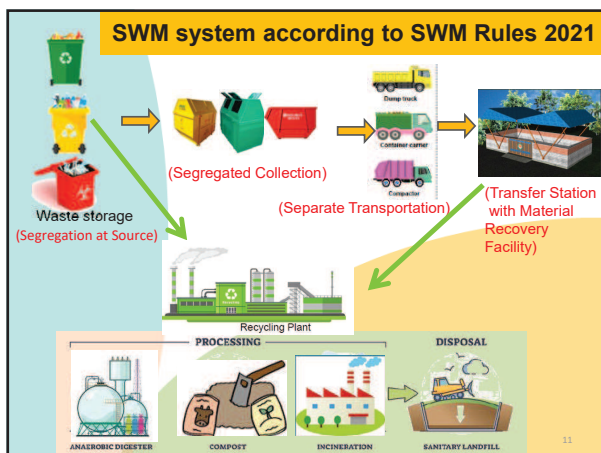
9

Roles & Responsibilities

- **National Coordination Committee (NCC)** under the SWM Rules, 2021 (issue directions required for implementation of SWM Rules; frame EPR guidelines; issue directions to stop or limit products creating polluting, hazardous waste; approve SWM plans of the LGAs; monitor performance of actors responsible for SWM; review annual reports on SWM)
- **Local Government Agencies** (perform SWM in environment-friendly and hygienic way; prepare SWM plans; prepare and submit annual plans; ensure segregation; collect, transport, manage SW; provide infrastructure; initiate recycling; measures for waste to energy; take PPP projects; set up and manage landfills)
- **Department of Environment** (control over all environmental matter; empowered to regulate products harmful to environment; framing and updating the guidelines/directives. For the execution of SWM Rules, 2021)

10

SWM system according to SWM Rules 2021

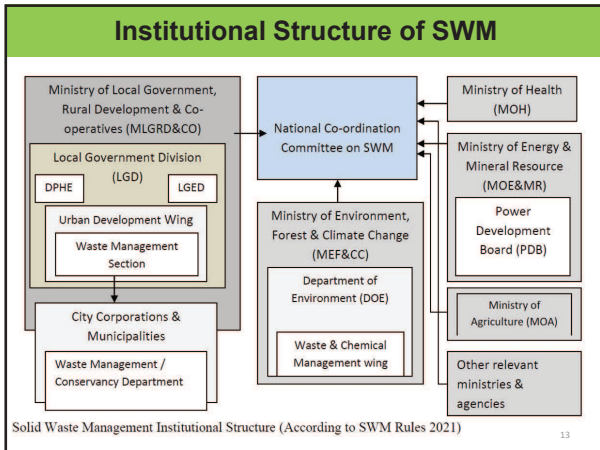


11

Challenges in implementing the SWM Rules

- (1) Capacity of the Department of Environment and local government Agencies
- (2) Lack of Manpower & Skilled Resources
- (3) Monitoring and enforcement
- (4) EPR formulation
- (5) Circular Economy **Establishment**

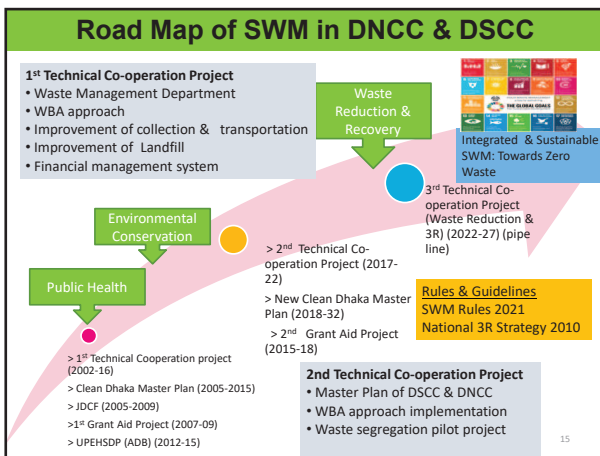
12



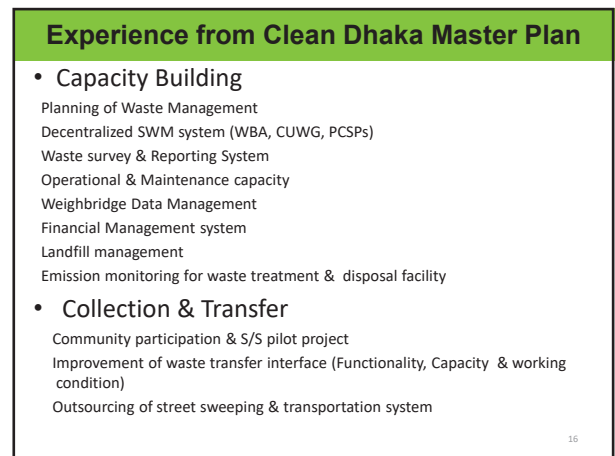
13



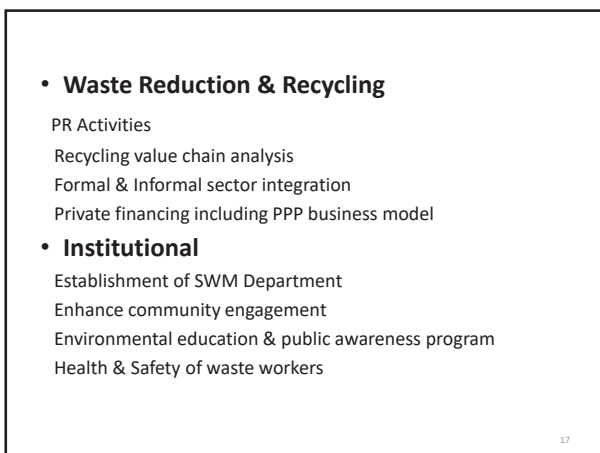
14



15



16

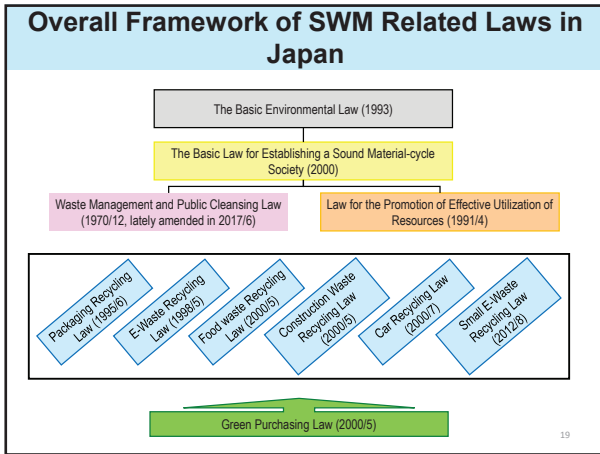


17

Historical Trend of Laws related to SWM

Time frame	Main issues	Main Acts
1960s - 1970s	Necessity of SWM to improve public sanitation	Waste Management Act (1970) Revision of the Waste Management Act (1976)
1980s	Improvement of SW disposal system to protect environment	Wide-area Coastal Environment Development Center Act (1981), Private Sewerage System Act (Johkasoh Law) (1983)
1990s	Commencement of the establishment of 3R system and tackle for DXNs issue	Revision of the Waste Management Act (1991), Act to Promote the Development of Specified, Facilities for the Disposal of Industrial Waste (1992), Japanese Basel Act (1992), Basic Environment Act (1993), Containers and Packaging Recycling Act (1995), Revision of the Waste Management Act (1997), Home Appliance Recycling Act (1998), Act on Special Measures against Dioxins (1999)
2000s	Promotion of 3R system toward circular economy and tackle for illegal dumping and industrial waste management	Basic Act for Establishing a Sound Material-Cycle Society (2000), Food Recycling Act (2000), Revision of the Waste Management Act (2000), Act on Special Measures concerning Promotion of Proper Treatment of PCB Wastes (2001), Automobile Recycling Act (2002), Act on Special Measures concerning Removal of Environmental, Problems Caused by Specified Industrial Wastes (2003), Revision of the Waste Management Act (2003 to 2006, 2010)
2010s from now	Improvement toward circular economy society and marine litter issues	Small Home Appliance and Recycling Act (2013), Plastic Resource Circulation Act (2021)

18



19

Basic Law on Establishing a Sound Material-Cycle Society

Fundamental Policy on resource circulating and appropriate waste management

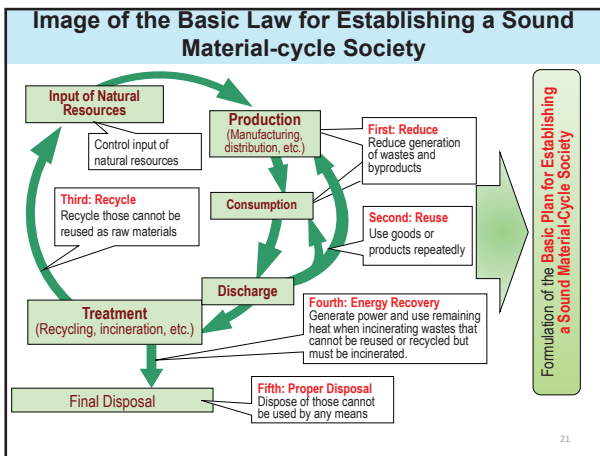
Background:
Aiming to achieve "Sustainable Society" from the aspect of effective material circulating, together with establishing "Low-carbon society" and "Nature harmonizing society".

Objective :

- To promote comprehensively and systematically the policies for the establishment of a Sound Material-Cycle Society
- To help ensure healthy and cultured living for both the present and future generations of the nation, through articulating the basic principles on the establishment of a Sound Material-Cycle Society,
- To Clarifying the responsibilities of the prefecture, local governments, businesses and citizens, and articulating fundamental matters for making policies for the formation of a Sound Material-Cycle society,
- To establish the Basic plan for Establishing a Sound Material-Cycle Society.

<https://www.env.go.jp/recycle/circul/kihonho/law.html> (Japanese)

20



21

Waste Management and Public Cleansing Law

Fundamental Policy on Appropriate Waste Management

Background:

- ✓ Increase in the amount of, and change in of the quality of the waste derived from economic activities, as a result of Japan's high economic growth
- ✓ Responding to environmental conservation measures related to waste management

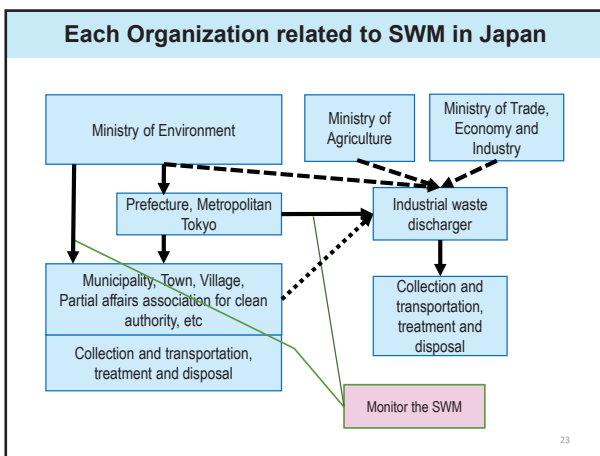
Objective:

This law is enacted for the purpose of preserving the living environment and improving public health through the restriction of waste discharge, appropriate sorting, storage, collection, transport, recycling, disposal, or other handling of waste and conservation of a clean living environment.

https://www.env.go.jp/en/recycle/basel_conv/files/Waste_Management_and_Public_Cleansing.pdf
<https://www.env.go.jp/en/laws/recycle/02.pdf>
<https://www.env.go.jp/en/laws/recycle/03.pdf>

Under this law, Cabinet Order (No. 300, 1971) and Ministerial Ordinance (regulation: No.35, 1971) are also established for more details.

22



23

Organization Structure of SWM Divisions in Ministry of Environment in Japan

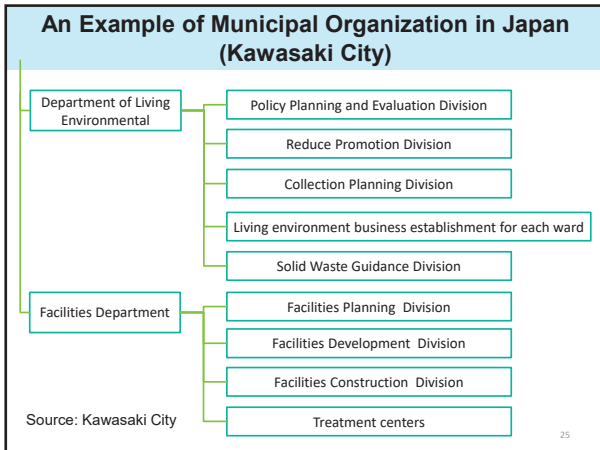
Environmental Regeneration and Material Cycles Bureau

- 24 senior officials and other officials

- Policy and Coordination Division**
 - Policy Planning, System Planning
 - Promotion of Sound Material-Cycle Society
 - Recycling Promotion
- Waste Management Division**
 - Disaster Waste Management
 - Management of Waste Contaminated with Radioactive Materials
 - Promotion of Johkasou
- Industrial Waste Management Division**
 - Restoration from Illegal Dumping
 - Specified Waste Management
 - Environmental Regeneration
 - Cross border movement information

Source: Ministry of Environment

24



25

Summarization of current situation of the Institutional & Regulatory System in Bangladesh

- 1. Law and regulations**
 - Basic law of SWM as SWM rule has been established.
 - Rules regarding E-waste and Medical waste management has been established
 - There is no law and regulation regarding Circular economy / EPR.
 - There is no implementation ordinance or guidelines to implement such rules
- 2. Organization**
 - (1) National Level**
 - The number of officials related to SWM is five persons in Waste & Chemical wing of DOE.
 - SWM section works both in waste management & chemical management
 - (2) LGI level**
 - In DNCC, DSCC, waste management department has been established, which has the responsibilities of planning, development and operation and maintenance of SWM
 - There is no such section in the other LGIs

26

How to improve the Institutional & Regulatory System in Bangladesh?

- How DOE/LGIs can institutionalize and operationalize SWM Rules?
- What are the Strengths and Weaknesses of the SWM rules?
- What support is needed by DOE & LGIs to implement the rules?
- Is it necessary to develop guideline and/or standard for the actual implementation of SWM including EPR?
- Is it necessary to implement subsidy system from national government to promote circular economy and/or EPR?
- Is it necessary to build capacity and allocate resources for the LGIs ?

27

Advisor on Environment Management
in Bangladesh
Interactive Training Workshop on SWM
Preparation of SWM Plan & Annual Report
by LGIs and Facilitation by DOE

21st December 2022

DOE Waste and Chemical Management Wing
/JICA Expert Team

1

Contents

- SWM Plan for LGIs
- SWM Plan for Other Authorities such as Industrial Zone
- Contents of SWM Plan in case of Japan
- Format of Annual Waste Report
- Purpose and Objectives of Annual Waste Report and How to Utilize it

2

Purpose of Formulating of SWM Plan for LGIs
(SWM Rules 2021)

- (1) Improve the existing disposal of solid waste
- (2) To examine solid waste segregation, processing and ultimate disposal related functions
- (3) Finalization of new site selection for solid waste segregation, processing and final disposal facilities
- (4) Commencement of segregation, processing and final disposal of solid waste at selected new sites and
- (5) Collective adoption of outline for implementation of the initiative in accordance with the manufacturer's extended responsibility (EPR) guidelines.

3

SWM Plans of Local Government Institutions

Sl.	Activities	Indicator	Unit	Deadline (From Planning)
1	Creating public awareness	Coverage of creating public awareness on segregation (family brought under program)	%	3 months
		Coverage of creating public awareness among local residents & organizations on temporary waste storage	%	4 months
		Training on environmental friendly waste transportation among waste collectors	Number	4 months
		Publicity on Environment friendly waste management	Number	3 months
		Media Campaign on Environment friendly waste management	Number	6 months
2	Conducting regular cleaning drive	Ward/ UP coverage for conducting cleaning drive	%	6 months

4

Sl.	Activities	Indicator	Unit	Deadline (From Planning)
3	Provide physical facilities	Provide separate waste bins based on waste category	Number	6 months
4	Sale center for reusable products	Established sale center of reusable products	Number	1 year
5	Prepare list of waste (vangari) traders or collectors	Ward wise prepared lists	%	6 months
6	Supply of prepared list to recycling organizations (company)	Established market connection (Waste exchange market place) (https://bhangari.com)	Number	8 months

5

Sl.	Activities	Indicator	Unit	Deadline (From Planning)
7	Encourage the establishment of recycling factories	Awareness creation among entrepreneurs	Number	1 year
		Reward / incentives provided		
		Financial or technical assistance provided		
8	Provide training on organic composting with the support of Department of Agriculture Extension	Training conducted	Number	8 months
9	Conduct mobile courts for implementation of rules	Mobile court conducted in every month	Number	Continuous
10	Settlement of complaints on solid waste pollution	Settled complaints	%	6 months

6

SWM Plan in Japan

- According to SWM basic law in Japan, every local authority has to prepare each SWM plan including SWM basic plan as the target year of 10 to 15 years and SWM implementation plan for each year
 - The direction for preparation of SWM basic plan has been prepared.
 - The direction suggested the SWM basic plan should consider the following points
1. Items to be analyzed for planning
 - (1) Profile of Local Authority
 - (2) Current situation of SWM (waste flow, SWM implementation structure, result of SWM, evaluation of SWM)
 - (3) Issues of SWM
 2. Planning
 - (1) Waste generation projection
 - (2) Future vision and target
 - (3) Strategy

7

An Example of Contents of SWM Plans

- 1. Background and Objectives**
 - 1.1 Background, 1.2 Objectives
- 2. Profile of Region**
 - 2.1 Location and natural condition, 2.2 Population, 2.3 Economic profile and Land use)
- 3. Current condition of solid waste management**
 - 3.1 Institutional Arrangement (Legislation, Organization, Finance (Revenue and Expenditure),
 - 3.2 Solid Waste Characterization (Waste Generation and Characterization, Current Waste Flow),
 - 3.3 Technical Aspect (Source Reduction and Discharge, Sweeping, Collection and Transportation, Recycle and/or Recovery, Final Disposal),
 - 3.4 Identified Key Issues
- 4. Future Framework**
 - 4.1 Socio-Economic Framework (Population, Other Socio-economic Situations),
 - 4.2 Projected Waste Generation

8

An Example of Contents of SWM Plans

- 5. Planning Strategy**
 - (5.1 Vision, Goal and Target, 5.2 Strategy to Satisfy the Target, 5.3 Future Waste Flow)
- 6. Technical System for Solid Waste Management**
 - (6.1 Source Reduction, 6.2 Sweeping, 6.3 Collection and Transportation, 6.4 Recycle and/or Recovery, 6.5 Final Disposal)
- 7. Institutional Arrangement for Solid Waste Management**
 - (7.1 Legislation, 7.2 Organization, 7.3 Finance (Revenue and Expenditure), 7.4 Public awareness and environmental education)
- 8. Implementation Plan**
 - (8.1 Implementation Schedule, 8.2 Responsible Organization)
- 9. Cost Estimation and Financial Aspect**
 - (9.1 Initial Cost, 9.2 Operation and Maintenance Cost, 9.3 Cost Recovery (Annual Budget and Expenditure)

9

Format of the Annual Waste Report

- Name of the Local Government Institutions:
- Total Population
- Contact details:
- Amount of solid waste generated (daily): tons
- Amount of solid waste generated (annual) : tons
- Amount of solid waste collected (annual) : tons
- Amount of solid waste illegally dumped (annual): tons
- Amount of solid waste uncollected (annual): tons
- Amount of Hazardous Industrial waste collected (annual): tons

10

- **Amount of waste processed (Public & Private enterprise) (annual)**
 - Organic waste processing/composting : tons
 - Recycling of Inorganic non-degradable waste : tons
 - Waste Incineration : tons
 - Open burning of waste : tons
 - Waste Landfilled : tons

Types of Landfill

- Unmanaged (Shallow /Deep) : tons
- Managed Anaerobic / Semi-aerobic : tons
- Uncategorized solid waste disposal sites : tons

11

Information related to landfill

- (A) Number of landfill sites :
- (B) Total area :
- (C) Whether there is weigh bridge facility :
- (D) Whether there is boundary wall of landfill area:
- (E) Whether there is lighting system in the landfill area:
- (F) If there is Bulldozers, compactors and other similar equipment, Specify:
- (G) Number of manpower deployed at landfill site:
- (H) Whether there is adequate covering material at landfill site:
- (I) Whether there is gas control system at landfill site :
- (J) Whether there is a system of leachate collection:

12

Waste Storage Facility

- Waste collection area :
- Number of houses :
- If NGO or any organization has been hired for house-to-house waste collection, Mention details :
- Bins

Type Size	Number
(A) Cement concrete build-up capacity	
(B) Trolley (capacity)	
(C) Container (for what type of waste or sticker with capacity)	
(D) Dumper placer	
(E) Other (specify)	

- Whether waste is collected everyday from all containers and storage : points :
- Waste is removed from the container physically or mechanically :

13

Waste transportation

Type	Existing	Actual need
(a) Truck		
(b) Truck Tipper		
(c) Tractor Trailer		
(d) Refuse Collector		
(e) Dumper Placer		
(f) Rickshaw van		
(g) Other (if any)		

14

(5) If there is any proposal to improve solid waste management, state it:

(6) If an attempt is made to give the responsibility of solid waste processing to a private person or organization, mention in details:

Name of person or organization	Name of the technology	Processing time and quantity	Name and address

(7) Steps taken to ensure that the following activities are performed in a healthy manner -

- Dairy Farm
- Animal slaughter
- Construction-demolition waste
- Unauthorized occupied of parks, walkways, etc.

(8) Slum:

Total number of slums :
Number of slums having Sanitation Facility:

15

(9) If mobile court is operated.

Total number of cases	Number of convicts	Collected amount of fines	Number of accused sentenced to imprisonment

(10) Medical waste management

- Number of government hospitals or clinics or health centers
- Number of City Corporation or Municipality Hospital or Clinic
- Number of private hospitals or clinics
- Whether the provisions of the Medical Waste (Management and Processing) Rules, 2008 are properly followed in all hospitals or clinics and health centers
- If there is any difficulty in following the provisions of Medical Waste (Management and Processing) Rules, 2008, its details:

16

What are the issues related to Waste Management Plan & Annual Waste Report Preparation

Participants Opinions

-
-
-

17

Issues on SWM Plan & Annual Waste Report Preparation

Important Issues

- Purpose of the Annual report & how to utilize the report
- Data collection method is not clear about the data such as waste generation, collection and disposal quantities (Waste generation & characterization survey, weigh bridge data/ truck load measurement, etc)
- How will the other agencies such as BEZA, BEPZA and other industries follow the same reporting system?



Necessary to develop the guideline for preparation of the report

18

Annual Report of SWM in Japan

- There is description of objectives of the annual report.
- The annual reports are respectively prepared for municipal solid waste and industrial waste
- Annual report of municipal solid waste is summarized by Ministry of Environment
(ex. https://www.env.go.jp/recycle/waste_tech/ippan/r2/data/env_press.pdf)
- The data format (excel file) has been prepared and send to each local authority to submit by them.
- After the preparation of report, it is publicized annually.

19

Data input and analysis for SWM Annual Report in Japan

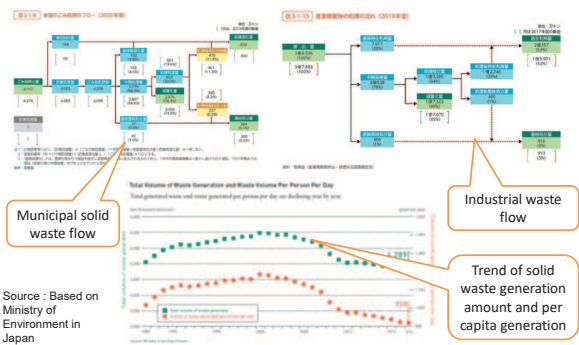
- Prepare the data format of excel sheet
- Input the data from each local authorities
- Analyze the data

Source : Based on Ministry of Environment in Japan

20

Data input and analysis for SWM Annual Report in Japan

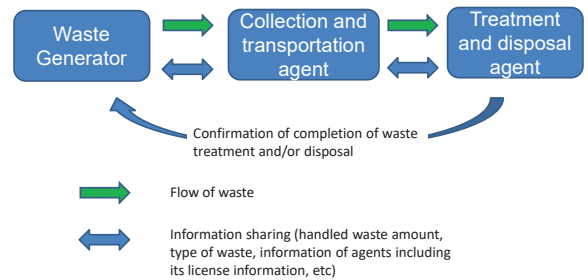
- To prepare waste flow after data input, calculation and analysis
- To prepare the historical trend of the data
- To prepare SWM annual report at national level



21

Daily Monitoring for Annual Report of Industrial Waste in Japan (Previous System)

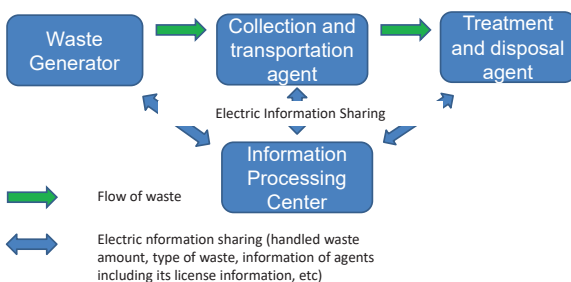
- Manifest system (Paper based)



22

Daily Monitoring for Annual Report of Industrial Waste in Japan (Current System)

- Manifest system (Electronic System)



23

Purpose and Objectives of Annual Waste Report and How to Utilize it

- The purpose of annual report will be to summarize the current situation of SWM in each LGI and to identify the SWM in national level
- The report prepared by LGIs will be utilized to prepare the national status report of solid waste management



- It will be better to prepare the contents of national report.
- It will be necessary that the national status report will be publicized to raise public awareness.

24

Data collection and estimation method

Example of data collection method

- Waste generation Amount :Estimation from unit generation rate and population
- Waste collection amount : Estimation from trip number, loading capacity and estimated loading rate of vehicle
- Waste treatment and disposal amount : loading capacity and estimated loading rate of vehicle through the check in the gate of disposal/ treatment facility



- It will be necessary to prepare the guideline regarding data collection and estimation method

25

Other agencies such as BEZA,BEPZA and other industries follow the same reporting system

- Introduction of monitoring system of industrial waste such as introduction of manifest system
- Data format preparation will be necessary



- It will be necessary to prepare the guideline regarding data collection and estimation method

26

Items of the Consolidated Annual Waste Report need to submit by DOE to National Coordination Committee

- Number of Action Plan submitted by City Corporations:
- Number of Action Plan submitted by Municipalities:
- Number of Action Plan submitted by Other Agencies:
- **SOLID WASTE Management status in Bangladesh**
- Generated (TPD)
- Collected
- Treated
- Landfilled

27

Compliance to SWM Rules (Number/names of LGAs/ Others)

- House-to-house collection
- Segregation
- Storage
- Covered transportation
- Solid Waste processing facilities planned/ installation/operational/non-operational
 - Composting
 - Biogas
 - RDF
 - Waste to Energy

28

- Disposal of solid waste (number/names of LGAs):
 - Landfill sites identified
 - Landfill constructed
 - Landfill under construction
 - Landfill in operation
 - Landfill exhausted
- Monitoring at Waste processing/Landfills sites
 - Surface water
 - Ground water
 - Leachate quality
 - Ambient air
 - Compost quality

29

**Advisor on Environment Management
in Bangladesh**

Interactive Training Workshop on SWM

**Introduction of EPR System of Container
and Packaging waste in Japan and how it
can be introduced in Bangladesh**

21st December 2022

**DOE Waste and Chemical Management Wing
/JICA Expert Team**

1

1

Contents

- Strategy & Action Plan of Plastic Waste Management in Bangladesh (including Video)
- Present regulatory framework/Directives/ Road Map
- Plastic Recycling scenario in Bangladesh
- Circular Economy (Material Cycle Society) approach in Japan
- Policy & guideline related to Container & Packaging waste in Japan
- How we can prepare EPR guideline in Bangladesh?

[Plastic pollution.mp4](#)

2

2

Plastic Waste Situation of Urban Areas of Bangladesh

• Out of the 821,250 tons/year waste only 36% is recycled in the urban areas of Bangladesh.

• Out of the total solid waste of 6464 tons/day, 646 Tons/day is plastic, which is 10% of the total waste generated in Dhaka city.

• At present only 37% of plastic waste is recycled from the total plastic waste generated in Dhaka city.

3

3

MFA of Plastics: 2018-2019

Ref: Waste Concern Study

4

4

FY2019-20

Among eight categories, the sectoral consumption was the highest for packaging with 937,262 metric tons (48% of the total) followed by Bangladesh produced **342,322 metric tons** recycled plastic.

Production Consumption Waste management

Bangladesh exported 377,742 metric tons of plastics

Bangladesh imported 1,710,296 metric tons

Per capita plastic consumption was 10.13kg

Per capita plastic generation was 7.9kg

Courtesy: Dr. M. sujauddin

5

5

Shayen Siddiki et al., 2022

During the FY 2019-20 the per capita plastic waste generation of Bangladesh was around 7.9 kilograms or around 22 grams per capita per day.

The largest contributor of plastic wastes was the packaging sector, accounting for around 73% of the total wastes generated by all eight sectors. Within that amount, only around 19% or 183,294 metric tons (mostly PET bottles) got collected as scrap, and a staggering 754,038 metric tons of plastic packaging wastes have been disposed openly to the environment during FY 2019-20.

Per capita plastic consumption

Per capita plastic generation

Department of Environment

6

6

Major Challenges

- Inadequate sectoral/product based research (...sectoral LCA, MFA)
- Inefficient Data Storage and Sharing Mechanisms
- Mainstreaming Informal Sector (.Even If we consider the EPR Implementation)
- Avoiding system loss (....inefficient collection, storage, transportation, recycle/resource recovery)
- Willingness for Product redesign/composition change to promote recycling/resource recovery.
- Avoiding non recyclable products.
- Enabling environment for circular economy (policy and economical instruments.)
- Technical Competency of the Entrepreneur as well as concerned department
- Behavioral status or people's mindset.

7

7

Import Policy order doesn't support plastic waste import (even for recycle/reuse)

Milestones in plastic waste management

- 2002: Notification ban on polystyrene bags through a regulatory order under the 1990 Environment Act
- 2004: Composition of plastic waste and market assessment in Dhaka
- 2006: Mandatory June Packaging Act 2010
- 2008: Medical Waste Management Rules 2008
- 2010: Implementation of plastic incineration in Dhaka and Chittagong
- 2011: Survey on solid packaging waste (SPW)
- 2012: Plastic park project to relocate old plastic factories
- 2013: Baseline study on solid packaging waste (SPW)
- 2014: Clear Dhaka master plan (2010-2032)
- 2015: Formation of technical advisory committee for the sustainable management of plastic waste management
- 2016: National Plastic Industry Development Policy 2016 (7th Draft)
- 2017: Approval granted for Waste-to-energy projects using incineration technology in Narayanganj
- 2018: High Court order to ban of single use plastics
- 2019: Baseline study for Dhaka, Chittagong and Cox's Bazar
- 2020: E-waste Mgt. Rules, 2021
- 2021: Solid Waste Mgt. Rules, 2021
- 2021: DMSA handed over its share to DCC and DCC

8

8

TOWARD A MULTISECTORAL ACTION PLAN FOR SUSTAINABLE PLASTIC MANAGEMENT IN BANGLADESH

- TARGET 1:** Achieve a 50 percent reduction in virgin material consumption in plastic manufacturing by 2030 by facilitating circular material flows from the 2020/21 baseline
- TARGET 2:** Phase out targeted SIP by at least 90 percent by 2030 from the 2020/21 baseline
- TARGET 3:** Reach a 50 percent plastic waste recycling rate by 2025 and an 80 percent plastic recycling rate by 2030 from the 2020/21 baseline
- TARGET 4:** Achieve a 30 percent reduction in annual plastic waste generation by 2030 from the 2020/21 baseline

9

9

Road Map for Plastic Management for Pollution Free Sustainable Development of Bangladesh

- 2021:** Official Launching of Road Map and Action Plan; Program draft Work Plan to stop plastic
- 2022:** Dissemination and Enforcing Solid waste management rules
- 2023:** Conduct baseline study on Marine plastic waste
- 2024:** Promote bio-degradable bags and packaging alternatives
- 2025:** Phase out targeted SIP by at least 90 percent
- 2026:** Standardize labeling of plastic products and materials
- 2027:** Introduction of Marine Debris Management Project
- 2028:** Eco-design and sustainable lifestyle
- 2029:** Minimize input of virgin materials
- 2030:** Standardize labeling of materials to enable recycling

10

10

National Coordination Committee at the Ministry of Environment, Forestry and Climate Change (MoEFCC) is to be established to monitor and facilitate the implementation of Action Plan

Inter-ministerial committee and **Technical Advisory Committee** will be formed under the National Coordination Committee.

Plastic Cell Under the DoE Waste and Chemical Management Wing will be constituted within DoE to monitor progress in the implementation of Road Map and Action Plan having multi-level communication. The institutional arrangement for the waste management defined in the Draft Urban Waste Management Handling Rules can be followed.

Local Level Implementation Agencies will be responsible for implementation of the action plan according to the road map and as directed by the Cell.

11

11

Plastic Waste Management Institutional Structure

Ministry of Environment, Forest & Climate Change (MEF&CC) (Lead)

- Department of Environment (DOE)
 - Waste & Chemical Management wing
 - Plastic Cell (Proposed)
- Inter-ministerial Committee (Proposed)
- Technical Advisory Committee (Proposed)
- National Co-ordination Committee (Proposed)
 - BPGMEA
 - BPFMEA
 - BIPET
 - Importers/Exporters
 - Manufacturers
 - Brand owners
- Waste pickers/collectors/PCSP, Dealers/Wholesaler, Processors/Recyclers, Factory/Industry, Consumers, CBOs/NGOs

Ministry of Local Government, **Ministry of Finance**, **Ministry of Industry**, **Ministry of Commerce**, **Ministry of Housing & Public Works**, **Ministry of Energy & Mineral Resource**, **Ministry of Shipping**, **Ministry of Textile & Jute**

12

12

The High Court Directive (January 2020) to the Government of Bangladesh to ban single-use plastic products in coastal areas, hotels, motels and restaurants across the country in one year as they create health and environmental hazards.


In response to the Directive in January 2020, a work plan on SUP was submitted to high court in January 2021.



13

Way forward to Stop Using Single Use Plastic (SUP)


Content	Year	1 st year (2021)		2 nd year (2022)		3 rd year (2023)	
		Jan-June	July-Dec	Jan-Jun	July-Dec	Jan-Jun	July-Dec
One-time cups, glasses, plates and other utensils	Passengers and cargo Ships	Sea Beach area	Hotel / motel / restaurant adjacent to the beach	Hat Bazaar / Bus Stand / Declared Public Place / Upzila Government / Semi-Government Offices / Educational Institutions Adjacent to the Beach	The entire Upzila adjacent to sea beaches	District adjacent to the beach	
Juice straw / Styrofoam food package/ coffee stirrers/Others							
Lolly pop cover, sachet, cigarette filter, cotton buds, Surgical gloves / masks	Solid waste rules Preparation	Creating acceptance on the views of policy makers (Brand owner / traders / Waste manager)	EPR guidelines Preparation	Establishment of environment friendly waste collection and waste disposal facilities in coastal area (Pilot project in Cox's Bazar and Patuakhali)	Providing waste collection and waste disposal training in coastal areas	EPR pilot project implementation in the coastal area.	



14

Way forward to Stop Using Single Use Plastic (SUP)


Considerations	Functions
Policy/Strategy issues	<ul style="list-style-type: none"> Single Use Plastic's Material Flow Analysis and Database Preparation. Single use plastic's present status assessment (Use and Disposal) in Coastal area. Determining the category of single use plastics and year based and item based phase out plans in coastal areas Regulatory framework development (Rules/SRO Preparation) Periodically declare single use plastic free areas (eg: boats, beaches, beach-adjacent hotels-motels, coastal district government offices, public transport, public places, etc.) Preparation guidelines for friendly collection and disposal of single use plastics those don't have any alternatives (eg: surgical gloves, masks)



15

Way forward to Stop Using Single Use Plastic (SUP)

Considerations	Functions
Administrative Issues	<ul style="list-style-type: none"> Requests concerned departments to stop the use of single use plastic in vessels Issuance of Demo-official letter to the Deputy Commissioners (DCs) to prevent the use of single use plastic in coastal areas Exchange of views with concerned stakeholders including hotel / restaurant owners in coastal districts / divisions. Publicity in print and electronic media (TVC preparation) Giving public notice in newspapers Encourage children to prevent plastic contamination through green clubs or nature clubs in coastal schools Spreading awareness through religious institutions/community involvement




16


Extended Producers Responsibility (EPR)

“Extended Producer Responsibility (EPR)” means environment friendly management of generated from the use of product of importer or manufacturer at consumer at their own responsibility or jointly with the local government authority or with other authorities and shall provide incentive for waste collection at consumer level for reusing, recycling, and proper management of generated waste.

EXTENDED PRODUCER RESPONSIBILITY (EPR)
 Extended Producer Responsibility (EPR) is a common feature amongst many systems:



Producers take physical and/or financial responsibility for the proper treatment or disposal of electrical & electronic products that have reached their end-of-life.

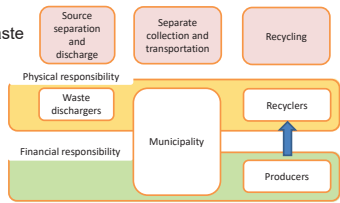



17

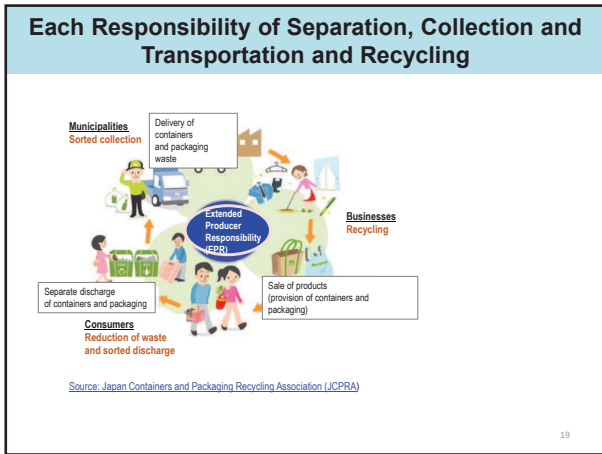
Introduction of Recycling System of Container and Packaging Waste in Japan Considering EPR

Background
 -60% of plastic waste is package waste
 -Container and Packaging Waste has short lifetime and they inevitably become waste

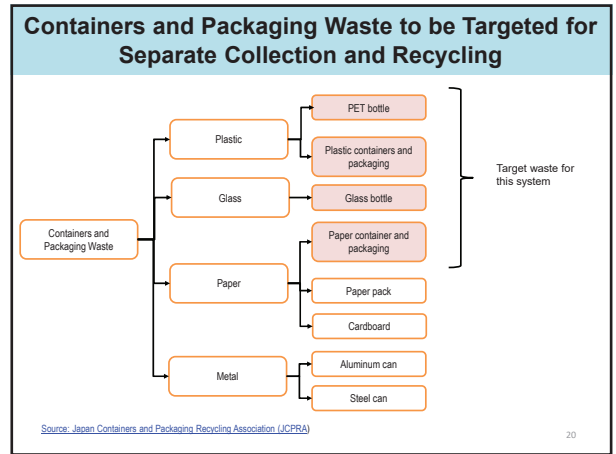
Direction of this System
 -Shifting of physical and/or financial responsibility toward producers and away from municipalities; and
 -Provision of incentives to producers to take environmental considerations into account when designing their products.

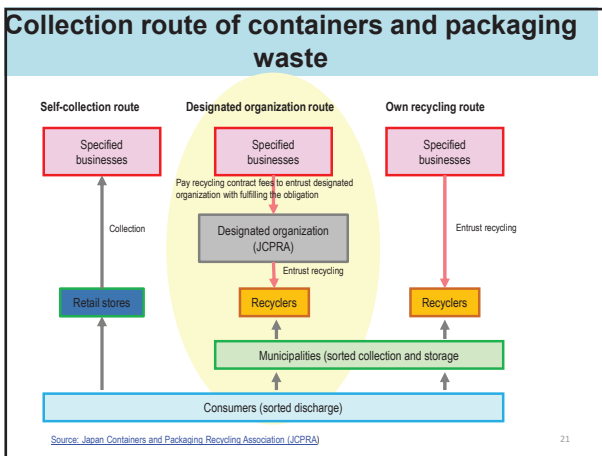
18



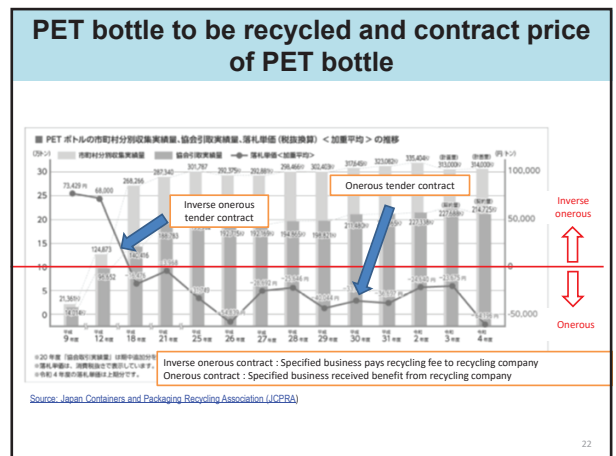
19



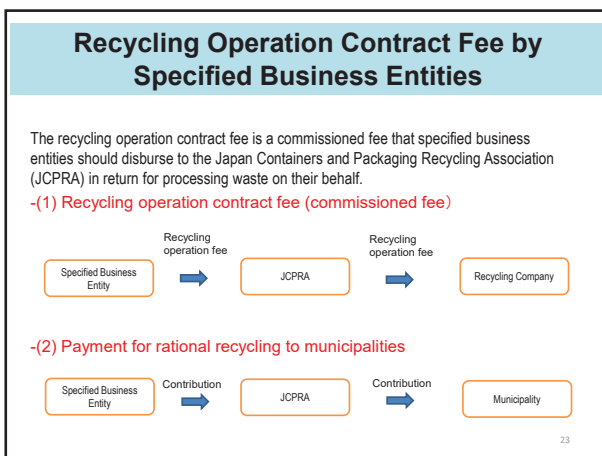
20



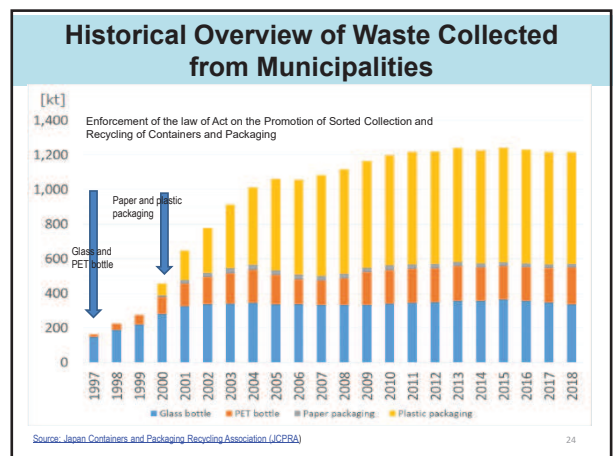
21



22



23



24

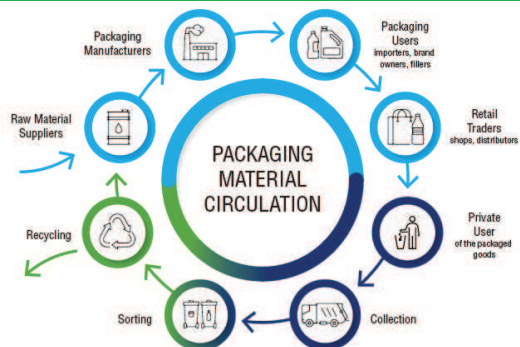
How we can prepare EPR guideline

- Identification of target waste for EPR introduction
- Consultation/coordination with concerned governments and producers/importers/traders association
- Identification of possibilities of recycling market
- Establishment of concept and strategy of the target waste to circulate
- Promotion of utilization of recycled product
- Establishment of coordinating/implementation association of EPR activities.

25

25

Circulation of packaging materials



26

26

Waste Management System And Recycling Market For Plastic Packaging Waste In Bangladesh

- High-value recyclable packaging is already separated from household waste and transferred to recycling systems
- Low-value packaging and non-recyclables are mostly disposed of and collected together with other municipal waste. So far, there is no systematic separation and recycling of the low-value recyclables.
- The recycling capacities are insufficient and informal

27

27

How to implement EPR in Bangladesh (No.1)

- Put EPR on the political agenda
- Establish a legal framework of a mandatory EPR system and strengthen an institutional framework
- Initiate effective, goal-oriented discussions with all stakeholders involved
- Create an in-depth and aligned understanding of the situation and its associated root-causes
- Alternative regulatory solutions should be explored and improvements in packaging waste management utilized, which would benefit EPR once implemented.
- The establishment of voluntary, industry-driven initiatives to gain country-specific experiences.

28

28

How to implement EPR in Bangladesh (No.2)

- To discuss what kinds of monitoring and enforcement mechanism are needed to ensure proper operationalization.
- Clear definition of roles and responsibilities of all stakeholders in the system involved as well as an clear legal framework.
- Establishment of a systematic and reliable institutional structure for management of packaging waste regardless of its value, and the value chain and recycling industry.
- To build on existing initiatives, pilots and programs and to cooperate with businesses

29

29

1

**Advisor on Environment Management
in Bangladesh**

Interactive Training Workshop on SWM

**Capacity Building on the emission monitoring
(land, water & air) for Waste Treatment and Disposal**

21st December 2022
DOE Climate Change & International Convention Wing
/JICA Expert Team

1

2

Contents

- Capacity Building on the Emission Monitoring
- Provision of Environmental Management in SWM Rules
- Puzzle on SWM
- Feedback of this Training Workshop

2

3

**Capacity Building on the Emission Monitoring
under the CBIT Project**

Md. Mahmud Hossain
Deputy Director (Climate Change), DoE &
Project Director, CBIT Project

21 December 2022

3

4

Presentation Outline

- Overview of the Project
- Major Outputs of the Project
- National GHG Inventory: Focusing Waste Sector
- Emission Data Monitoring System

4

5

Overview of the Project

Project Title	: Strengthening Capacity for Monitoring Environmental Emissions under the Paris Agreement in Bangladesh (Commonly known as the CBIT project)
Project Duration	: January 2020 to January 2023
Funding Source	: Global Environment Facility (GEF)
Total Budget	: 733.76 lakh (in BDT) [0.86 million US\$]
Implementing Agency	: Department of Environment (DOE)
Development Partner	: Food and Agriculture Organization (FAO)

5

6

Overview of the Project.....Contd.

Background

- Meet **Enhanced Transparency Framework (ETF)** under the Paris Agreement (**Article 13**)
- Strengthen institutional and human capacities** to report on NDCs, especially GHG emissions, mitigation, and adaptation activities (**Article 11**)

6

7 Overview of the Project.....Contd.

Overall Objective

To **strengthen institutional and human capacities** in Bangladesh to meet the Enhanced Transparency Framework (ETF) of the Paris Agreement and **track the progress against priority mitigations and adaptations actions** identified in the NDC focusing on **Energy, IPPU, AFOLU, and Waste** sectors.

7

8 Overview of the Project.....Contd.

Project Components

- Strengthened national institutional arrangements and capacities to enhance MRV transparency in line with NDC activities
- Strengthened technical capacity to assess the emissions and removals, and monitor mitigation activities of NDC
- Strengthened capacity to monitor and report adaptation activities in support of NDC

8

9 Overview of the Project.....Contd.

Project Outcomes

- Institutional arrangements** for data collection and sharing, archiving and reporting strengthened focusing on AFOLU, Energy, IPPU and Waste sectors.
- Monitoring and reporting** the progress of the adaptation actions.
- Best practice ETF reporting process**, information gathering, system infrastructure and module sharing.
- Reporting on inventories of emissions sources and sinks and monitoring of mitigation activities** strengthened.

9

10 Major Activities of the Project

- Establish an online MRV Platform for data collection, data analysis, and UNFCCC reporting
- Institutional arrangement with Key Stakeholders for regular GHG, Adaptation & Mitigation related data collection
- Prepare GHG and Environmental Emission Database System
- Strengthen IT Infrastructure of DoE
- Strengthen GIS Lab of DoE
- Conduct 34 Trainings and 08 Stakeholder Consultations with relevant stakeholders
- Develop ETF Roadmap
- Organize Workshop on BTR Roadmap, Adaptation Monitoring Indicator and Data Collection Template
- Preparation of Communication Materials

10

11 National GHG Inventory

- Energy**
- IPPU (Industrial Process and Product Use)**
- AFOLU (Agriculture, Forestry and Other Land Use)**
- Waste**

11

12 Sector-wise Key Stakeholders

Sector	Stakeholders	Sector	Stakeholders
Agriculture, Forestry and Other Land Use (AFOLU)	1. Department of Agricultural Extension,	Industrial Processes and Product Use (IPPU)	1. Bangladesh Chemical Industries Corporation
	2. Bangladesh Bureau of Statistics		2. Bangladesh Steel & Engineering Corporation
	3. Bangladesh Livestock Research Institute		3. Bangladesh Chemical Manufacturing Association
	4. Department of Livestock Development Institute		4. Bangladesh Agro-Processors' Association
	5. Soil Research		5. Bangladesh Paper Mill Association
	6. Bangladesh Livestock Research Institute		6. Bangladesh Glass Merchant Association
	7. International Rice Research Institute		7. Bangladesh Ceramic Manufacturers & Exporters Association
	8. Forest Department		8. Bangladesh Ceramic Society
	9. Bangladesh Cement Manufacturers Association		

12

13 Sector-wise Key Stakeholders.....contd.

Sector	Stakeholders	Sector	Stakeholders
Power and Energy	1. BPC	Waste	1. Dhaka North City Corporation
	2. Power Cell		2. Dhaka South City Corporation
	3. BPD8		3. Rajshahi City Corporation
	4. Rural Power Company Ltd.		4. Barisal City Corporation
	5. North-West Power Generation Company Ltd.		5. Khulna City Corporation
	6. Electricity Generation Company of Bangladesh		6. Rangpur City Corporation
	7. Ashuganj Power Station Company Ltd.		7. Sylhet City Corporation
	8. Petrobangla		8. Gazipur City Corporation
	9. BAPEX		9. Narayanganj City Corporation
	10. Ittas Gas		10. Chittagong City Corporation
	11. Energy and Mineral Resource Division		11. Comilla City Corporation
			12. Mymensingh City Corporation
			13. Dhaka WASA
	14. Chittagong WASA		

#Total 42 GHG emission and mitigation data providers
#No. of organization will be increased if adaptation actions are considered (private sectors & NGO)

13

14 IPCC Guidelines for National GHG Inventory

14

15 2006 IPCC Guidelines for National GHG Inventory

15

16 IPCC Good Practice Guidance

This report (2000) provides guidance to assist countries in producing inventories that are neither over nor underestimates so far as can be judged, and in which uncertainties are reduced as far as practicable.

16

17 IPCC Methodological Tiers

A tier represents a level of methodological complexity. According to IPCC-

Tier 1:
A simple first order approach that uses spatially coarse default data based on globally available data characterized by large uncertainties and sometimes with methods involving several simplifying assumptions.

Tier 2:
A more accurate approach substituting country or region-specific values for the general defaults and more disaggregated activity data characterized by relatively smaller uncertainties.

Tier 3:
Higher order methods involving detailed modeling and/or inventory measurement systems driven by data at a greater resolution that provide estimates with lower uncertainties than the previous two methods.

17

18 List of Greenhouse Gases (GHGs)

Greenhouse gases are covered in the IPCC 2006 guideline

Carbon Dioxide (CO ₂)	Obligated to Report
Methane (CH ₄)	
Nitrous Oxide (N ₂ O)	
Hydrofluorocarbons (HFCs)	Encourage to Provide
Perfluorocarbons (PFCs)	
Sulphur hexafluoride (SF ₆)	
Nitrogen Trifluoride (NF ₃)	
Trifluoromethyl Sulphur Pentafluoride (SF ₅ CF ₃)	
Halogenated Ethers	
Other Halocarbons	

18

19 Emission Sources from Waste Sector

Methane (CH4) emission
from municipal solid waste (MSW) disposal

Methane emission
from domestic waste-water

Methane emission
Emission from Industrial waste-water

Nitrous Oxide (N2O)
Emissions from Domestic waste-water

Emission Sources from Waste Sector

19

20 Reporting Table: National GHG Inventory

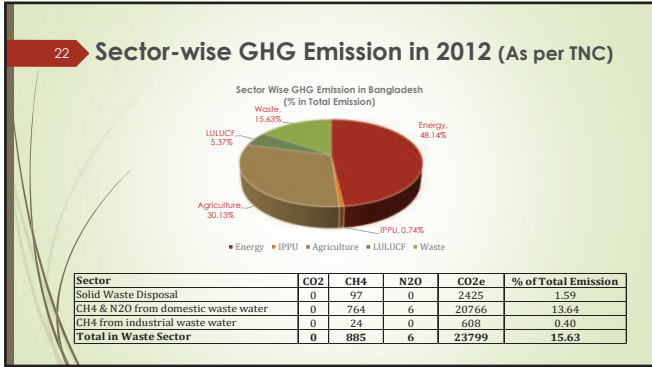
Greenhouse gas source and sink categories	Emissions (Gg)		
	CO ₂ Emissions (Gg)	CH ₄ Emission	N ₂ O Emission
Total National Emissions and Removals			
1 - Energy	69867.27	93.18	3.60
1.A - Fuel Combustion Activities	69867.27	93.18	3.60
A - Electricity Generation	29130.01	0.57	0.08
B - Manufacturing Industries and Construction	30018.41	1.35	0.20
C - Transport	8441.99	89.87	3.35
D - Other Sectors	12276.85	1.40	0.06
2 - Industrial Processes and Product Use	1121.13		
2.A - Mineral Industry	674.61		
A - Cement production	674.61		
2.B - Chemical Industry	446.51		
A - Ammonia Production	446.51		
3 - Agriculture		536.86	
A - Enteric Fermentation		536.86	
B - Manure Management		123.04	17.14
C - Rice Cultivation		603.55	
D - Direct Nitrous Oxide (N ₂ O) from Fertilizer application			17.62
E - Indirect Nitrous Oxide (N ₂ O) emissions from N based fertilizer			5.73

20

21 Reporting Table: National GHG Inventory

Greenhouse gas source and sink categories	Emissions (Gg)		
	CO ₂ Emissions (Gg)	CH ₄ Emission	N ₂ O Emission
F - Total Indirect N₂O Emissions - Volatilization			5.79
G - Total Indirect N₂O Emissions - Leaching/Runoff			1.67
3.B - Land-use Change and Forestry			
A - CO ₂ emission from soil	3247		
B - Conversion of forest land to other land use	561.53		
C - CO ₂ emission due to fuel wood removal for consumption	4,368		
4 - Waste		97	
A - Solid Waste Disposal		97	
B - Methane emission from domestic waste water		764	
C - Nitrous Oxide Emission from Domestic wastewater			5.59
D - Methane emission from industrial waste water		24.31	
Memo Items (M)			
International Bankers	601.05	0.006	0.037
A - International Aviation (International Bankers)	577.68	0.004	0.037
B - International water-borne navigation (International Bankers)	23.37	0.002	0.001
Memo Items			
CO ₂ from Biomass burning for Energy purpose	53837.92		
Total CO₂e emission from all sources in Gt/grams	152269		
Total CO₂e emission from all sources in Million Tons	152.27		
Total Aboveground Biomass Carbon Stock in Million Tons as per Major National Land Use Categories (NLUC)	-378.98		

21

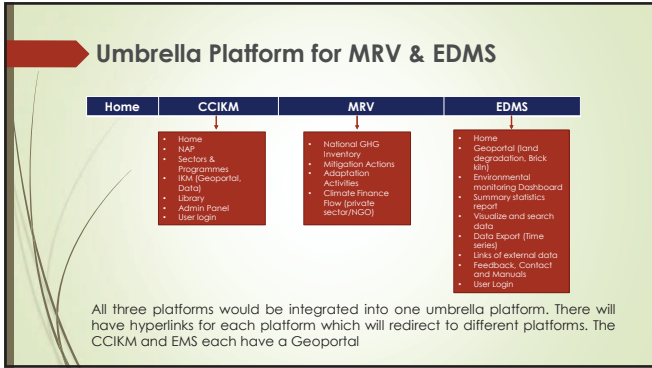


22

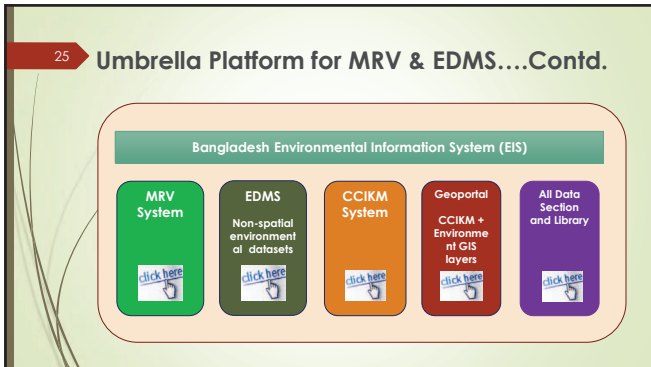
23 Waste Sector Data Collection Template

EA - Solid Waste Regional Data (EWRS) for	Category code	Activity data	Unit	Activity description
Name of the category as indicated in the 2006 IPCC Guidelines		Mass of the waste/stockpile of a business activity/industry or agricultural/other sector of land use		Any additional information and definition that would help data providers to deliver correct data
Solid Waste Disposal (CH4)	4A1, 4A2, 4A3	Mass of waste deposited	Gg	If data is not available, it can be estimated based on total population and a waste per capita rate. It is necessary to include data that is not included in the IPCC Guidelines (4A2) and (4A3) only.

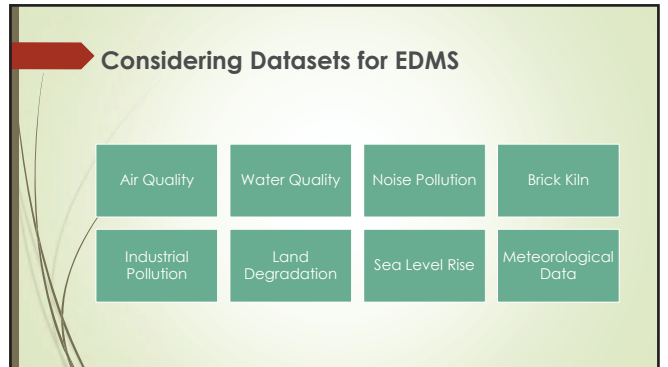
23



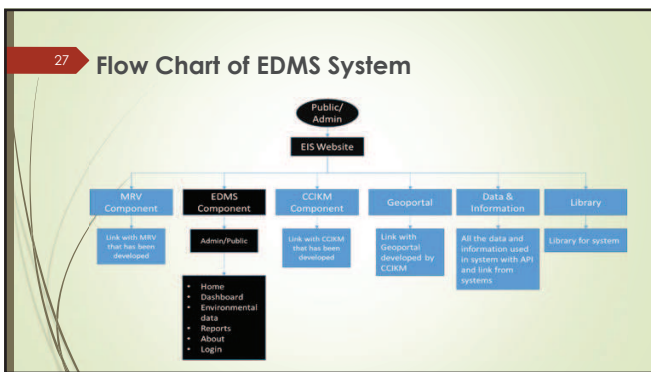
24



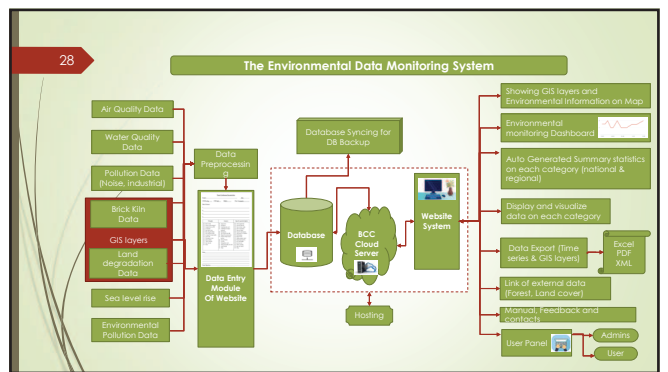
25



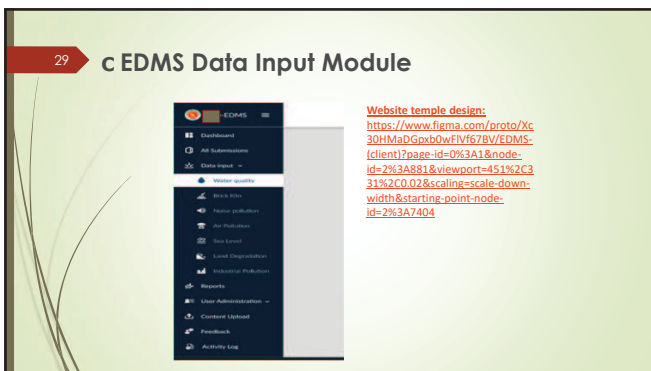
26



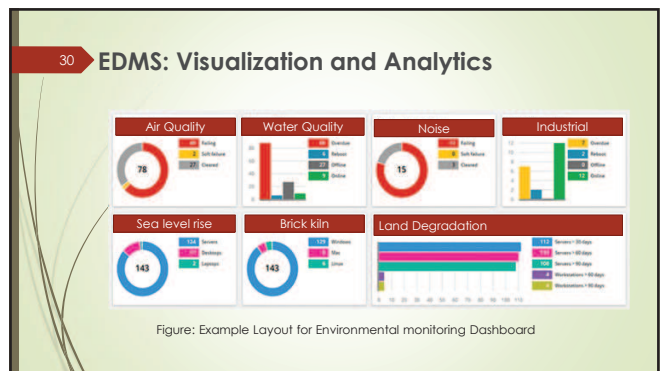
27



28



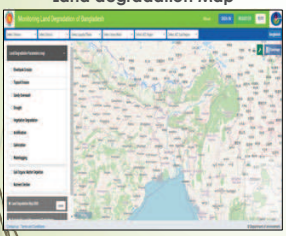
29



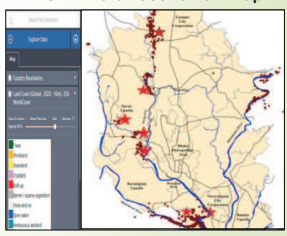
30

31 **EDMS: Visualization and Analytics**

Land degradation Map



Bricklin Data Location on Map



31

32 **Features of EDMS System**

- Auto Generated Summary statistics on each category (national & regional)
- Display and visualize data
- Downloadable data (time series and geospatial) with different format
- Link with external data (Forest, Land cover) any all related data and links
- Manual, Feedback and FAQ will also be integrated
- GIS Layers and Environmental Data/Information
- Environmental Monitoring Dashboard
- User Panel Access

32

33

Provision of Environmental Management in SWM Rules

33

34 **EIA Requirement**

- Solid waste management facility such landfill site and/or Waste to Energy facility is red category as per ECR 1997
- IEE/EIA must be done
- Based on IEE, prepare the ToR for EIA – Get site clearance
- Prepare EIA or ESIA
- Prepare EMP and Environmental Monitoring Plan
- Get EIA approval and Environmental Clearance
- EC renewal/Implement EMP/Environmental Monitoring Plan

34

35 **Environmental Monitoring**

Issue	Description
Site selection	(A) Environmentally Critical Areas (ECA), Protected Areas, Sanctuary, Declared Environmentally Sensitive Areas and Flood Land shall not be allowed for landfill project (B) Life span of landfill should be at least 20-25 years and can be used phase by phase by making "landfill cells". (C) Solid waste processing & disposal site should have capacity of more than 5 tons, buffer zone should be kept around the waste area where no development activities can be undertaken
Distance	(A) Landfill shall be more than 200 meters from rivers, wetlands, ponds. (B) 250 meters from the residential development project. (C) 500 meters from national highways, residential areas, public parks and water supply wells. (D) 3 km from the airport and airbase

35

36

Issue	Description
Environmental pollution control	(A) Storm water drain should be constructed and surface water contamination should be prevented. (B) Non-permeable lining system shall be placed in the side and bottom of the disposal area. By placing 1.5 mm thick HDPE geo-membrane or geo-synthetic liner or equivalent liner and over 90 cm thick soil (mud or modified soil) or composite liner with permeability co-efficient of less than 1×10^{-7} cm/sec. (C) Ground water level shall be at least 2 m below the level of mud or modified soil barrier. (D) There should have leachate collection and treatment system, leachate cannot be discharged into the open environment
Water quality	(A) The quality of ground water in the area should be collected and monitoring data should be stored as a baseline reference before landfill is set up. Within 50 meters of the periphery of the landfill area, the quality of groundwater should be routinely monitored for different seasons of the year; summer, monsoon and post-monsoon. Such monitoring should ensure that groundwater is not contaminated by landfill activities.

36

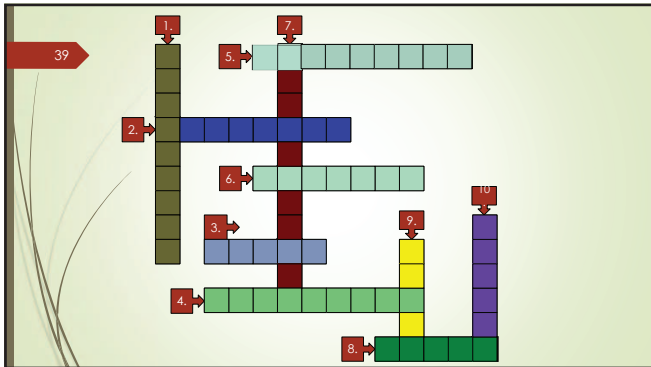
37

Issue	Description
Air quality	<p>(1) Gas control system including collection of gas shall be installed at the landfill site to reduce the emission odor in the landfill, to prevent the spread of gas</p> <p>(2) The concentration of methane gas produced from landfill shall not exceed 25% of the minimum combustible level in any case.</p> <p>(3) Landfill gas shall be used in thermal process or power generation on the basis of facilities. Otherwise the landfill gas must be burned and it cannot be exposed directly to the air or trapped illegally.</p> <p>(4) The quality of the ambient air in the landfill and its surroundings should be monitored regularly.</p>

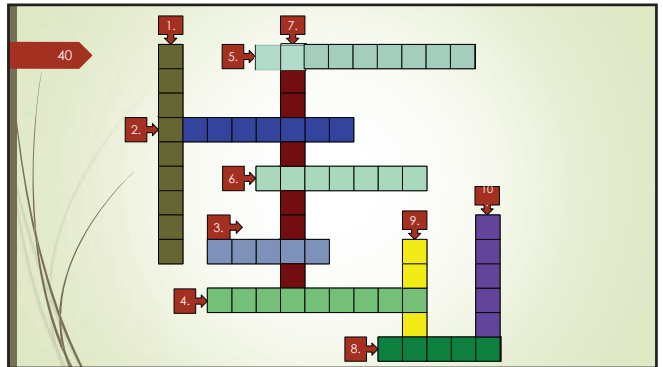
37

- PUZZLE
- 38
- (1) The material which spoils our Environment, we need to control it before discharge (9). Starts with P
 - (2) The ultimate place where we deposit our wastes (8). Starts with L
 - (3) We use it in our daily life and has a recyclable value, if we reduce the use we can save our trees (3). Starts with P
 - (4) It is a household hazardous material, we use it in our mobile phones, clocks, cameras etc. It contains heavy metal, please do not throw it with general waste (9). Starts with B
 - (5) It is limited, we need to be judicious in using it (9). Starts with R
 - (6) We can make it from waste and can use it (7). Starts with C
 - (7) Where we live, we need to protect it (11). Starts with E
 - (8) Think before discharge, We can save our resources, if we use it again and again (5). Starts with R
 - (9) By throwing, **We Are Spoiling The Environment. Wise Approach to Sustainability through Technological Excellence** (5). Starts with W
 - (10) Choosing to use thing with care and thus generate less waste (6). Starts with R

38



39



40

41

**Thank You
for
Your Active Participation**

41

添付資料 4

廃棄物管理

第2回ワークショップ資料

**Agenda of 2nd Interactive Training Workshop on SWM in
“JICA Advisor on Environmental Management in Bangladesh”**

Time: 9:30 am

Date: 20th, July 2023

Venue: DoE head office (a hybrid of a face-to-face meeting in the 2nd-floor auditorium room of DoE and a remote meeting by Zoom)

1. Background

The first training workshop discussed the issues and possible solutions of SWM in Bangladesh, including the details of SWM Rules 2021. Through the discussion, it has been identified that the actual implementation of SWM Rule (2021) such as SWM plan and annual report to be prepared by each local government authorities is significant. Therefore, in this second training workshop, the preparation of SWM plan and its implementation and will be discussed. In addition, the annual reporting process, the data generation and data compilation will be advised.

2. Objectives

The main objectives of the workshop are as follows;

- I. To share the knowledge and experience of preparation of Solid Waste Management Plan and its implementation process with the concerned governmental officers through interactive discussion, and
- II. To share how to prepare the annual report and the data generation for reporting including data compilation through this training.

3. Draft Agenda of the Training Program

Time	Content	Speaker	Time expected
9.30-10:00	Registration		30 min
10:00 - 10:05	Welcome speech by DOE	Director, WCM of DOE	5 min.
10:05 - 10.10	Welcome speech by JICA	JICA Representative, JICA Bangladesh Office	5 min.
10.10 -10.25	Project Brief and Summary of the identified issues by JET	Kengo Naganuma, Chief Advisor, JICA Expert Team	15 min.
10:25-10:35	Summary of Previous Training Workshop and Purpose of Training Workshop	Satoshi Higashinakagawa, Solid Waste Management Expert, JICA Expert Team	10 min.
10.35 -10.55	Snacks Break		20 min
10:55-11:05	Explanation of Solid Waste Management Plan and Annual Report required by SWM Rule (2021)	Dr. Mamun WCM, DOE	10 min.
11:05- 11:15	Guide to Solid Waste Management	Satoshi	10 min.

Time	Content	Speaker	Time expected
	Planning and Annual Reporting based on Japan Experience	Higashinakagawa, Solid Waste Management Expert, JICA Expert Team	
11:15 - 11:35	Explanation of preparation of DNCC/DSCC SWM M/P and its implementation	Mr. Abul Hasnat Md. Ashraful Alam, Superintending Engineer, DNCC	20 min.
11:35 - 12:15	Group discussion about (1) how to prepare SWM Plan and (2) how to prepare annual report, the data management and reporting system	2 groups discussion separately for all participants (MC by Dr Tariq, JICA Expert Team & Mr Maruf , Asst. Director, DOE)	40 min.
12:15- 12:25	Presentation from the Group on preparation of SWM plan & Annual Reporting including summarization	Representatives of group of (1),	10 min.
12:25 - 12:35	Presentation from the Group on preparation of SWM Plan & Annual Reporting including summarization.	Representatives of group of (2)	10 min.
12:35 - 12:55	Presentation on the new proposals based on the identified issues (by JET)	Kengo Naganuma, Chief Advisor, JICA Expert Team	20 min
12:55 - 13:05	Proposal for further assistance from international donor	Dr. Mamun WCM, DOE	10 min.
13:05 - 13:15	Open discussion on the new proposals (by JET and DoE)	JET and DoE	10 min
13:15 - 13:25	Remarks from JICA Representative	JICA Representative, JICA Head Quarter	10 min.
13:25 - 13:35	Remarks from Chief Guest	Secretary, MOEF&CC	10 min.
13:45 - 13:55	Closing Remarks	Director General, DOE	10 min.
13:55-	Lunch	All participants	

4. Participants

I. Bangladesh Side

The tentatively expected participants are described in Attachment-1.

II. Japanese Side

JICA Headquarter, JICA Senior Advisor, JICA Bangladesh Office, JICA Expert Team

Attachment-1

Expected Participants:

Main Target participant

DOE (Waste & Chemical Management wing)- 5, DOE (Natural Resource Management Wing)- 1 or 2, DOE (Monitoring & Enforcement wing)-1, DoE (Planning Wing)- 1, DoE (Climate Change and International Convention Wing) - 1, DoE (Air Quality Management) –2, DOE (Dhaka Metropolitan)-2, DOE (Dhaka District)-1, DOE (Chattogram Metropolitan)-2, DOE

(Chattogram district)-1, Narayangonj DOE/NCC- 1+1, Gazipur DOE/GCC-1+1, Munshigonj DOE/
Paurashava- 1+1, Narshindi DOE/ Paurashava 1+1,ManikganjiDOE/ Paurashava 1+1,
DNCC/DSCC -1+1, CCC-1, Cumila DoE/CuCC – 1+1.
Ministry of Environment, Forest & Climate Change (MOEF&CC) -1, Local Government Division
(LGD)-1, Local Government Engineering Department (LGED)-1, Department of Public Health
Engineering (DPHE)-1,
Representatives from WB, ADB and GIZ

End of Document

**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Solid Waste Management (SWM)

Session 1: Project Brief and Summary of the Identified Issues by JET

20th July 2023

JICA Expert Team

1

1

1. Background, Project Outcomes and Period

Background

- MOEFCC requested JICA to conduct capacity development for the Department of Environment (DoE) in water environmental management and solid waste management sectors in April 2021.
- JICA appointed an expert team to commence the technical assistance (TA) named "Advisor on Environment management in Bangladesh".

Objective

- Output 1: To identify priority issues to be addressed on environmental management** of (i) water pollution control and (ii) SWM, and
- Output 2: To identify the expected actions for environmental management capacity development by DoE** on (i) water pollution control and (ii) SWM, related to (a) legislative enforcement, (b) institutional capacity development, and (c) cooperation with relevant organizations.

Project Period November 2021 to November 2023

2

2

2. DoE Managers and JICA Expert Team

(1) DoE

Position	Name, Section and Position etc.
DG of DoE	Dr. Abdul Hamid
ADG of DoE	Mr. Kazi Abu Taher
Project Director (Focal Person)	Ms. Syeda Masuma Khanam, Director of Natural Resource Management Wing
Relevant managers participating in the Project in HQ of DoE	Mr. Mohammed Solaiman Haider, Director of Planning Wing Mr. Md. Hasan Hasibur Rahman, DD of Planning Wing Ms. Razinara Begum, Director of Waste and Chemical Management Wing Dr. Abduljabbar Mamun, DD of Waste and Chemical Management Wing Mr. A.K.M. Rafiqul Islam, DD of Natural Resource Management Wing Mr. Mohammad Masud Hasan Patwari, Director of Enforcement and Monitoring Wing Mr. Syed Ahmmad Kabir, DD of Enforcement and Monitoring Wing Mr. Masud Iqbal Md. Shameem, Director of Env. Clearance and Certificate Wing
Chattogram DoE	Mr. Hillol Biswas, Director, Chattogram Metropolitan Ms. Nasim Farhana Shirki, Director, Chattogram Laboratory Mr. Kamrul Hasan, Deputy Director, Chattogram Lab.

(2) JET

Position	Name
Team Leader / Environmental Management	Mr. Kengo Nagayama
Water Pollution Control	Mr. Shinji Tanaka
Solid Waste Management	Mr. Satoshi Higashinakagawa
Local Experts	Mr. ABM Sadique Rahman Dr. Tang Bin Yousef Mr. Md. Al Musabbir Hossen

3

3

3. Output-1: Implemented Activities

4

4

4(1). Contents of 1st Workshop on Water Pollution Control (1st February 2023)

Name of Session	Contents
Session 1 General concept of the wastewater treatment	- Presented biological action in the water, nitrogen cycle, sources of water pollution - Discussed about the Coordination system in Japan, DoE inspection procedure for pollution control and challenges
Session 2 Basics of a wastewater treatment (ETP) technique 1 – Screen/Physical Treatment	- Design checking system in DoE is only during EIA - ETP operational issue: during inspection it is checked whether ETP in operation or not, dosing etc.
Session 3 Basics of a wastewater treatment (ETP) technique 2 – Biological treatment	- Explained biological treatment: aerobic and anaerobic, nitrogen cycle, aeration tank, HRT, activated sludge process, MBBR, MBR, SBR, etc. - Latest technology like MBBR, MBR, SBR are also currently using in Bangladesh and DoE is aware about those technology - Observed condition through inspection by DoE - Environmental Clearance Certificate on design of ETP
Session 4 Introduction of the emitter registration system in Japan	- Discussed for comparison of Japanese and Bangladesh environmental protection legal system - In Japan, equal or more than 50m ³ /day of wastewater are responsible to maintain their treatment facilities, but in Bangladesh, not based on capacity of industry but on types and category - Licensed Environmental expert should be assigned as environmental manager for each industry in Japan, but Bangladesh does not have this system - Limitation in Bangladesh is mainly weakness of mechanism for reflecting policy, high population density, less human resource and logistic in DoE, lack of awareness on environmental issues

5

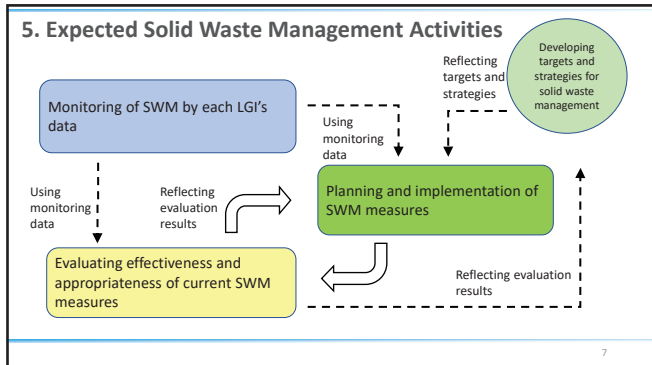
5

4(2). Contents of 1st Workshop on Solid Waste Management (21st December 2022)

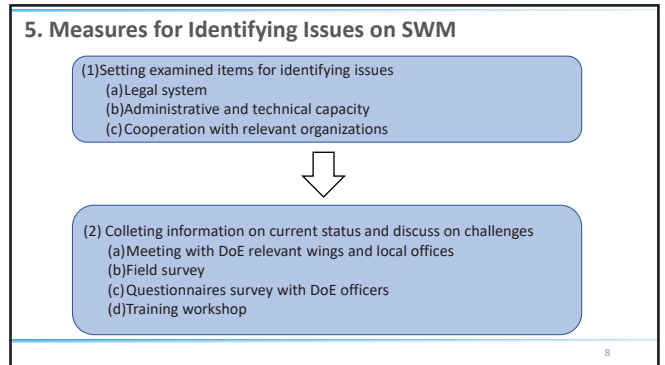
Name of Session	Contents
Session 1 General concept of the SWM and Introduction of the current situation in Bangladesh (including the brief introduction of SWM Rule)	- Understand the general concept of SWM - Share the information of current situation of SWM in Bangladesh
Session 2 Introduction of policy & institutional system of SWM in Bangladesh & Japan	- Explanation of SWM Rule [2021] - Law and regulation system of each type of waste in Japan
Session 3 Preparation of SWM plan and annual report by LGI and facilitation by DOE	- Discussion on necessity of SWM plan and annual report by LGI, and brief explanation of the case of Japan
Session 4 Introduction of EPR system of container and packaging waste in Japan and how it can be introduced in Bangladesh	- Explanation of current plastic waste flow - Introduction of EPR system of packaging waste in Japan
Session 5 Capacity building on the emission monitoring (land, water & air) for waste treatment and disposal and feedback of all the session	- Capacity building emission monitoring - Necessary survey for monitoring

6

6



7



8

6. Identified Issues (1) – Legal System

Item	Current Status	Challenges
Municipal Solid Waste Management	- Solid Waste Management Rule (2021) has been formulated	<ul style="list-style-type: none"> To improve the SWM rule at suitable timing. To prepare guidelines of solid waste management planning for implementation of the SWM rule. To prepare guidelines of annual report of SWM for implementation of the SWM rule. To prepare the technical guidelines for collection, transportation, treatment and disposal related to solid waste management
Industrial Waste Management	- Environmental Conservation Act indicate polluter pay principals - Hazardous Waste (E-waste) Management Rules (2021) has been established - Medical Waste Management and Handling Rules (2008) has been established	<ul style="list-style-type: none"> To prepare law and regulations for each type of waste with consideration of EPR and/or polluters pays principal approach

9

6. Identified Issues (2) – Administrative and Technical Capacity

Item	Current Status	Challenges
Municipal Solid Waste Management	<ul style="list-style-type: none"> Difficulty of collecting the data of SWM National 3R Strategy has been formulated but there is no SWM plan at national level 	<ul style="list-style-type: none"> To improve the inadequate monitoring system To develop solid waste management plan at national level To develop the implementation system for actualizing an action plan of plastic waste management
Industrial Waste Management	<ul style="list-style-type: none"> Difficulty of monitoring of industrial waste There are rules of e-waste and hazardous waste 	<ul style="list-style-type: none"> To develop the efficient monitoring system To develop the treatment and disposal facilities for hazardous waste To develop the system of medical waste management

10

6. Identified Issues (3) – Cooperation with Relevant Organizations

Item	Current Status	Challenges
Municipal Solid Waste Management	<ul style="list-style-type: none"> DOE has five staff members in charge of SWM DOE is regulatory body of SWM Implementation body is Local Government Institutions (LGIs) with technical assistance of LGD, DPHE and LGED 	<ul style="list-style-type: none"> Lack of staff in charge in SWM in DOE Necessary of collaboration between DOE and LGD, LGED, DPHE as well as LGIs
Industrial Waste Management	<ul style="list-style-type: none"> There is no department specialized in the management and monitoring of hazardous waste No implementation system of E-waste management 	<ul style="list-style-type: none"> To develop monitoring and implementation system of industrial waste from each source through the cooperation with LGIs.

11

- ### 7. Items to be discussed
- ✓ Is there any other serious issues to be raised for improvement of solid waste management capacity of DoE?
 - ✓ Among the identified issues, which ones are considered as priority ones and how do you set the timeline of the proposed activities?

12

8. On-going and Further Activities in the Project (Tentative)

Month	On-going and Planed Activities (Tentative)
Jul. and Aug. 2023	<ul style="list-style-type: none"> • To hold two Workshops for discussing on the expected actions by DoE for enhancement on water pollution control and solid waste management. <ul style="list-style-type: none"> (a) WS on water pollution control by DoE officers and JET (b) WS on SWM by DoE officers and JET with Dhaka North and South City Cooperation (Note) With main objectives, in the WS on SWM, Dhaka city SWM MP will be disseminated. • To hold a Coordination Meeting to conclude the expected actions by DoE with DoE Managers and JET.
Sep. 2023	<ul style="list-style-type: none"> • To hold a Final Seminar to disseminate the expected actions by DoE to MOEFCC, JICA, and relevant organizations.
Nov. 2023	<ul style="list-style-type: none"> • To prepare a Project Completion Report for recording the Project outcomes.

13

**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Solid Waste Management

**Session 2: Summary of Previous Training Workshop
and Purpose of 2nd Training Workshop**


20th July 2023

JICA Expert Team

1

Contents of Program of Previous Workshop

- Session 1 General Concept of the SWM and Introduction of the current situation in Bangladesh (including the brief introduction of SWM Rule)
- Session 2 Introduction of policy & institutional system of SWM in Bangladesh & Japan.
- Session 3 Preparation of SWM plan and annual report by LGI and facilitation by DOE
- Session 4 Introduction of EPR system of container and packaging waste in Japan and how it can be introduced in Bangladesh
- Session 5 Capacity Building on the emission monitoring (land, water & air) for Waste Treatment and Disposal and feedback of all the session.



2

Session-1

General Concept of the SWM and Introduction of the current situation in Bangladesh (including the brief introduction of SWM Rule)

- 1. What is Solid Waste Management (SWM)?**
 - Explain the necessity of SWM from waste generation discharge minimization to 3R and final disposal
 - Explain the waste hierarchy of reduce, reuse, recycle, recovery, disposal
 - Explain the importance of waste minimization and segregation at source
- 2. What is the situation of SWM in Bangladesh?**
 - Basic law of solid waste management has been stipulated.
 - Review the current situation of solid waste management in Bangladesh
- 3. How to improve the situation of SWM in Bangladesh after presentation of Japanese cases**
 - Explain the historical trend and current situation of solid waste management in Japan
 - Discussion about the methods of collection, transportation, intermediate treatment and disposal

3

Session-2

Introduction of policy & institutional system of SWM in Bangladesh & Japan

- 1. Explain SWM Rules 2021 as basic solid waste management law in Bangladesh**
 - Explanation of roles of DOE, LGD, National Coordination Committee, LGIs and other organizations, public
 - Necessary activities to implement the rule including the preparation of SWM plan and annual report and to formulate EPR and to establish circular economy
- 2. Explain the Current Institutional System of SWM in Bangladesh**
 - Relation of the organization related to SWM including the national government such as DOE, LGD, LGED, MOH, etc and LGIs, etc
- 3. Explain the Historical Trend and Current Institutional System in Japan**
- 4. Discussed how to improve the Institutional & Regulatory System in Bangladesh**
 - Introduction of extended producer's responsibilities
 - Empowering conservancy inspectors for illegal activities of waste

4

Session-3

Preparation of SWM plan and annual report by LGI and facilitation by DOE

- 1. Solid Waste Management Plan required by SWM Rule (2021)**
 - Explanation of SWM Plan for LGIs described in SWM Rule (2021)
 - Introduction of contents of SWM Plan in case of Japan
- 2. Annual Waste Report required by SWM Rule (2021)**
 - Explanation of Annual Report required by SWM Rule (2021)
 - Brief introduction of contents of the annual report as case of Japan
- 3. Discussed How to implement the preparation of plan and annual report by LGIs and to summarize the report as national level**

5

Session-4

Introduction of EPR system of container and packaging waste in Japan and how it can be introduced in Bangladesh

- 1. Explain the system of plastic waste management system being prepared in Bangladesh**
 - Explanation of estimated current plastic waste flow
 - Necessary challenges and explanation of road map
- 2. Introduction of container and packaging waste system, especially plastic waste in Japan**
 - Explanation of stakeholders such as waste dischargers, collectors, recyclers and producers
 - Explanation of activities of each stakeholder in recycling flow in container packaging
- 3. Discussed how to implement plastic waste management by reflecting EPR concept in Bangladesh after the above explanation**

6

Session-5

Capacity Building on the emission monitoring (land, water & air) for Waste Treatment and Disposal and feedback of all the session.

1. Capacity Building on the Emission Monitoring

- Emission monitoring from solid waste management activities
- Calculation method, especially focused on GHG emission

2. Provision of Environmental Management in SWM Rules

- EIA requirement for Solid Waste Management Project
- Preparation of Environmental Management and Monitoring Plan

7

7

Summarize of the 1st Training Workshop and Objectives of 2nd Training Workshop

Summary of the 1st Training Workshop

- Current situation and various issues of current SWM situation in Bangladesh has been presented
- After the stipulation of SWM Rule (2021), necessary activities for its implementation has been discussed
- To share how to prepare the annual report and the data generation for reporting including data compilation through this training.

Main Objectives of the 2nd Training Workshop

- To share the knowledge and experience of preparation of Solid Waste Management Plan and its implementation process with the concerned governmental officers through interactive discussion
- To share how to prepare the annual monitoring report and to implement the data collection for reporting including data compilation.
- To consider the future actions to improve the Solid Waste Management in national level

8

8

**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Solid Waste Management

Session 3: Guide to Solid Waste Management Planning and Annual Reporting

20th July 2023

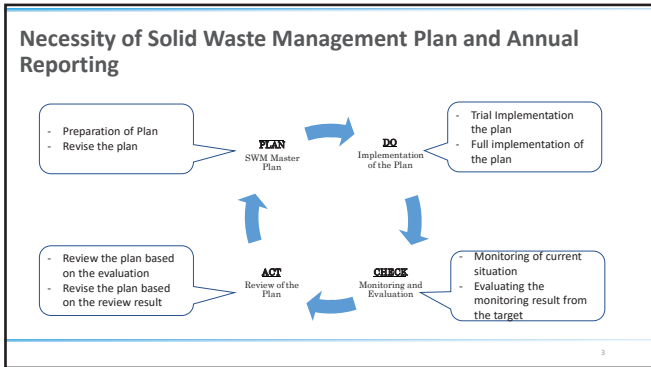
JICA Expert Team

1

Why it is necessary of preparation of planning and monitoring report of Solid Waste Management?

1. Planning
 - To Examine the current situation and identify the issues
 - To set the goal and vision for improve the situation of waste management
 - To estimation of future projection
 - To prepare the strategy and plan
 - To prepare implementation schedule and organization, budget, etc
2. Periodical Monitoring
 - To examine the current situation
 - To analyze the gap between current situation and plan
 - To revise the plan after the gap analysis

2



3

Why SWM Plan in Necessary? (Objectives)

SWM Plan shall be prepared satisfying the following objectives

- To clearly identify the issues / problems in current situation;
- To deeply consider and find the solution for those issues;
- To understand the goal and target commonly among concerned stakeholders;
- To clarify the strategic approach to attain the goal;
- To determine the effective actions, their timeline and milestone, necessary resource;
- To clarify the evaluation and monitoring procedure of the itemized actions to understand the progress.

4

What is the contents of SWM Plan?

- Title of SWM Plan;
- Background of SWM Plan;
- Identified Issues / Problems and their causes;
- Possible measures to solve above mentioned issues
- Related upper policy, law, regulation and upper / related plans;
- Concerned stakeholders;
- Goal to be achieved;
- Actions of solid waste management with concerned organization;
- Required duration and implementation schedule;
- Required budget and expenditure if any;
- Monitoring method

5

Solid Waste Management (SWM) Plan in Japan

- According to SWM basic law in Japan, every local authority has to prepare each SWM plan including SWM basic plan as the target year of 10 to 15 years and SWM implementation plan for each year.
- The direction for preparation of SWM basic plan has been prepared.
- The direction suggested the SWM basic plan should consider the following points
 1. Items to be analyzed for planning
 - (1) Profile of Local Authority
 - (2) Current situation of SWM (waste flow, SWM implementation structure, result of SWM, evaluation of SWM)
 - (3) Issues of SWM
 2. Planning
 - (1) Waste generation projection
 - (2) Future vision and target
 - (3) Strategy

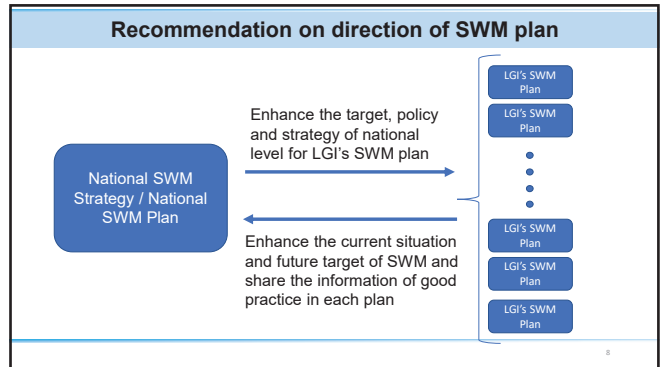
6

Solid Waste Management (SWM) Plan in Japan

Contents of the Plan of Solid Waste Management

1. Introduction (Background, Objective)
2. General condition of local authority (demographic trend, Industry trend, Other Plan)
3. Current Situation of Waste Management (Waste flow, Waste disposal system, Waste Disposal Result and evaluation, Issue Identification)
4. Waste management plan (Waste generation and disposal amount estimation, countermeasure for waste minimization, Types and classification of waste to be collected separately, waste treatment and its responsibilities, development of waste treatment and disposal facility, others)

7



8

Annual Report of SWM in Japan

- There is description of objectives of the annual report.
- The annual reports are respectively prepared for municipal solid waste and industrial waste
- Annual report of municipal solid waste is summarized by Ministry of Environment (ex. https://www.env.go.jp/recycle/waste_tech/ippan/r2/data/env_press.pdf)
- The data format (excel file) has been prepared and send to each local authority to be submitted by them.
- After the collection of the data from each local authority, the data of every local authority is summarized as annual report.
- After the preparation of report, it is publicized annually.

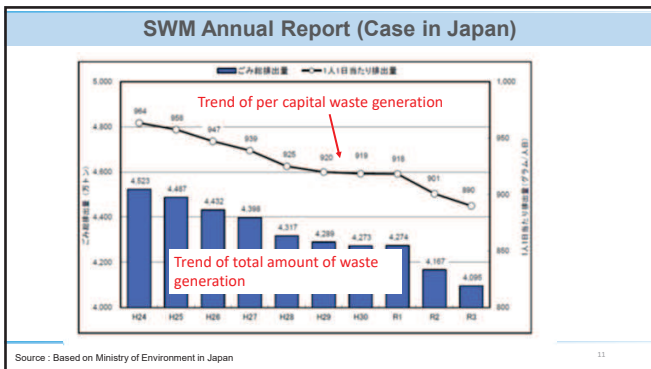
9

Data input and analysis for SWM Annual Report in Japan

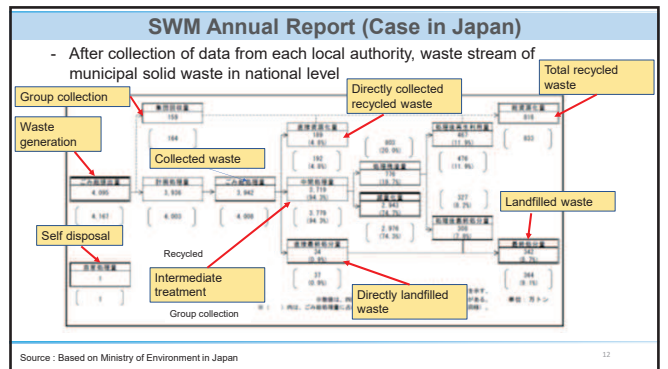
- Prepare the data format of excel sheet
- Input the data from each local authorities
- Analyze the data

Source : Based on Ministry of Environment in Japan

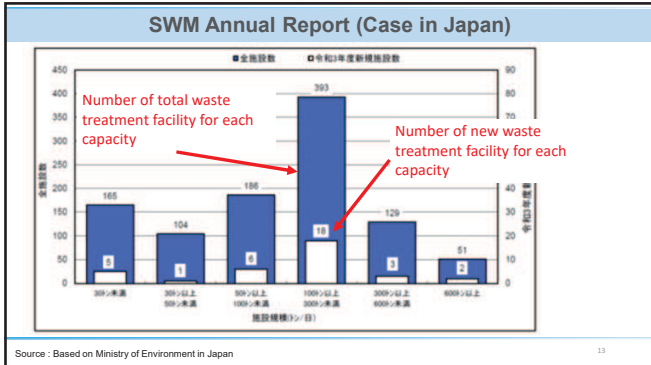
10



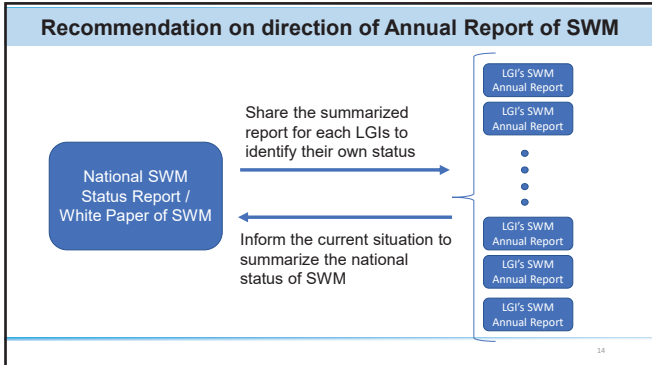
11



12



13



14

Session 4

Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City, and Chittagong City

NEW CLEAN DHAKA MASTER PLANS 2018-2032



Dhaka South City Corporation (DNCC)

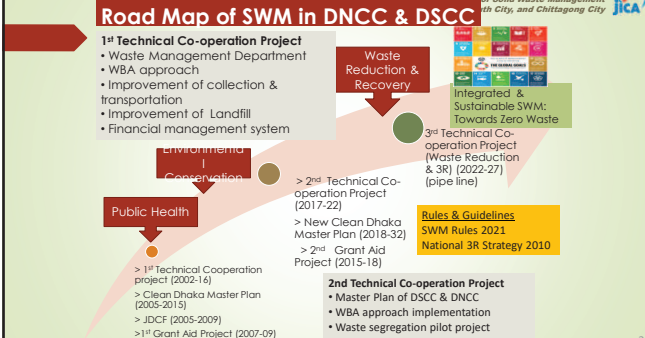
Dhaka North City Corporation (DNCC)

23 February 2020
JICA Project Team

1

Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City, and Chittagong City

Road Map of SWM in DNCC & DSCC



- 1st Technical Co-operation Project**
 - Waste Management Department
 - WBA approach
 - Improvement of collection & transportation
 - Improvement of Landfill
 - Financial management system
- 2nd Technical Co-operation Project (2017-22)**
 - New Clean Dhaka Master Plan (2018-32)
 - Grant Aid Project (2015-18)
- 3rd Technical Co-operation Project (Waste Reduction & 3R) (2022-27)**
 - Integrated & Sustainable SWM: Towards Zero Waste
 - pipe line
- 2nd Technical Co-operation Project**
 - Master Plan of DSCC & DNCC
 - WBA approach implementation
 - Waste segregation pilot project

Rules & Guidelines SWM Rules 2021 National 3R Strategy 2010

2

Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City, and Chittagong City

Experience from Clean Dhaka Master Plan

- Capacity Building
- Planning of Waste Management
- Decentralized SWM system (WBA, CUWG, PCSPs)
- Waste survey & Reporting System
- Operational & Maintenance capacity
- Weighbridge Data Management
- Financial Management system
- Landfill management
- Emission monitoring for waste treatment & disposal facility
- Collection & Transfer
 - Community participation & S/S pilot project
 - Improvement of waste transfer interface (Functionality, Capacity & working condition)
 - Outsourcing of street sweeping & transportation system

3

Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City, and Chittagong City

Waste Reduction & Recycling

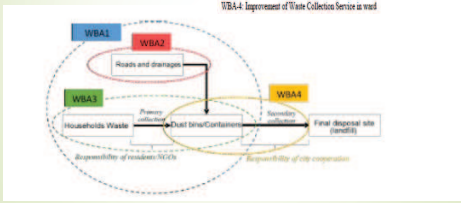
- PR Activities
- Recycling value chain analysis
- Formal & Informal sector integration
- Private financing including PPP business model
- Institutional**
 - Establishment of SWM Department
 - Enhance community engagement
 - Environmental education & public awareness program
 - Health & Safety of waste workers

4

Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City, and Chittagong City

Ward Based SWM Approach

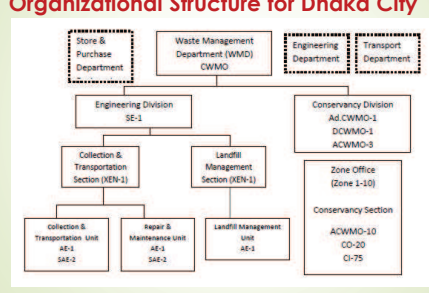
WBA-1: Construction & Management of Ward Office
WBA-2: Safety Education for Citizens & establishment of safety and sanitation committee
WBA-3: Public awareness raising
WBA-4: Improvement of Waste Collection Service in ward



5

Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City, and Chittagong City

Waste Management Department Organizational Structure for Dhaka City

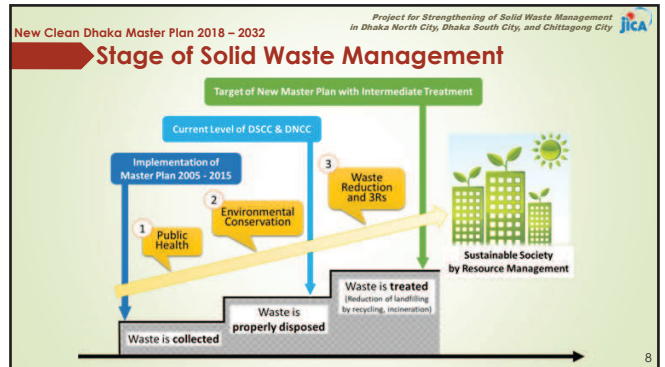


6

Project for Strengthening of Solid Waste Management
in Dhaka North City, Dhaka South City, and Chittagong City

New Clean Dhaka Master Plan 2018 – 2032

7



8

Project for Strengthening of Solid Waste Management
in Dhaka North City, Dhaka South City, and Chittagong City

New Clean Dhaka Master Plan 2018 – 2032

Present Condition

	DNCC	DSCC	Total
Waste generation	3,663 tons/day	2,847 tons/day	6,510 tons/day
Waste collection	2,930 tons/day	2,533 tons/day	5,463 tons/day (84 %)
Recycling	10 %	10 %	–
Intermediate treatment	Not yet introduced by City Corporations		
Landfill site	Amin Bazar LFS	Matuail FLS	–
Landfill disposal	73 %	80 %	–

9

Project for Strengthening of Solid Waste Management
in Dhaka North City, Dhaka South City, and Chittagong City

New Clean Dhaka Master Plan 2018 – 2032

Master Plan Targets by 2032

	Present	Target by 2032
Waste Collection	The extension area is not covered	100 % area coverage
Waste Reduction	0 % (No action)	12 – 13 %
Recycling	10 %	44 – 48 %
Landfill Disposal	73 – 80 %	29 – 33 %

10

Project for Strengthening of Solid Waste Management
in Dhaka North City, Dhaka South City, and Chittagong City

New Clean Dhaka Master Plan 2018 – 2032

Future Solid Waste Management in 2032

	Current	By 2032
Waste generation	6,510 tons/day	8,498 tons/day (DNCC: 4,763 tons/day, DSCC: 3,735 tons /day)
Waste collection	5,463 tons/day	7,649 tons/day
Landfill site	DNCC: Amin Bazar LFS DSCC: Matuail LFS	DNCC: New Amin Bazar LFS & New LFS at Nasirabad DSCC: New Matuail LFS
Intermediate treatment	None	Waste-to-Energy Plant, Recycling Plants etc.
Organization	Waste Management Department (WMD)	WMD Expansion with new sections (Intermediate treatment, PR, W&A)
Collection equipment	Various types (trucks, compactor etc.)	Mostly compactors

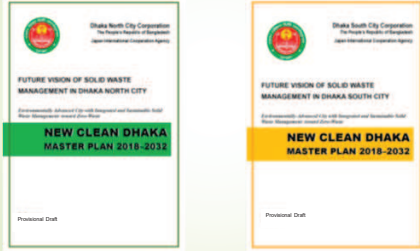
11

- Project for Strengthening of Solid Waste Management
in Dhaka North City, Dhaka South City, and Chittagong City
- ### New Clean Dhaka Master Plan 2018 – 2032
- ## Actions:
- Public awareness and community involvement
 - Mechanized street sweeping and drain cleaning
 - Modernized waste treatment
 - Intermediate treatment (Waste-to-Energy) and resource recovery
- ### Challenges

 - WMD staff shortage (vacancy posts)
 - Intermediate treatment plant operation, management organizational setup
 - Landfill site DPPs & Waste collection DPPs

12

Handing the Draft Master Plan to Hon. Minister



13

13

Thank you for your attention.

14

14

Session 5

Title: Prepare a Solid Waste Management Plan and Annual Reporting System

Group Work: 40 minutes Group presentation: 10 minutes (3/5 ppt slides)

This case study examines the development and implementation of a comprehensive solid waste management plan in a hypothetical city, referred to as City X. The aim is to showcase the key considerations, strategies, and actions involved in designing an effective waste management plan and also develop a annual reporting system of the activities.

City X is a medium-sized urban area (Municipality Class I) with a population of approximately 500,000 residents. The city has been facing significant challenges in waste management, including inadequate waste collection systems, limited recycling infrastructure, and improper disposal practices leading to environmental pollution. In response to these issues, the municipality has planned to develop a sustainable solid waste management plan. The waste management plan comprises a range of strategies and interventions to achieve the defined goals. These include:

- a. Waste Minimization: Encouraging waste reduction practices such as source segregation, composting, and promoting the use of reusable products through awareness campaigns and incentives.
 - b. Recycling and Resource Recovery: Enhancing recycling infrastructure, establishing recycling centers, implementing segregated waste collection systems, and collaborating with recycling industries to promote resource recovery.
 - c. Waste Collection and Transportation: Improving waste collection services through fleet management, and the introduction of modern collection equipment.
 - d. Waste Treatment and Disposal: Developing waste treatment facilities such as composting plants, anaerobic digestion units, and waste-to-energy plants to minimize the amount of waste sent to landfills. Ensuring proper landfill management, including landfill site selection, containment systems, and leachate management, landfill gas capture to mitigate environmental impacts.
 - e. Public Awareness and Education: Implementing educational campaigns, workshops, and community outreach programs to raise public awareness about waste management practices, waste segregation, and the importance of recycling
1. f. Implementation and Monitoring: The waste management plan has to be implemented in phases, with clear timelines and responsibilities assigned to different departments and agencies. Regular monitoring and evaluation has to be carried out to assess the plan's effectiveness, measure progress towards the

defined goals, and identify areas for improvement. Key performance indicators such as waste diversion rates, recycling rates, and citizen satisfaction surveys have to be carried out to track the plan's success.

2.

g. Results and Outcomes: The implementation of the solid waste management plan in City X yields significant positive outcomes. The city experiences a notable reduction in waste generation due to increased public awareness and waste minimization efforts. Recycling rates significantly improves as a result of enhanced infrastructure and efficient collection systems. The city's landfill usage decreases substantially, with a greater emphasis on waste treatment and resource recovery. Furthermore, the plan's success led to improved environmental conditions, reduced pollution, and enhanced overall quality of life for City X residents.

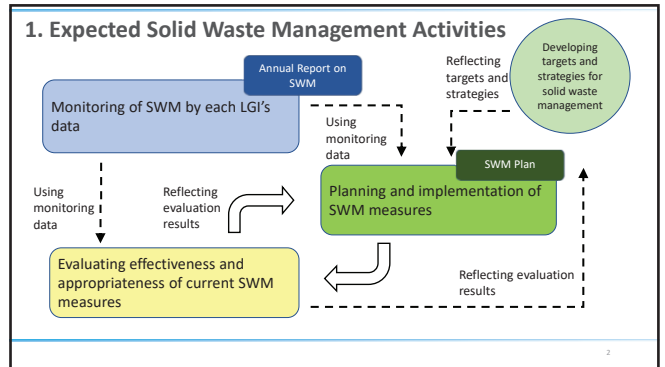
**Advisor on Environment Management
in Bangladesh**

2nd Interactive Training Workshop on Solid Waste Management (SWM)

**Session 6: Proposal on Expected Activities
based on the Identified Issues**

20th July 2023
JICA Expert Team

1



2

2. Proposed Activities (1) – Legal System

Item	Challenges	Possible Proposed Activities
Municipal Solid Waste Management	<ul style="list-style-type: none"> To improve SWM rule (2021) such as description of waste definition To guide preparation of SWM plans and annual reports by LGIs To guide suitable SWM from technical viewpoints 	<ul style="list-style-type: none"> To prepare guidelines of SWM planning for operation of the SWM rule To prepare guidelines for preparation of SWM annual report of SWM for operation of the SWM rule. To prepare technical guidelines for collection, transportation, treatment and disposal To revise the SWM rule as necessary based on the experiences obtained
Industrial Waste Management	<ul style="list-style-type: none"> To develop institutional systems for each type of industrial waste management To enhance EPR described in the SWM rule To adopt polluter pays principal approach 	<ul style="list-style-type: none"> To prepare law and regulations for each type of industrial waste with consideration of EPR and/or polluters pays principal

3

2. Proposed Activities (2) – Administrative and Technical Capacity

Item	Challenges	Possible Proposed Activities
Municipal Solid Waste Management	<ul style="list-style-type: none"> To improve insufficient monitoring systems To develop an SWM plan at national level To develop an administrative systems for operation of the action plan of plastic waste management 	<ul style="list-style-type: none"> To prepare guidelines for SWM planning in LGI level with setting national level goals and targets for SWM in Bangladesh, considering each LGI condition To establish administrative system for operation of plastic waste management action plan
Industrial Waste Management	<ul style="list-style-type: none"> To develop efficient monitoring systems To develop treatment and disposal facilities for hazardous waste To develop systems of medical waste management 	<ul style="list-style-type: none"> To consider suitable monitoring system such as manifest system to identify the generation source for examining proper treatment and disposal ways To prepare guidelines to construct hazardous and medical waste treatment and disposal facilities

4

2. Proposed Activities (3) – Cooperation with Relevant Organizations

Item	Challenges	Possible Proposed Activities
Municipal Solid Waste Management	<ul style="list-style-type: none"> Lack of staffs in charge of SWM in DOE Necessary of collaboration between DOE, LGD, LGED, and DPHE 	<ul style="list-style-type: none"> To develop materials for the national coordination committee. To strength cooperation among related ministries and agencies
Industrial Waste Management	<ul style="list-style-type: none"> To develop monitoring systems of industrial waste from each source. To examine the ways of enhancing local pollution sources control capacities by cooperating with local administrative bodies. 	<ul style="list-style-type: none"> To establish monitoring systems of industrial waste such as manifest or on-site monitoring with cooperation of LGIs To coordinates among DoE., the relevant ministries and LGIs through National Coordination Committee

5

- ### 3. Items to be discussed
- ✓ Is there any other activities to be conducted for improvement of SWM capacity of DoE and LGI?
 - ✓ How do you set the timeline for implementing the proposed activities?
 - ✓ What kinds of external support do you need?

6

添付資料 5

最終セミナー資料

Agenda of Final Seminar for “Advisor on Environmental Management in Bangladesh”

Time: 9:30 am

Date: 21st November 2023

Venue: DoE head office (a hybrid meeting with a face-to-face meeting in the 2nd-floor auditorium room of DoE and a remote meeting by Zoom)

1. Background

The JICA technical cooperation project named “Advisor on Environmental Management in Bangladesh” (the Project) will be completed at November 2023. Under the Project, a series of training workshops has been implemented, and the issues and solution for environmental management capacity development for DoE have been discussed. As per the schedule in the remaining period of the Project we have discussed, we plan to have an interactive seminar for presenting the findings obtained by co-work between DoE and JICA Expert Team through the Project and sharing the planned actions by DoE with relevant organizations for environmental management in water pollution control and solid waste management sectors.

2. Objectives

The main objectives of the workshop are as follows;

- (1) To share the activities of this advisory work including identified issues on water pollution control and solid waste management sectors, and
- (2) To discuss on expected actions by DoE in future for enhancing environmental management in water pollution control and solid waste management sectors

3. Draft Agenda of the Training Program

Time	Content	Speaker	Time expected
9:30 - 10:00	Registration and Snacks		30 min
10:00 - 10:05	Welcome speech by DoE	Director NRM	5 min.
10:05 - 10:10	Speech by DoE	Director WCM	5 min.
10:10 - 10:15	Speech by MoEFCC	Addl. Secretary	5 min.
10:15 - 10:20	Welcome speech by JICA	Representative from JICA Bangladesh Office	5 min.
10:20 - 10:35	Summary of activities in this advisory work by JET	Kengo Naganuma, Chief Advisor, JICA Expert Team	15 min.
10:35 - 10:50	Findings & recommendations from JET (Water pollution Control and Solid Waste Management)	Shinji Tanaka and Satoshi Higashinakagawa, JICA Expert Team	15 min.
10:50 - 11:05	Way Forward for Enhancement of Environmental Management by DoE	Representative of DOE	15 min.
11:05 - 11:35	Open discussion	-	30 min.
11:35 - 11:40	Remarks by JICA Representative	JICA Representative	5 min.
11:40 - 11:50	Closing Remarks	Director General, DOE	10 min.

4. Participants

(1) Bangladesh Side

The tentatively expected participants are described in Attachment-1.

(2) Japanese Side

Representatives of JICA

**Attachment-1: Expected Participants from Bangladesh Side for the Final
Seminar for the Project**

1. Secretary or additional Secretary of Development Wing, Ministry of Environment, Forest & Climate Change (MOEFCC)
2. Director General, DoE
3. Secretary Local Government Division, LGD (As a Chief Guest)
4. Director or Deputy Director, NRM Wing, DoE
5. Director or Deputy Director, WCM Wing, DoE
6. Director or Deputy Director, Monitoring and Enforcement Wing, DoE
7. Director or Deputy Director, Planning Wing, DoE
8. Director or Deputy Director, ECC Wing, DoE
9. Director or Deputy Director, Administration Wing, DoE
10. Director or Deputy Director, Dhaka Metropolitan, DoE
11. Director or Deputy Director, Dhaka Region, DoE
12. Director or Deputy Director, Dhaka Laboratory, DoE
13. Director or Deputy Director, Chattogram Metropolitan, DoE
14. Director or Deputy Director, Chattogram Laboratory, DoE
15. Representative of DoE district office (Chattogram District, Gazipur District, Narayanganj District, Munshiganj District, Narsingdi District, Manikganj District,
16. Representative of City Cooperations (Dhaka North City, Dhaka South City, Chattogram City, Gazipur City, and Narayanganj City)
17. Representative of LGED
18. Representative of DPHE
19. Representative of Pourashava (Munshiganj, Narsingdi, and Manikganj)
20. Representative of donors (WB, ADB, and GIZ)
21. Representative of Municipal Association of Bangladesh (MAB)
22. Representative of Business community (such as FBCCI)
23. Representative of Corporate agencies (such as Unilever)

End of Document

Advisor on Environment Management in Bangladesh

Final seminar

Findings & recommendation -1 & Feedbacks from DoE-1 (Water pollution Control)


21st November 2023

1

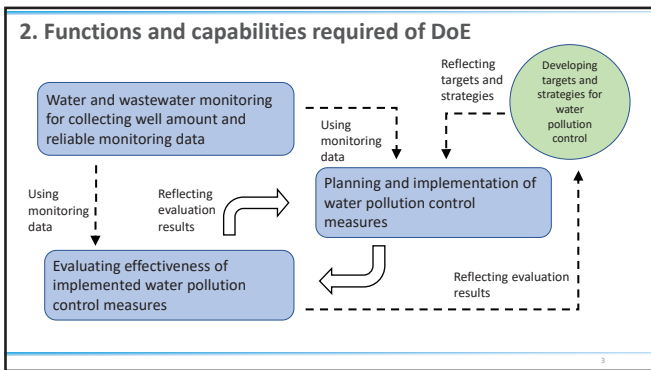
1. Environmental pollution phenomena and causes

- Water pollution is the discharge of **toxic substances** and **organic matter** into rivers, lakes, ponds, oceans, etc. due to human activities and industrial development.
- Sources include domestic wastewater, industrial wastewater, agricultural/pastoral wastewater.

Category	Detailed sector	Major pollutant
Multiple effluent in urban area	Domestic wastewater form Households, Commercial, Hotels, Schools, Hospitals and Restaurants	Organic matter(Organic Carbon, N, P)
Industrial effluent	Industrial park, Factories, Power plants	Heavy metals, Acidic /alkaline effluent, Organic matter, Oils
Agricultural wastewater	Irrigation farmland, Poultry farm, Livestock farm	Organic matter(C, N, P)
Others	Ship transportation, Dumping site, Construction site	Heavy metals, Acidic /alkaline effluent, Organic matter, Oils



2



3

3. Identified Issues (1) – legal System

Item	Current Status/Issues	Recommendations
Water Pollution Control	- Bangladesh Environment Conservation Act (ECA) 1995, 2010 revision - Environmental Conservation Rules (ECR), 2023	• To monitor newly regulated parameters, e.g. nutrients and heavy metals • To guide pollution control with severer standard values on N (nitrogen) and P (phosphorous)
On-site Inspection	- On-site inspections is conducted in accordance with ECR. - Environmental Court Act (2000, 2002 and 2010 revisions)	• To enhance capacity on administrative guidance for improvement of ETP inspections and enforcement
EIA	Currently being revised EIA Guidelines for Industries (1997)	• To enhance capacity for issue and update ECC based on ECR 2023
River, Lake and Watershed Management	- Water Act (2013) - Water Resource Planning Act (1992) - National Water Policy (1999) - Bangladesh Water Rules (2018) - WARPO Guidelines (2020)	• To enhance capacity to manage water resource with adopting watershed management concept

4

3. Identified Issues (2) – Administrative and Technical Capacity

Item	Current Status/Issues	Recommendations
Water Pollution Control	DoE only focuses on managing the industrial sector and does not care about domestic wastewater or wastewater from the agricultural sector	• To grasp impact on water pollution load by wastewater discharged from various sectors, e.g. domestic sector, agriculture sector, etc.)
On-site Inspection	DoE is responsible for onsite inspection in nationwide with limited number of staffs. DoE laboratories analytical capacities are insufficient and has no their accredited system.	• To develop a system for identifying priority targets to be inspected and controlled. • To enhance DoE laboratories capacities for improving credibility of wastewater analysis for granting fines based on the analytical results under ECR2023. • To adopt laboratory accrediting system for DoE laboratories
EIA	DoE conducts EIA and issue ECC in accordance with ECA and ECR2023.	• To enhance capacity of DoE officers (especially local staffs) for assessing validity of ETP at the timing of EIA review and renewal of ECC.
River, Lake and Watershed Management	Preparation of plans for river environment restoration are being considered.	• To enhance capacity for planning water pollution control in watershed level

5

3. Identified Issues (3) – Cooperation with Relevant Organizations

Item	Current Status/Issues	Recommendations
Water Pollution Control	The meetings are held on an irregular basis with related ministries and agencies responsible for water resource management (BWDB), sanitation (DPHE), sewerage development and operation (WASA) etc.	• To strengthen necessary cooperation with related ministries, agencies and bureaus for comprehensive wastewater management.
On-site Inspection	- Local industrial pollution source control is conducted by limited DoE local officers, such as dispatched one DD, one or two AD, with several inspectors only in each DoE local office.	• To examine the way of enhancing local pollution source control capacities by cooperating with local government, especially at the cities/areas having large number of industrial wastewater sources to be controlled.
River, Lake and Watershed Management	- BWDB emphasizes water resource management as watershed level with planning to increase the number of monitoring sites from 18 to 357 for .	• To enhance water monitoring data sharing mechanism with relevant ministries and agencies • To improve water quality monitoring capacity of relevant ministries and agencies with solving existing issues such as lack of equipment and reagents

6

4. What should DoE prioritize?

	Legal System What is the prioritized legal systems?	Administrative and Technical Capacity What is the prioritized technical capacity?	Cooperation with Relevant Organizations What is the prioritized cooperative activities with other ministries?
Multi sector Pollution Control	<ul style="list-style-type: none"> Enhancement of the supplemental documents of ECR 2023 (Preparation of Guidelines) 	<ul style="list-style-type: none"> Capacity development to estimate water pollution load from each sector (Preparation of Technical guideline) 	<ul style="list-style-type: none"> To strengthen necessary cooperation with related ministries on water pollution control
On-site Inspection & Enforcement	<ul style="list-style-type: none"> Enforcement of On-site inspections and enforcement systems (Preparation of Guidelines) 	<ul style="list-style-type: none"> Estimate priority emission sources and strengthen inspection capacity Enhancement of DoE laboratories capacities 	<ul style="list-style-type: none"> To examine the way of enhancing local pollution source control capacities by cooperating with local government
ECC(EIA) Process	<ul style="list-style-type: none"> Enhancement of ECC process supplemental documents (Preparation of Guidelines) 	<ul style="list-style-type: none"> Capacity development to evaluate ETP capabilities and capacity 	-
River, Lake and Watershed Management	<ul style="list-style-type: none"> Enhancement of legal systems for watershed monitoring (Methodology for monitoring) 	<ul style="list-style-type: none"> To enhance capacity for planning water pollution control in watershed level 	<ul style="list-style-type: none"> To enhance water monitoring data sharing mechanism with relevant ministries and agencies

**Advisor on Environment Management
in Bangladesh**

Final Seminar

**Finding and Recommendation - 2:
(Solid Waste Management)
by JICA Expert Team**

21 November 2023

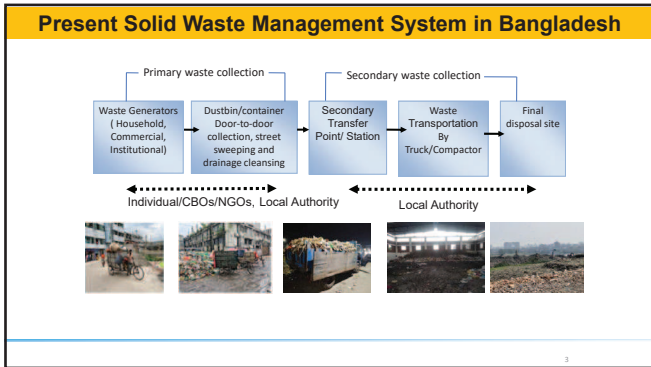
Department of Environment & JICA Expert Team

1

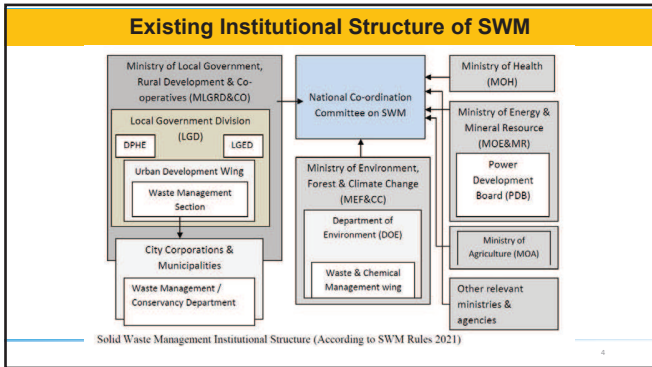
Today's Explanation

1. Review of existing situation of SWM
2. Finding and Recommendation
 - 2.1 Finding (Legal System, Administrative and technical capacity, Organization (Cooperation with relevant organizations))
 - 2.2 Recommendation
3. Recommended Image of Road Map
4. Image of Recommendation

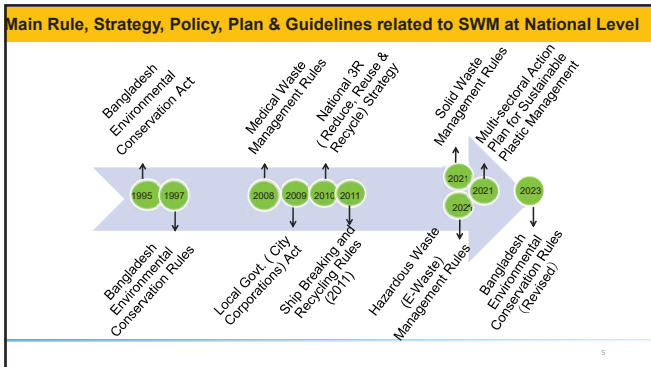
2



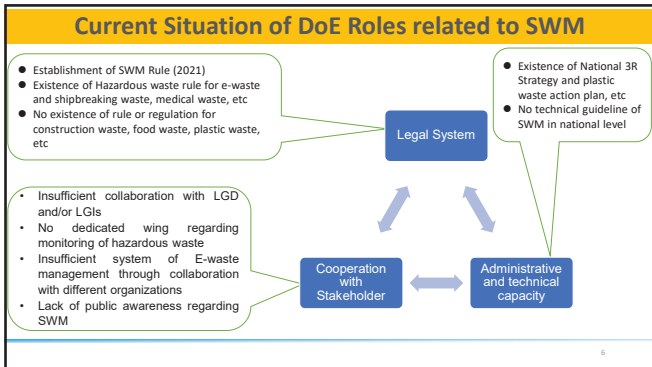
3



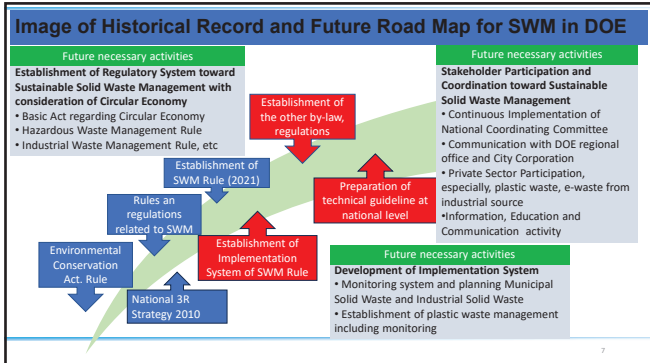
4



5



6



7

3. Identified Issues (1) – Legal System

Item	Current Status /Issues	Recommendation
Municipal Solid Waste Management (Municipal SWM)	<ul style="list-style-type: none"> Solid Waste Management Rule (2021) has been formulated but necessary to consider the implementation However, the other acts are not adoptable to Solid Waste Management Rule (2021) such that Upazila Act does not specify the responsibilities of SWM 	<ul style="list-style-type: none"> To improve the SWM rule at suitable timing. To revise the other acts in line with SWM rule To prepare guidelines for implementation of SWM planning for implementation of the SWM rule. To prepare guidelines of annual report of SWM for implementation of the SWM rule.
Non Municipal Solid Waste Management (Non municipal SWM) like Industrial and Medical Waste Management	<ul style="list-style-type: none"> Environmental Conservation Act indicate polluter pay principals Hazardous Waste (E-waste) Management Rules (2021) has been established but only focused on E-waste Medical Waste Management and Handling Rules (2008) has been established 	<ul style="list-style-type: none"> To prepare comprehensive industrial hazardous waste rules To prepare rules and/or regulations for each type of waste such as construction waste, food waste, packaging waste, used automobile waste, etc with consideration of EPR and/or polluters pays principal approach

8

3. Identified Issues (2) – Administrative and Technical Capacity

Item	Current Status /Issues	Recommendation
Municipal Solid Waste Management (Municipal SWM)	<ul style="list-style-type: none"> Difficulty of collecting the data of SWM National 3R Strategy has been formulated but there is no SWM plan at national level An action plan of plastic waste management is prepared but there is no implementation system There is no technical guidelines in national level 	<ul style="list-style-type: none"> To improve the inadequate monitoring system To develop solid waste management plan at national level To develop the implementation system for actualizing an action plan of plastic waste management To prepare the technical guidelines for collection, transportation, treatment and disposal related to solid waste management
Non Municipal Solid Waste Management (Non municipal SWM) like Industrial and Medical Waste Management	<ul style="list-style-type: none"> Difficulty of monitoring of industrial waste including plastic waste There are rules of hazardous waste for e-waste but no treatment and disposal facilities for it Medical Waste Management and Handling Rules (2008) has been established but no sufficient system for medical waste management 	<ul style="list-style-type: none"> To develop the efficient monitoring system like manifest for industrial waste To prepare the guidelines for plastic waste from industrial source To develop the treatment and disposal facilities for hazardous waste To develop the system of medical waste management

9

3. Identified Issues (3) – Cooperation with Relevant Organizations

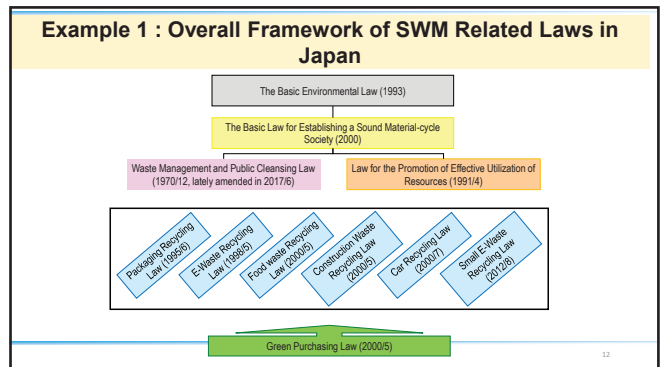
Item	Current Status /Issues	Recommendation
Municipal Solid Waste Management (Municipal SWM)	<ul style="list-style-type: none"> DOE is regulatory body of SWM and has only five personals in charge of SWM Implementation body is Local Government Institutions (LGIs) with technical assistance of LGD, DPHE and LGED 	<ul style="list-style-type: none"> Increase number of personnels and development of their capacity in charge in SWM in DOE Improve the collaboration manner between DOE and LGD, LGED, DPHE as well as LGIs
Non Municipal Solid Waste Management (Non municipal SWM) like Industrial and Medical Waste Management	<ul style="list-style-type: none"> There is no dedicated wing / section specialized in the management and monitoring of hazardous waste Insufficient system of E-waste management through collaboration with different organizations 	<ul style="list-style-type: none"> To develop monitoring and implementation system of industrial waste from each source (e.g. manifest system) through the cooperation with relevant organizations. To develop E-waste management system through collaboration with relevant organizations such as Producers Responsible Organizations, etc.

10

4. Recommendation → How to prioritize?

Legal System	Technical Capacity	Cooperation with Relevant Organizations
<ul style="list-style-type: none"> To improve the SWM rule at suitable timing. To revise the other acts in line with SWM rule To prepare guidelines for SWM planning and annual report preparation of the SWM rule. Establishment of Comprehensive industrial hazardous waste rules To prepare by-law and regulations for each type of waste with consideration of EPR and/or polluters pays principal approach 	<ul style="list-style-type: none"> To improve the inadequate monitoring system To develop solid waste management plan at national level To develop the implementation system for actualizing an action plan of plastic waste management To prepare the technical guidelines related to solid waste management To develop the efficient monitoring system like manifest for industrial waste To prepare the guidelines for plastic waste from industrial source To develop the treatment and disposal facilities for hazardous waste To develop the system of medical waste management 	<ul style="list-style-type: none"> Increase staffs and development of their capacity in charge in SWM in DOE Improve the collaboration manner between DOE and LGD, LGED, DPHE as well as LGIs To develop monitoring and implementation system of industrial waste from each source (e.g. manifest system) through the cooperation with relevant organizations. To develop E-waste management system through collaboration with relevant organizations

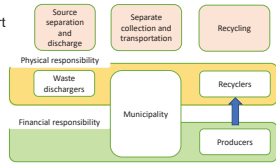
11



12

Example 2 : Introduction of Recycling System of Container and Packaging Waste in Japan Considering EPR

- 60% of plastic waste is package waste
 - Container and Packaging Waste has short lifetime and they inevitably become waste
- Direction of this System
- Shifting of physical and/or financial responsibility toward producers and away from municipalities; and
 - Provision of incentives to producers to take environmental considerations into account when designing their products.

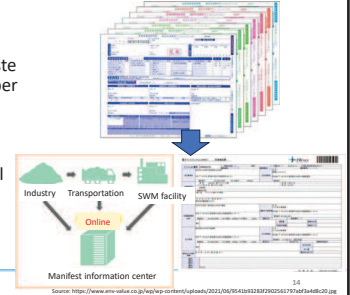


13

13

Example 3 : Monitoring System of Industrial Waste (Manifest / WDS System)

- Japan has a WDS system and a **manifest system** for industrial waste treatment which are used for proper manner.
- **Manifest** is applied on the actual handover and treatment stage to secure the traceability of industrial waste.
- We had already implemented the **digital manifest system**.



Source: <http://www.ema.vulva.co.jp/kyo/wp-content/uploads/2012/05/PS41010101020205619-0013-488c20.pdf>

14




JICA Technical Assistance on Environmental Advisor
in Bangladesh

**Way Forward for Enhancement
of Environmental Management
by DoE**

21 Nov. 2023

1




Vision of Department of Environment

To ensure sustainable environmental
governance for achieving high
quality of life for the present and
future generations.

2




Mission of DoE

To help secure a clean and healthy environment
for the benefit of present and future generation:

- ☛ Through the fair and consistent application of
environmental rules and regulations;
- ☛ Through guiding, training, and promoting
awareness of environmental issues; and
- ☛ Through sustainable action on critical
environment problems that demonstrate
solution and that galvanize public support and
involvement.

3




Vision of Department of Environment



To ensure sustainable environmental
governance for achieving high
quality of life for the present and
future generations.

4




**Priority Activities for Enhancement of
Environmental Management in
Water Pollution Control Sector**



5

Capacity Building of Laboratories

- ☛ Quality Control/Quality Assurance for lab work
- ☛ Calibration
- ☛ ETP inspection & sampling
- ☛ water quality & Air quality modeling
- ☛ Stack/Point source emission monitoring
- ☛ Laboratory Safety
- ☛ Laboratory Audit etc.



6

Environmental Clearance (EIA, ETP, Air Treatment Facility and Sludge Management)

- ETP drawing and design, evaluation and performance monitoring.
- Advanced treatment process and zero discharge system for liquid waste.
- sludge management system.

7

Direction on Water Pollution Control

Arrangement of laboratories (WB)

Draft Inspection manual of ETP (GIZ)

Draft Enforcement manual

ECR2023

Laboratory accrediting process (JICA, GIZ)

- Watersheds management including wastewater other than industrial sector, such as
- Strengthen relationships with other ministries

Long-term Goal

Short-term Goal

Proper implementation of ECR2023
Adequate monitoring of the industrial wastewater



8




Priority support for short-term goals

	Legal System	Administrative and Technical Capacity	Cooperation with Relevant Organizations
First Priority	<ul style="list-style-type: none"> • Enforcement of On-site inspections and enforcement systems (Preparation of Guidelines) 	<ul style="list-style-type: none"> • Estimate priority emission sources and strengthen inspection capacity • Enhancement of DoE laboratories capacities 	<ul style="list-style-type: none"> • To examine the way of enhancing local pollution source control capacities by cooperating with local government
Second Priority	<ul style="list-style-type: none"> • Enhancement of ECC process supplemental documents (Preparation of Guidelines) 	<ul style="list-style-type: none"> • Capacity development to evaluate ETP capabilities and capacity 	-

9

Priority support for long-term goals

	Legal System	Administrative and Technical Capacity	Cooperation with Relevant Organizations
3rd Priority	<ul style="list-style-type: none"> • Enhancement of the supplemental documents of ECR 2023 (Preparation of Guidelines) 	<ul style="list-style-type: none"> • Capacity development to estimate water pollution load from each sector (Preparation of Technical guideline) 	<ul style="list-style-type: none"> • To strengthen necessary cooperation with related ministries on water pollution control
4th Priority	<ul style="list-style-type: none"> • Enhancement of legal systems for watershed monitoring (Methodology for monitoring) 	<ul style="list-style-type: none"> • To enhance capacity for planning water pollution control in watershed level 	<ul style="list-style-type: none"> • To enhance water monitoring data sharing mechanism with relevant ministries and agencies

10




Priority Activities for Enhancement of Environmental Management in Solid Waste Management Sector

11




Concern on Solid Waste Management

- Solid Waste: Problem and Prospect.
- Management Polices and Technologies.
- Implementation of 3-R Strategies: Reduce, Reuse and Recycle.

12

Priority Activities by DOE

Legal System	Technical Capacity	Cooperation with Relevant Organizations
<ul style="list-style-type: none"> To improve the SWM rule at suitable timing. To revise the other acts in line with SWM rule To prepare guidelines for SWM planning and annual report preparation of SWM for implementation of the SWM rule. Establishment of Comprehensive industrial hazardous waste rules To prepare by-law and regulations for each type of waste with consideration of EPR and/or polluters pays principal approach 	<ul style="list-style-type: none"> To improve the inadequate monitoring system To develop solid waste management plan at national level To develop the implementation system for actualizing an action plan of plastic waste management To prepare the technical guidelines related to solid waste management To develop the efficient monitoring system like manifest for industrial waste To prepare the guidelines for plastic waste from industrial source To develop the treatment and disposal facilities for hazardous waste To develop the system of medical waste management 	<ul style="list-style-type: none"> Increase staffs and development of their capacity in charge in SWM in DOE Improve the collaboration manner between DOE and LGD, LGED, DPHE as well as LGIs To develop monitoring and implementation system of industrial waste from each source (e.g. manifest system) through the cooperation with relevant organizations. To develop E-waste management system through collaboration with relevant organizations

13

Ideas on Expansion of Waste and Chemical Management Wing Structure

The wing's ultimate goal is to manage waste in an environmentally responsible and sustainable manner, which includes waste reduction, recycling, safe disposal, and public education.

The wing has the responsibilities of Municipal Solid Waste and Industrial Waste are big concerns in Bangladesh to implement the Solid Waste Management Rules, E-waste Management Rules, Ship-breaking (hazardous) waste recycling Rules.

There is a need of reformation & strengthen the existing waste and chemical management wing of DOE.

14

Ideas on Coordination among other agencies for Solid Waste Management

-Setting working groups for some specific issues regarding SWM

- After the session in the working group, they will make presentation in the committee for the approval, etc

15

Thank You

Burigonga River, Farashgonj, Dhaka, Photo: AKM Rafiqul Islam

16

添付資料 6

廃棄物管理に関する国家調整委員
会へ向けたワーキングペーパー

Working Paper for National Coordination Committee on Waste Management

Background of the SWM Rules:

Due to rapid urbanization and economic growth, the generation of solid wastes is increasing day by day. According to 8th Five Year Plan (2020-2025), the cities will be generating around 47,000 tons per day by 2025. Due to limitation of resources and infrastructures, the Local Government Institutions could collect 44-76% of the generated wastes. Rest of the wastes are indiscriminately dumped into drains, low lands and rivers bring the environment and public health at risks. Waste reduction and recycling are rarely practiced. Single Use Plastic (SUP) and the Multiple Layer Plastic (MLP) are not reused or recycled, finds its way to water bodies or landfilled. Medical wastes are not collected and treated in an environmentally sound manner. To improve the solid waste management situation and to streamline the solid waste system including waste transfer, treatment and disposal; Ministry of Environment, Forest & Climate Change (MoEF & CC) has formulated Solid Waste Management Rules in its authority under Section 20 of the Bangladesh Environmental Conservation Act, 1995 and the rules is enacted on 9th December 2021.

The Government, in pursuance of the purpose of these rules, constitutes a 21 members National Coordinating Committee on Solid Waste Management comprising of the following members, namely: -

(A) Secretary, Ministry of Environment, Forests and Climate Change	Chairperson
(B) At least one officer not below the rank of Joint Secretary of the Department of Finance	Member
(c) At least one officer not below the rank of Joint Secretary of the Local Government Division	Member
(D) At least one officer not below the rank of Joint Secretary of the Ministry of Environment, Forests and Climate Change	Member
(E) At least one officer not below the rank of Joint Secretary of the Department of Legislative and Parliamentary Affairs.	Member
(F) At least one officer not below the rank of Joint Secretary of the Ministry of Housing and Public Works	Member
(G) At least one officer not below the rank of Joint Secretary of Health Services Department	Member
(H) At least one officer not below the rank of Joint Secretary of the Ministry of Agriculture	Member
(I) At least one officer not below the rank of Joint Secretary of the Ministry of Industry	Member
(J) At least one officer not below the rank of Joint Secretary of the Ministry of Water Resources	Member

(K) At least one officer not below the rank of Joint Secretary of Power Department	Member
(L) At least one officer not below the rank of Joint Secretary of the Ministry of Chittagong Hill Tracts	Member
(M) At least one officer not below the rank of Joint Secretary of the Ministry of Shipping	Member
(N) Director General, Department of Environment	Member
(O) Chairman, Bangladesh Inland Water Transport Authority	Member
(P) Chief Executive Officer, City Corporation (All)	Member
(Q) An expert representative on waste management nominated by the Government	Member
(R) A representative of a non-governmental organization (NGO) nominated by the government	Member
(S) A representative of the Federation of Bangladesh Chambers of Commerce and Industry (FBCCI)	Member
(T) A representative member of a plastic manufacturer or importer	Member
(U) Director, Department of Environment	Member-Secretary

Functions of the Committee:

The functions of the Committee shall be as follows:

- (A) Monitor the waste management activities that includes waste segregation, collection, intermediate treatment and recycling and sound disposal without polluting the soil, water and air through leaching or burning.
- (B) Review and monitor the activities described in the annual reports submitted by the local government authorities or other authorities and provide instruction for improvement if any
- (C) Provide necessary instructions to prepare manuals/guidelines for the introduction and application of new technologies or methods for waste segregation, processing, reusing and final disposal
- (D) Provide directives on waste segregation, reuse and final disposal
- (E) Approve solid waste management plans submitted by local government authorities
- (F) Call for clarification or provide necessary instructions from the concerned local government authorities and other authorities if irregularities or proper procedures are not followed in waste management
- (H) Issue instructions to stop or limit the use of hazardous waste materials that pollute the environment
- (I) Provide necessary recommendations on the Extended Producers Responsibility (EPR) guidelines

Challenges to implement SWM Rules:

- Absence of roadmap or guideline to implement SWM Rules
- Gap in inter-organizational and inter-departmental communication & information sharing
- Lack of institutional capacity (resource & manpower) of the Local Government Authorities
- Inadequate budget allocation for solid waste management service
- Low awareness of the people regarding waste management specially source-segregation
- Lack of private sector engagement in existing waste management system
- Technical guidelines to implement and monitor source-segregation, segregated collection, intermediate treatment & disposal is yet to develop
- Absence of incentives for waste reduction & recycling
- Circular Economy & EPR is a new concept in Bangladesh to adopt and implement

Discussion issues:

- Local Government Institutions (LGIs) should carry out solid waste management activities in an environmentally friendly and hygienic manner and should prepare a comprehensive plan following national strategies and guidelines on solid waste management including waste reduction, reuse and recycling and after taking approval from Local Government Division (LGD) and submit it to the National Co-ordination Committee.
- Local Government Institutions (LGIs) should promote source reduction, source segregation, segregated collection, transportation and proper treatment and final disposal of waste
- Waste should be segregated into three categories and deposited in three different color bins Green (Wet), Yellow (Dry) and household hazardous waste (Red) depending on the situation of the LGIs.
- Inclusion of Public relation, education and behavioural change activities and encourage community engagement to create awareness among the people about reduction and segregation of waste at source
- LGIs should prepare work plan for proper management of solid waste including waste segregation, processing and final disposal.
- LGIs should prepare baseline data (waste generation & composition, collection, recycle and disposal)
- Identify the institutional, policy and infrastructure gap in the Local Government Institutions and do necessary institutional reformation (Technical, Managerial and Financial) including capacity building
- LGIs should prepare Annual Waste Report based on the prescribed format (Table-2) and submit it by 30 September

- Explore invest opportunities in waste management sector and develop SWM business model to attract private sector and Public Private Partnership (PPP) opportunities
- Medical Waste should be managed according to the provisions stipulated in Medical Waste (Management and Processing) Rules 2008
- The producers/ manufacturer should take responsibility of management and disposal of non-degradable materials such as Single use plastic (SUP) and the Multiple Layer Plastic (MLP) through adopting Extended Producers Responsibility (EPR) guideline
- Establishment of Circular Economy and develop waste exchange marketplace

Desired Actions/outputs:

1. Clear instruction should be given to the LGIs for implementation of SWM Rules
2. LGIs should develop institutional capacity and infrastructure and follow the provisions in the rules. LGD should provide support to the LGIs.
3. DOE should communicate with the LGIs and the other stakeholders like LGD, LGED, DPHE including the private sector for implementing the rules
4. DOE & LGIs should take initiatives to raise awareness among the waste generators
5. DOE & LGIs should prepare manuals and guideline (solid waste management planning & operation & Annual Report Preparation) for waste management if necessary.
6. To prevent the misunderstanding of waste segregation category, DOE should prepare the guideline of waste segregation
7. No medical waste is mixed up with domestic waste. Medical waste should be collected & treated separately.
8. DOE should promote Circular Economy and prepare EPR guideline to phase out Single Use Plastic (SUP) & Multiple Layer Plastic (MLP).

添付資料 7

チャットグラム

DoE 環境分析ラボトリ

認証取得支援報告書

JICA Technical Assistance Project

“Capacity Building on Laboratory Management and Accreditation
for DOE Laboratory, Chattagram”

Under the Project Advisor on Environmental Management in Bangladesh

**Report on Gap Assessment of DOE Laboratory Management
System on the requirement of ISO 17025 standards**

June 2023

Table of Contents

Chapter – 1: The Assignment	2
1.1 Preamble	2
1.2 Objective of the Assignment.....	2
1.3 Methodology.....	2
1.4 Scope of Activities	3
Chapter – 2: Findings of ISO / IEC 17025 Assessment	4
Chapter – 3: Scope and preparation for Accreditation.....	17
A. Scope of Analytical Parameters to be Accredited.....	17
B. Preparation for Accreditation (technical requirements):	18
C. Training Needs	18
Chapter – 4: Plan of Action for getting accreditation (Future project).....	19
Chapter – 6: Feedback from the Laboratory Personnel.....	22
Annex – 1: Current facilities of DOE Lab, Chattagram	24

Chapter – 1: The Assignment

1.1 Preamble

The Laboratory of Department of Environment (DoE) was assigned by the Director General, DoE for the testing of environmental quality parameters for the monitoring of Environmental Conservation Rule (ECR-97) and the Environmental Clearance related issues as per the authority given by Environmental Conservation Act (ECA)-1995. Laboratory capacity development is the very important component to ensure the compliance of current national Environmental Conservation Rule. But DoE laboratory should increase its capacity making accreditation by Bangladesh Accreditation Board (BAB) and standards procedure followed by ISO 17025 and other international Standard Operating Procedure (SOP) for testing some specific parameters. DoE laboratory, Chattagram has not been accredited till now and necessary documentation along with required SOP has to be developed for the most tested parameters particularly for water quality parameters. In this regard a gap analysis was required to assess the current state of the laboratory documentation process in line with ISO 17025, the laboratory management standard. In addition a training session was needed covering the basic accreditation procedure and its benefits in order to create awareness about the necessity of laboratory management system. The requirements and the standard format of the Standard Operating Procedures (SOP) for laboratory activities were also planned to discuss in the training program.

1.2 Objective of the Assignment

The main objective of the assignment was to build capacity of DOE Laboratory, Chattagram in order to achieve accreditation by Bangladesh Accreditation Board (BAB). In this regard, the following specific objectives were considered for this assignment.

1. Identify the level of the laboratory capacity and assess the gap of the management system
2. Improve the knowledge of the laboratory personnel about the ISO standard through an orientation
3. Prepare work plan and a time frame to get accreditation
4. Prepare a template to develop Standard Operating Procedures (SOP) for specific parameter of testing

1.3 Methodology

The assessment of DOE Laboratory, Chattagram followed the principles of management system auditing specified in ISO 19011:2018, Guidelines for auditing management systems. Using a combination of remote data review, onsite verification, staff interviews and analytical method witnessing, JICA Assessment Team evaluated the laboratory's establishment and implementation of a quality management system to govern and control its testing services. The assessment was conducted in two parts; a remote document review followed by an onsite verification by the Assessment Team.

Remote data review of the laboratory's documented quality system was conducted to confirm the availability of procedures and records required by the standard, identify any missing requirements, and facilitate understanding of laboratory management expectations for laboratory function based on the documents.

Onsite implementation verification of laboratory mandate, internal policies, and process, as well as the expectation level of ISO 17025 - accreditation was conducted to determine strengths and weaknesses. To gauge competency of staff to conduct environmental quality testing, the team interviewed the laboratory staffs from field (Sampler & Field Tester) and within the laboratory personnel and observed the execution of an experiment (COD analysis), to confirm understanding of internal processes as well as principals of good laboratory practices. A checklist form was also used to assess the fulfillment of the requirements of the ISO 17025 standard. Finally a brief session was conducted along with a short training to share the gaps of the laboratory and the requirements to be fulfilled by the laboratory.

1.4 Scope of Activities

A laboratory gap analysis was conducted to identify the current status of DOE Chattagram Laboratory management system in line with new ISO 17025:2017 standard. The following chronological activities were done.

1. Preliminary meeting with laboratory management staff to understand them about the basic requirement of accreditation and how the gap analysis of laboratory would be conducted.
2. Review the existing facility and documents of the laboratory
3. Visit the DOE laboratory at Chattagram
4. Meeting with Director (acting) and Deputy Director and sharing the objectives of the visit.
5. Introductory meeting with laboratory staff and brief on the process of gap analysis
6. Laboratory visit to see the existing facilities and equipment of the lab
7. Method witnessing - Sampling and Field testing through field visit
8. Method witnessing - Laboratory Analysis
9. Assessment of existing documentation process
10. The immediate findings along with corrective action measures were shared with the laboratory staff during the assessment
11. The assessment findings were briefed to the laboratory staff and the management
12. A template on the preparation of SOP were described to the lab staff for preparing necessary SOPs for them
13. The laboratory staff were briefed on the process of accreditation by BAB as part of a training
14. Finally, the major gaps in the laboratory activities were discussed and shared the importance of getting accreditation to the laboratory staff.

Chapter – 2: Findings of ISO / IEC 17025 Assessment

This section of the gap assessment report provides objective observations of the laboratory's compliance with the requirements of ISO 17025 and internal policies and procedures.

A. Adherence with ISO 17025 Standard Requirements

In its current state, the laboratory follows the general procedures of sampling and testing of environmental parameters and does not comply with the all the requirements of the ISO standard. The assessment team observed several deficiencies as well as several opportunities for improvement in order to fulfill the requirements of ISO standard.

B. Overall Compliance (summary findings)

The staff and management personnel interviewed and observed during assessment were knowledgeable of their assigned tasks and provided consistent verbal descriptions of laboratory practices and control mechanisms. Written objective evidence was not sufficient to confirm compliance with the assessment criteria based on the ISO 17025 standard. Many of the observation/nonconformities witnessed stemmed from a lack of proper documentation of policies and procedures and lack of a comprehensive calibration program to cover equipment and equipment standards. The laboratory will need to procure certified reference standard, establish a process of regular equipment calibration and updated training on current practices. Despite the challenges faced by Laboratory, both management and laboratory staff are committed to improve their quality management system and to obtain ISO 17025 accreditation.

The laboratory management has decided to get accreditation on specific parameters of water quality and the scopes have been outlined in Chapter-3.

C. Assessment of the requirements of ISO 17025:2017 Details

The gap assessments of the DOE laboratory based on the requirements of ISO 17025:2017 are described in the following table. The table describes the requirement of the ISO standard and the findings in place and also describe the opportunity for improvement.

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
4.	General Requirements		
4.1	Impartiality	As per government laboratory, its impartiality and confidentiality policies have been reflecting from the gadget notification of staff employment and appointment rules. However, the laboratory needs to prepare a Quality Manual (QM) for the description of overall operational procedures. In QM, for this general requirements, it should be clearly defined the Code for Confidentiality, Impartiality and Conflict of interest as evidence of adhering to its policy.	DOE Laboratory should ensure consistent understanding of the differences between conflict of interest, impartiality, and confidentiality and prepare relevant forms accordingly.
4.2	<i>Clause 4 of the standard relates to the overall way of laboratory activities are to be conducted; objectively and confidentially. This clause requires the managing body of a testing laboratory to ensure activities are undertaken objectively and information be maintained confidentially.</i>		
5.	Structural Requirements		
5.1	Organization & Management Structure <i>Clause 5 of the standard requires the laboratory to be a legal entity, document the activities governed by the quality system, roles and responsibilities of staff and operational and management structure.</i>	As a governmental organization, located at a permanent premise, the laboratory fulfills the requirements of the clause. The Deputy Director, who irrespective of other responsibilities, has the authority and resources needed to carry out his duties according to the clause 5.6 of the standard.	In Quality Manual, an organogram for laboratory staff need to be shown to define their management structure.
6.	Resource Requirements		
6.2	Personnel <i>The laboratory shall document its policy for addressing human resource requirements and shall establish a procedure to provide instructions on how it will adhere to its policy.</i>	Nine staffs have been engaged with laboratory for sampling, testing and reporting the tested results. Records for individual job description, training and personnel competencies have not been documented.	The management of the laboratory should document the roles and responsibilities of individual lab staff. The staff competence requirements shall be defined particularly the requirements for education, qualification, training, technical knowledge, skills and experience.
6.3	Facilities and Environmental Conditions <i>The laboratory shall document its policy for addressing facility and environmental maintenance and establish procedure to provide instructions on how it will adhere to its policy.</i>	In general, the laboratory areas were clean and well organized with adequate space to conduct testing in a safe manner.	Temperature criteria are to be provided in SOPs or on data collection forms used for recording daily results as required by the testing parameters. The thermometers are to be routinely calibrated and have the capability to provide a minimum and maximum reading for a given time frame.

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
<p>6.4</p> <p>Equipment</p> <p><i>The laboratory shall document its policy for addressing equipment calibration and maintenance and establish procedure to provide instructions on how it will adhere to its policy and maintain regular records as evidence of adhering to its policy and procedures.</i></p> <p><i>The laboratory shall have a procedure for handling, transport, storage, use and planned maintenance of equipment in order to ensure proper functioning and to prevent contamination or deterioration</i></p>	<p>The DOE laboratory has the basic equipment needed to perform both field and lab based chemical testing of environmental parameters. During the assessment, available equipment was confirmed against the provided equipment inventory. The available equipment for both field and lab testing are listed in Annex-3. The equipment calibration records have not been documented. The Analytical Balance is not calibrated and no standard mass is available for calibration and monitoring of the balance.</p>	<p>The laboratory equipment is brought to a current state of calibration using qualified service providers followed by training of laboratory staff to perform general maintenance and routine calibration. Additionally, the valid calibration standard (either CRM or traceable standard) should be readily available for all equipment used in both field and the lab. Documented procedure and records of regular maintenance and calibration of analytical instruments need to be established in the lab.</p> <p>The field equipment (particularly the multi-parameter meter) shall be calibrated before starting the testing every day and the calibrated data should be retained.</p> <p>It is also recommended that the laboratory has two of each type of equipment particularly for the field to reduce downtime and risk of not having equipment available to perform requested testing.</p> <p>A set of standard mass need to be procured and a calibration plan of analytical balance should be in place.</p>	<p>The certified reference materials (CRM) with stated metrological traceability to the international System of Units (SI) should be procured and for all the parameters under scope. The equipment need to be calibrated by the CRM or to be used as check standard or quality control standard to establish the metrological traceability of the measurement results.</p> <p>The metrological traceability related to mass, volume of glassware and measuring device need to be considered to establish the uncertainty of the test results.</p>
<p>6.5</p> <p>Metrological traceability</p> <p><i>The laboratory shall establish and maintain metrological traceability of its measurement results by means of a documented unbroken chain of calibrations, each contributing to the measurement uncertainty, linking them to an appropriate reference.</i></p>	<p>The laboratory has reference materials with certificates from the producer for the metal standards. However, there is no procedure to establish measurement results are traceable to SI units.</p>	<p>The laboratory has reference materials with stated metrological traceability to the international System of Units (SI) should be procured and for all the parameters under scope. The equipment need to be calibrated by the CRM or to be used as check standard or quality control standard to establish the metrological traceability of the measurement results.</p> <p>The metrological traceability related to mass, volume of glassware and measuring device need to be considered to establish the uncertainty of the test results.</p>	<p>The certified reference materials (CRM) with stated metrological traceability to the international System of Units (SI) should be procured and for all the parameters under scope. The equipment need to be calibrated by the CRM or to be used as check standard or quality control standard to establish the metrological traceability of the measurement results.</p> <p>The metrological traceability related to mass, volume of glassware and measuring device need to be considered to establish the uncertainty of the test results.</p>

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
6.6	<p>Externally provided products and services</p> <p><i>The laboratory shall ensure that only suitable externally provided products and services that affect laboratory activities are used, when such products and services a) are intended for incorporation into the laboratory's own activities, b) are provided, in part or in full, directly to the customer by the laboratory, as received from the external provider; c) are used to support the operation of the laboratory</i></p>	<p>Generally the procurements of laboratory supplies are maintained by the local office as per government procurement rule.</p>	<p>In order to routinely calibrate the analytical balance and daily monitoring of performance of analytical balance the laboratory should procure a set of standard mass or calibrated mass. If only standard mass is procured, it should be calibrated from the National Metrological Institute or any other calibration Laboratory.</p> <p>A calibrated thermometer needs to be procured and use for checking environmental condition where appropriate.</p> <p>The volumetric devices (volumetric flask, pipette burette etc.) need to be calibrated at least twice in a year.</p> <p>The in-house calibration procedure needs to be prepared by the laboratory.</p>
7.	<p>Process Requirements</p>		<p>The laboratory procurement authority will follow the government procurement rule for purchasing quality reagents, standards from authentic sources and lab accessories from quality vendors. Purchasing services and supplies and the ordering procedures should be maintained as such to ensure quality supplies.</p>
7.1	<p>Review of requests, tenders and contracts</p> <p><i>The laboratory shall have a procedure for the review of requests, tenders and contracts.</i></p>	<p>DOE Laboratory has procedures according to the government rule. The statement of conformity of the test results are adequately defined according to the Environmental Conservation Rule 1997/2017. All records are adequately retained.</p>	

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
<p>7.2</p> <p>Selection, verification and validation of methods</p> <p><i>The laboratory shall use appropriate methods and procedures for all laboratory activities and, where appropriate, for evaluation of the measurement uncertainty as well as statistical techniques for analysis of data.</i></p> <p><i>The laboratory shall ensure that it uses the latest valid version of a method unless it is not appropriate or possible to do so.</i></p> <p><i>Methods published either in international, regional or national standards, or by reputable technical organizations, or in relevant texts or journals, or as specified by the manufacturer of the equipment, are recommended. Laboratory-developed or modified methods can also be used.</i></p> <p><i>Procedures and records shall be kept up to date and shall be made readily available to personnel.</i></p>	<p>The DOE laboratory follows the analytical methods from various sources as and when appropriate as per its available resources. For water and wastewater quality parameter testing, the DOE laboratory has US APHA Standard Methods for the examination water and wastewater, 22nd edition. But the current APHA method is 24th Edition. For some WQ parameters, e.g COD & BOD, the laboratory follows the analytical methods supplied by the equipment manual. For COD analysis, when the reagent kit is finished, the laboratory personnel prepare the reagent (potassium dichromate) in-house. There was no verification data for comparing both the methods based on supplier's reagent and in-house reagent. The method validation procedures for analytical parameters have not also been prepared.</p>	<p>The Laboratory needs to prepare the procedure of Analytical Method Validation and keep records of method validation data for all the parameters under scope. The lab personnel need training on Analytical Method Validation procedure and how to keep and maintain validation data.</p> <p>It is also needed to prepare and document the Standard Operating Procedures (SOP) of all analytical parameters under the scope. All validation data and SOP should be available to the lab personnel.</p>	
<p>7.3</p> <p>Sampling</p> <p><i>The laboratory shall have a sampling plan and method when it carries out sampling of substances, materials or products for subsequent testing.</i></p> <p><i>The laboratory shall retain records of sampling data that forms part of the testing that is undertaken.</i></p>	<p>DOE laboratory undertakes sampling of environmental samples after getting requisition from its clients. Besides, samples of selected sites are also collected as a part of environmental monitoring program. The laboratory has dedicated staffs that perform the sampling. The field staff keeps the records of field testing results and sample information for Lab tests in a pre-formatted "Sample Collection and Analysis Sheet". Note that this sheet is common for all environmental samples e.g. water, air and sound. According to the clause 7.3.3 of ISO 17025:2017, the records of sampling data are partly covered in the data collection sheet of DOE. However, the</p>	<p>The laboratory needs procedures of sampling plan and methods for specific environmental parameters. The designated sample collector will collect sample according to the plan and procedure and keep all relevant records in a controlled format / checklist. The sampling procedure should describes but not limited to:</p> <ul style="list-style-type: none"> a) selection of samples or sites; b) sampling plan i.e. how the samples are collected (grab / composite) and which parameters need to be tested during collection c) for which testing parameters in the lab, the sample is collected d) how much (amount/volume) sample to be collected 	

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
		format is not controlled and approved.	<p>e) what types of sample containers are required (acid cleaned / sterile etc.)</p> <p>f) any preparation and treatment of samples are required for subsequent testing in the lab (like acid preservation for metals or chemically fixing of the analyte i.e. for DO and sulfide analysis in the lab)</p> <p>g) sample coding format for unique identification of samples</p> <p>The following additional information should include into the sample collection and field testing sheet which is currently used:</p> <p>a) identification of the equipment used for field testing</p> <p>b) calibration status of field equipment</p> <p>c) environmental or transport conditions</p> <p>d) Identification of sample location (diagrams / maps / GPS coordinates etc.)</p> <p>e) deviations, additions to or exclusions from the sampling method and sampling plan</p>
7.4	<p>Handling of test items</p> <p><i>The laboratory shall have a procedure for the transportation, receipt, handling, protection, storage, retention, and disposal or return of test items, including all provisions necessary to protect the integrity of the test item, and to protect the interests of the laboratory and the customer. Precautions shall be taken to avoid deterioration, contamination, loss or damage to the item during handling, transporting, storing/waiting, and preparation for testing.</i></p>	<p>The sampling record data is retained in different record formats like: sample receiving register log book, Coding register log book etc. before going to lab analysis. All sampling information including field test reports are uploaded online as a part of Laboratory Information Management System (LIMS). The register logbooks are kept in the assigned cabinet. Samples are kept in a refrigerator if the testing is delayed. There was no facility to check the temperature of the refrigerator at which samples are to be preserved. No procedure was developed for retaining samples after testing for a definite period.</p>	<p>According to the standard, a written procedure is needed for the handling of test items, before going to the lab analysis. All data collection format (the existing logbooks plus any new format) should be controlled and approved. All samples should be preserved under certain condition, depending on the sample criteria, if the testing is delayed or for the retention samples after testing. The lab should have available storage facility e.g. refrigerator, for both samples, before and after test, to avoid deterioration, loss or damage to the test item. When samples are to be stored under specified environmental conditions, these conditions are maintained, monitored and recorded in a log book.</p>
7.5	Technical records	This is in general practice by the lab to keep all types of information, related to the test item.	The standard requires that all lab technical records should contain:

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
	<p>The laboratory shall ensure that technical records for each laboratory activity contain the results, report and sufficient information to facilitate, if possible, identification of factors affecting the measurement result and its associated measurement uncertainty and enable the repetition of the laboratory activity under conditions as close as possible to the original. The technical records shall include the date and the identity of personnel responsible for each laboratory activity and for checking data and results. Original observations, data and calculations shall be recorded at the time they are made and shall be identifiable with the specific task.</p>	<p>Generally, the printed copies are kept in a file and notes and calculations are kept in a notebook.</p>	<p>a) the date and identity of personnel responsible for each activity b) report of results c) suitable information to assist with determining aspects that affect measurement uncertainty and to allow for repetition of activities under conditions replicating the original (as far as possible) d) clear records and traceability of any amendments from original observations or versions, including the person responsible for the amendments, the date, and what changes were made.</p> <p>These conditions will be reflected in the Record Control Procedure, which is a mandatory document as mentioned in clause 8.4 of the ISO standard.</p>
7.6	<p>Evaluation of measurement uncertainty</p> <p><i>A statistical depiction of measurement uncertainty is the degree of uncertainty surrounding any measurement's findings. In order to determine whether a method is appropriate, the standard discusses the significance of measurement uncertainty. This leads to test measurements that are suitable for the intended use.</i></p> <p><i>According to the standard, each testing laboratory must determine the degree of uncertainty associated with a method at a given level of confidence (for example, 95% confidence). This represents the statistical certainty that the true result lies within the stated margin.</i></p>	<p>The laboratory has not yet documented its policy for evaluating and calculating uncertainty of measurement and has not established any procedure to provide instructions on how it will adhere to its policy.</p>	<p>The laboratory should evaluate or, at least, estimate measurement uncertainty by identifying contributions to measurement uncertainty and considering all significant contributions including those arising from sampling and using appropriate methods of analysis. Where detailed measurement uncertainty evaluation is not possible due to the nature of the test method, the measurement uncertainty may be estimated based on principles of the techniques or practical experience of the performance of the method. The laboratory should prepare a procedure on evaluation of uncertainty of measurement for testing methods and measuring equipment.</p> <p>The laboratory staffs need practical training on the quantitation and evaluation of measurement uncertainty of test results and the internal calibration of equipment.</p>
7.7	<p>Ensuring the validity of results</p>	<p>The laboratory has not documented its policy for ensuring the validity of results. The Internal or</p>	<p>The internal quality control procedure need to be prepared and to be implemented for monitoring</p>

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
	<p>The standard requires laboratories to ensure that the results are valid through a process of internal and external quality controls. The purpose of internal quality control is to provide assurance that the current test procedure (a run or batch of samples) achieves the validated method performance.</p> <p>The standard also requires laboratories to monitor method performance externally, by comparing results and performance to other laboratories. The purpose of this external assurance is to identify any possible bias.</p>	<p>external quality control procedure for test measurement was not in place.</p>	<p>analytical testing performance.</p> <p>The external quality control policy needs to be documented. For each method in the accredited scope of work, either enrollment in proficiency testing program participation is required, or participation in other inter-laboratory comparisons. For both internal and external quality control approaches, laboratories are required to:</p> <ul style="list-style-type: none"> • record data in a manner such that trends are detectable • apply suitable statistical techniques to review the results(when practical) • analyze data from the monitoring to identify necessary controls to improve performance of activities • take appropriate action if trends are detected or results are outside of pre-defined limits / criteria • prevent reporting of erroneous results <p>Laboratory personnel need training on Lab Internal Quality Control Process and Laboratory Quality Assurance Process.</p>
7.8	<p>Reporting of results</p> <p>As testing reports are legal documents, being the final output of a contracted test measurement for a client. Laboratories must determine which requirements are applicable to service-general requirements (7.8.2), common requirements (7.8.2), specific requirements for test reports (7.8.3), requirements for reporting sampling (7.8.5), reporting statements of conformity (7.8.6), reporting opinions and interpretations (7.8.7), and requirements for amendments (7.8.8).</p>	<p>DOE laboratory has a reporting format, which fulfill the general requirements and almost all common requirements of ISO standards clause 7.8.1 and 7.8.2 respectively. The format is not a controlled form that meets the requirements of document control and record control as described in the clauses 8.3 and 8.4 of the ISO standard respectively.</p>	<p>The laboratory are required to provide results in a report, unless a simplified form is agreed to</p> <ul style="list-style-type: none"> • meet the content requirements of the appropriates clauses (7.8.2 to 7.8.8) • identify the method used • place a disclaimer on the report if customer-supplied information could affect the result validity • specify that results apply to the specific sample received (“as received”) when the laboratory was not responsible for sampling • include any decision rule on any issued conformity statement, along with specific

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
7.9	<p>Complaints</p> <p><i>The laboratory shall have a documented process to receive, evaluate and make decisions on complaints.</i></p>	<p>DOE Laboratory has a general complaints handling process. The documentation process is not controlled according to the requirements of ISO standard. No procedures and controlled record format were established for handling the complaints.</p>	<p>content listed in the standard in clause 7.8.6.2</p> <ul style="list-style-type: none"> • clearly mark any expressed interpretations and/or opinions reported that are associated with the tested item results • clearly identify any re-issued, changed, or amended reports and identify any changed information; if a totally new report is issued, include a reference to the original report <p>Laboratories issuing test reports must also include all the information / data needed for test result interpretation. This includes any specific test conditions (e.g., environmental) and measurement uncertainty (where applicable).</p> <p>The laboratory needs a procedure and recording format to handle the complaints from its clients. According to the requirements, the laboratory should:</p> <ul style="list-style-type: none"> • have a complaints handling process that is documented with an available description if requested by any involved party • take responsibility for the receipt of a complaint, verifying the validity, evaluation of information, and decisions to address complaints • acknowledge to the complainant, wherever possible, the complaint receipt, as well as supply progress reports, the outcome, and notice of the closure of the complaint handling • assign an independent person, who was not involved directly in the activity subject to complaint, to review, approve, or communicate the outcome to the complainant <p>The handling of complaints is directly interrelated with clause 8.5, <i>Actions to address risks and opportunities</i> and addressing nonconforming work -</p>

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for improvement
7.10	<p>Nonconforming work</p> <p><i>The requirement for nonconforming work is that laboratories must implement a procedure when any part of its results or activities do not comply with either ISO 17025, its own laboratory procedures, or customer requirements.</i></p>	<p>The implementation of non-conforming work generally do not document as required by ISO standard.</p>	<p>clauses 7.10 Nonconforming work and 8.7 Corrective actions.</p> <p>A mandatory procedure and retained records are required, detailing</p> <ul style="list-style-type: none"> ● assigned authority and responsibilities, including for the resumption of work ● the evaluation process and implication (significance) of the nonconformance ● decisions made on the halting or acceptability of work ● the impact assessment to analyze any risk to the validity of previous results ● how actions are based on identified risk levels ● notification of customers, if necessary, if work is recalled <p>the need to implement corrective actions if there is uncertainty regarding compliance with laboratory policies and procedures, or if evaluation indicates the possibility of reoccurrence of nonconforming work</p>
7.11	<p>Control of data and information management</p> <p><i>The laboratory shall have access to the data and information needed to perform laboratory activities. The laboratory information management system(s) (both computerized and non-computerized) used for the collection, processing, recording, reporting, storage or retrieval of data shall be validated for functionality, including the proper functioning of interfaces within the laboratory information management system(s) by the laboratory before introduction. Whenever there are any changes, including laboratory software configuration or modifications to</i></p>	<p>The DOE laboratory information management system is followed both non-computerized and computerized systems. In the laboratory, all information is recorded as paper based. The test report is produced both paper-based and online. However, all data and information need to be controlled according to the requirements of ISO standard.</p>	<p>As data and information are primary inputs and outputs for all ISO 17025 activities, there is a need for clear management of these valuable resources. In this clause, the standard applies requirements to both computerized and non-computerized system data and information. The laboratory should:</p> <ul style="list-style-type: none"> ● have the necessary access to information and data, including instructions and manuals, to support the laboratory activities ● validate Laboratory Information Management Systems(LIMS), including interfaces for functionality ● authorize, document, and validate changes before implementation ● operate the LIMS according to laboratory

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
8.	Management system requirements		<p>specifications to safeguard integrity of data and information</p> <ul style="list-style-type: none"> • protect the system from unauthorized access • provide safeguards against tampering or loss • check data transfers and calculations in an appropriate and systematic manner • ensure that any operator or external service provider of any off-site LIMS activities complies with appropriate ISO 17025 requirements
8.2	Management system documentation		ISO standard specifies the overall (overarching) requirement for management system documentation. It is important for laboratories to see this requirement as a process, not a once-off or once-in-a-while activity. This requirement should be met with a process approach with dynamic linking of activities as inputs and outputs, not simply cross-references.
8.3	Control of management system documents		Laboratories must(dynamically and effectively):
8.4	Control of records		<ul style="list-style-type: none"> • Create, document, implement, and support policies and objectives that address consistent laboratory operations, competence, and impartiality
8.5	Actions to address risks and opportunities		<ul style="list-style-type: none"> • ensure that the personnel throughout the organization acknowledge and uphold the policies and laboratory objectives
8.6	Improvement		<ul style="list-style-type: none"> • show evidence of the continual improvement of the established system
8.7	Corrective actions		<ul style="list-style-type: none"> • link, reference, or include all documentation, systems, processes, and records in the management system
8.8	Internal audits		<ul style="list-style-type: none"> • provide access to applicable parts of the management system to personnel, dependent on their responsibilities
8.9	Management reviews		<p>In this regard, the DOE laboratory should establish its management system according to the</p>

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
			<p>requirements of ISO standard stated in the clauses 8.2 to 8.9. The summary of this management system requirements are as follows:</p> <ol style="list-style-type: none"> 1) Establish quality policy and quality objectives of the laboratory activities and approved by the top management and ensure that the policies and objectives are acknowledged and implemented at all levels of the laboratory organization (8.2) 2) The laboratory shall control all the documents (internal and external) that relate to the fulfillment of the requirements (8.3). The document control procedure need to be prepared. 3) The laboratory shall establish and retain legible records to demonstrate fulfillment of the requirements (8.4) 4) The standard requires laboratories to consider, plan, evaluate, and take action to address risks and opportunities (8.5). The purpose is to ensure that a risk-based approach is managed effectively. 5) The laboratory shall identify and select opportunities for improvement and implement any necessary actions (8.6). Opportunities for improvement can be identified through the review of the operational procedures, the use of the policies, overall objectives, audit results, corrective actions, management review, suggestions from personnel, risk assessment, analysis of data, and proficiency testing results. The laboratory shall seek feedback, both positive and negative, from its customers. The feedback shall be analyzed and used to improve the management system, laboratory activities and customer service.

Clause	ISO 17025:2017 Requirements	Assessment findings	Opportunities for Improvement
			<p>6) The standard requires laboratories to address nonconformities through a sequence of specified steps, take appropriate actions based on the effects of the non conformity, and retain appropriate records using a corrective action procedure (8.7). Handling of complaints, clause 7.9, is directly associated with this process. Furthermore, as corrective actions need to be based on the impact of the nonconformity, this process is directly interrelated with Addressing risk and opportunities, clause 8.5.</p> <p>7) ISO 17025 requires that laboratories establish an internal audit program / schedule, perform internal audits (with defined scope and criteria) at pre-planned intervals, communicate the results of audits, implement appropriate corrective actions, and retain records (8.8). The purpose is to obtain information to evaluate if the management system complies with ISO 17025 and the requirements of the laboratory.</p> <p>8) The standard requires that laboratories review their management system at suitable pre-planned intervals to ensure its ongoing applicability, capacity, and performance capability (8.9).</p>

Chapter – 3: Scope and preparation for Accreditation

Quality testing of the physical chemical attributes of environmental specimens requires equipment and knowledge to perform specific tests. Provided DOE Chattagram Laboratory can obtain the necessary resources outlined in this report, the following table outlines a proposed flexible scope of accreditation in water quality parameters. A flexible scope would provide international recognition that DOE Lab has the quality system and technical competence to provide accurate and reliable results to inform regulatory decisions on environmental parameters.

A. Scope of Analytical Parameters to be Accredited

SN	Scope of parameter to be accredited	Existing Reference Standard with date of Expiry	Instrumentation / Methods of analysis	Comments
1.	p ^H	pH 7 (Oct 2023) pH 4 (Oct 2025) pH 10 (Sep 2023)	pH Meter / Multi-meter	Bench Top / Portable
2.	Dissolved Oxygen (DO)		Winkler Test / DO Meter/ Multi-meter	Lab procedure / Bench Top / Portable
3.	Chemical Oxygen Demand (COD)	Jun 2027	COD reactor with Colorimetric testing	The reflux method followed by titrimetric method can be developed at laboratory scale to validate the colorimetric testing
4.	Biological Oxygen Demand (BOD)	N (Jul 2023) KOH (Jun 2025)	Automatic BOD Analyzer	CRM of BOD Cal standard to be procured
5.	Total Dissolved Solids (TDS)	KCl (Aug 2026)	EC Meter / Multi-meter	Bench Top / Portable
6.	Electrical Conductivity (EC)	KCl (Aug 2026)	EC Meter / Multi-meter	Bench Top / Portable
7.	Temperature	--	Multi-meter	Calibrated Thermometer to be available
8.	Coliform	--	Membrane Filtration	CRM to be procured
9.	Nitrate (NO ₃ ⁻)	--	Colorimetric	CRM to be procured
10.	Phosphate (PO ₄ ³⁻)	--	Colorimetric	CRM to be procured
11.	Phenol	--	Colorimetric	CRM to be procured
12.	Chromium (Cr)	Expired	AAS (Flame & GF)	CRM to be procured
13.	Cadmium (Cd)	Expired	AAS (GF)	CRM to be procured
14.	Iron (Fe)	Expired	AAS (Flame)	CRM to be procured
15.	Arsenic (As) – Kit	Sep 2024	Gutzeit Method AAS (Hydride Generator)	CRM to be procured Method of AAS to be developed
16.	Suspended Solid (SS)	--	UV Spectrophotometry	CRM to be procured
17.	Oil & Grease	--	Gravimetric method	CRM to be procured
18.	Ammonium Nitrogen (NH ₄ -N)	--	UV Spectrophotometry	CRM to be procured
19.	Chloride (Cl ⁻)	--	Argentometric Titration	CRM to be procured
20.	Hardness	--	Titration	CRM to be procured

B. Preparation for Accreditation (technical requirements):

In order to ensure the quality analysis of the proposed parameters as well as to fulfill the requirements of accreditation the DOE Ctg laboratory should undertake the following internal program.

1. The Laboratory requires making available all the certified reference standards / materials for the testing parameters.
2. The standard operating procedure (SOP) need to be prepared and approved by the laboratory personnel. Prototype SOPs for COD and BOD analysis are given in the Annex 6.
3. The testing methods of all parameters should be validated according to the approved processes / SOPs and record of the validation data need to be retained appropriately. The following validation data should be recorded
 - a. Linear range of parameters,
 - b. Limit of Detection (LOD) and Limit of Quantitation (LOQ),
 - c. Accuracy of the method,
 - d. Precision of the method
 - e. Recovery of the analyte
 - f. Evaluation of measurement uncertainty etc.

These validated parameters are mandatory for submitting the application to BAB.

4. Establishing quality control method and performance monitoring of the testing methods
5. Training on each testing methods to the laboratory personnel
6. Authorization of testing parameters within the laboratory personnel
7. Laboratory personnel should prepare themselves to participate in Proficiency Testing Program / Inter-laboratory comparison practices to evaluate the competence of the analyst.

C. Training Needs

According to the assessment of laboratory personnel, it has been emphasized that capacity building of lab personnel in terms of technical courses is essential in order to get laboratory accreditation. The capacity building will be classified as two segments. In one segment, the knowledge on sampling, analytical skill and quality control process will be developed for all laboratory staff. The other segment includes the knowledge development on quality management system and accreditation process for selected laboratory staff. The topics of training / capacity building program are listed in the following table.

Segment - 1	Segment – 2
1. Environmental sampling technique	1. Basic requirements of ISO 17025:2017
2. Analytical methods of testing parameters	2. Management Procedures
3. Method Validation and verification process of testing parameters	3. Quality assurance and control
4. Internal quality control of test report / validity of test results	4. Evaluation of measurement uncertainty of analytical results
5. Calibration of measuring devices (Balances / volume / thermometer etc.)	5. Instrument Calibration and Metrological traceability

Chapter – 4: Plan of Action for getting accreditation (Future project)

A plan of action is suggested to enhance the readiness of DOE Laboratory, Chattagram for submitting its application for ISO/IEC 17025:2017 accreditation to Bangladesh Accreditation Board.

A. ISO 17025:2017 standard Implementation Steps:

Steps	Activities	Responsibility*	Expected Timeline**
1.	Establish a Quality Policy and Quality Objectives for the fulfillment of laboratory requirement to obtain the accreditation. In this regard two separate statements need to be documented for policy and objectives from the higher management and circulate to the personnel related to the laboratory management. The policy and objective can be displayed in different places where the laboratory staff and the customer have access.	Director & Deputy Director	1 week
2.	Prepare Management System Documents in order to fulfill the requirements of all the clauses mentioned in the ISO standard. A list of Mandatory Documents to be prepared is shown below Table-1 of Annex-2. A list of technical documents (not mandatory but essential for lab activities) to be prepared is shown in Table-2 of Annex-2.	Deputy Director & Senior Chemist	04 Months
3.	Prepare Quality System Forms in order to keep all types of records, generated from the management, field and laboratory activities as described in the clauses 5.1 to 8.9 of ISO standard. A list of quality forms to be developed is shown in Table-3 of Annex-2.		
4.	Prepare Quality Manual for Laboratory activities (not mandatory for ISO standard but a requirement by BAB)		
5.	Prepare Standard Operating Procedures (SOP) for Instrument Operation and Testing of parameters under the scope of accreditation. As DOE laboratory has decided to include 20 parameters, as mentioned in Chapter-3, for getting accreditation, the SOP of these should be completed.	Senior Chemist & Junior Chemist	04 Months
6.	The method validation of each parameter needs to be performed simultaneously during preparation of SOPs. The method validation data will be retained in the laboratory for future used.	Senior Chemist & Junior Chemist	04 Months
7.	Procurement of necessary supplies like reference standards, CRMs, set of standard mass, thermometer etc.	Deputy Director	02 Months
8.	Calibration of measuring equipment and analytical instruments & keeping records	Senior Chemist & Junior Chemist	02 Months
9.	Need based Staff Training to be arranged both by	Deputy Director	Regular

Steps	Activities	Responsibility*	Expected Timeline**
	external and internal resources		
10.	Monitoring of Environmental parameters, analytical QC data, control charts etc., performance monitoring of lab staff, proficiency testing / ILC etc.	Senior Chemist	Regular
11.	Conduct Internal Audit and prepare the audit report	Deputy Director	02 Weeks
12.	Conduct Management Review meeting and prepare the meeting minutes	Director Deputy Director	01 Week
13.	Prepare the Application Form for submitting to BAB	Deputy Director	02 Weeks
14.	Submission of Application Form including Quality Manual and Audit Report, to BAB	Deputy Director	

* This is proposed by the consultant but the responsible people for specific task can be selected by the top management of the laboratory.

** The expected timeline is tight schedule if the staffs are dedicated to implement the tasks. Finally the Laboratory Management will decide the timeline.

B. Implementation timeline

The implementation timeline of the proposed major activities, mentioned in the above table, is shown in the following Gantt chart.

SN	Activities	Months										
		1	2	3	4	5	6	7	8	9	10	
1	Establish a Quality Policy and Quality Objectives	█										
2	Prepare Management System Documents	█	█	█								
3	Prepare Quality System Forms	█	█	█								
4	Procurement of necessary supplies		█	█								
5	Prepare Standard Operating Procedures				█	█	█	█				
6	Method validation of analytical parameters				█	█	█					
7	Calibration						█	█				
8	Staff Training		█		█		█		█		█	
9	Monitoring						█	█	█	█	█	
10	Prepare Quality Manual										█	
11	Internal Audit										█	
12	Management Review meeting											█
13	Prepare the Application Form											█
14	Submission of Application Form											█

C. Proposed Budget

Item #	Item Description	Quantity	Unit Price (Taka)	Total Price (Taka)
A.	Procurement of laboratory supplies			
1	Calibration and Maintenance of Analytical Instruments (yearly)	20 Instruments	40,000.00	8,00,000.00
2	Calibration of Measuring Devices (yearly) Analytical Balance / Microbalance /Thermometer	05 Devices	20,000.00	100,000.00
3	Spare parts of Analytical Instruments (electrodes, cuvette, etc.) (yearly)		Lump sum	6,00,000.00
4	Certified Reference Standards (CRM)	20 parameters	10,000.00	2,00,000.00
5	Analytical Reagents (yearly)		Lump Sum	5,00,000.00
	Approximate cost of laboratory supplies			22,00,000.00
B.	Capacity Building Training			
1	Segment – 1 (Chapter-3 C)	05 topics	50,000.00	2,50,000.00
2	Segment – 2 (Chapter-3 C)	05 topics	50,000.00	2,50,000.00
	Approximate cost of capacity building program			5,00,000.00
C.	External Support (consultant, vendor etc.)			
1	Hiring consultant for capacity building of laboratory staff	25 days	40,000.00	10,00,000.00
2	Vendor's support for equipment refurbish, repairing etc. (yearly)	25 days	20,000.00	5,00,000.00
	Approximate cost of external support			15,00,000.00
D.	Accreditation Cost			
	Pre-assessment cost		Approximate	2,00,000.00
	Assessment cost (including Auditor's TA/DA)		Approximate	4,00,000.00
	Surveillance assessment cost		Approximate	3,00,000.00
	Approximate cost of assessment for accreditation			7,00,000.00
	Total approximate cost			50,00,000.00

Chapter – 6: Feedback from the Laboratory Personnel

As a feedback of the orientation on accreditation gap analysis, the opinion of laboratory staff (9 persons) regarding the significant issues in Day 1 and Day 2 are summarized in the following table. The % respondent is shown in the square bracket [].

1. Please select the most important learning in day 1 about the sampling and field testing.	
[33 %]	The laboratory personnel follow the procedures of sampling and field testing according to the requirements of ISO 17025 standards.
[11%]	The laboratory personnel take information about sampling and field testing data in a standard Chain of Custody (COC) form, which is sufficient to fulfill the requirement of the ISO standard.
[22%]	The COC form need to be revised according to the requirement of ISO standard
[22 %]	The laboratory personnel follow the Standard Operating Procedures (SOP) for sampling and field testing parameters
[44 %]	The SOP for sampling and field testing parameters need to be prepared and followed
[44 %]	The field staff will take more precaution about personnel protection methods during sampling
[78%]	Laboratory personnel will be able to prepare all relevant documents that will be necessary for sampling and field analysis
[56%]	Laboratory personnel need assistance to prepare all relevant documents that will be necessary for sampling and field analysis

2. Please select the most important learning in day 2 about the laboratory testing and documentation.	
[22%]	The laboratory has SOPs for all instrument and analytical methods and keep all records in prescribed formats
[78%]	It needs to prepare SOPs and record keeping system for analytical methods and data management
[0 %]	The laboratory has own data recording system and sufficient for fulfill the requirement of ISO 17025
[67%]	The laboratory need to fit the documentation and record keeping system in accordance with the requirement of ISO 17025

3. Please select the most important learning in day 2 about the laboratory management system in order to fulfill the requirements of ISO 17025 accreditation process?	
[0%]	The laboratory is well equipped with instrumentation and has full documentation system and is ready for accreditation
[67%]	The laboratory is well equipped with instrumentation but has partial documentation system and need a certain preparation to get accreditation
[11%]	The laboratory has insufficient analytical instruments to get accreditation and need to procure a more instruments and develop or renovate the laboratory facilities
[56%]	The laboratory can proceed for accreditation based on its current facilities and equipment and improve its management system through a continual improvement process

4. Please select the most important concerns that related to the current status for preparation of accreditation process of Chattogram Laboratory.				
(a) To get accreditation, the management system documents and SOPs, in accordance with ISO 17025 are	[0%] ready	[67%] partially ready	[0%] not ready	[22%] just started
(b) The required laboratory management documents can be prepared by:	[11%] own resources	[56%] partially by own resources	[11%] external support	
(c) For the preparation of getting accreditation, the knowledge and experience of laboratory personnel are:	[11%] enough	[11%] not enough	[67%] need to be improved	
(d) To enrich the knowledge gap, the laboratory personnel needs	[0%] Hands-on training at lab premises	[11%] Training from in-house resources	[67%] Training from external resources	

5. What are the most important items for accreditation that Chattogram laboratory already have? The un-marked items will be considered as further developments are needed.	
[78%] Own laboratory establishment	[44%] Available environmental facilities
[56%] Analytical equipment	[11%] Equipment calibration (at some interval)
[11%] Method validation process	[67%] Testing parameters for water quality
[44%] Testing parameters for air quality	[0%] Testing parameters for noise / sound quality
[0%] Full documents and records	[89%] Partial documents and records
[78%] Educational qualification of existing staff	[0%] Sufficient training on sampling and testing
[11%] Quality Control procedure in place	[11%] Reference standards
[56%] Management support	[67%] Willingness of laboratory staff
[0%] Management System documents	[11%] Internal Audit of the testing and management
[22%] Sufficient resources	[0%] Handling of non-conforming works
[0%] Proficiency Testing /Inter-lab study	[11%] Follow risk-based approach for management

6. Please select the topics of the training need for your lab personnel to achieve accreditation	
[33%]	Analytical methods of water quality testing parameters
[33%]	Analytical methods of air quality testing parameters
[11%]	Analytical methods of sound quality testing parameters
[78%]	Method Validation and verification process of testing parameters
[56%]	Internal quality control of test report / validity of test results
[67%]	Evaluation of measurement uncertainty of analytical results
[89%]	Instrument Calibration and Metrological traceability
[67%]	Internal Audit of laboratory management
[89%]	Basic requirements of ISO 17025:2017
[67%]	Management Procedures

Annex - 1: Current facilities of DOE Lab, Chattagram

Table-1: List of analytical parameters and frequency of analysis

Serial No	Parameters	Frequency of Analysis	Comments
Water Analysis:			
1	pH	Daily	Field Analysis
2	DO	Daily	Field Analysis
3	TDS	Daily	Field Analysis
4	BOD	Daily	Lab Analysis
5	COD	Daily	Lab Analysis
6	SS	Daily	Lab Analysis
7	Oil & Grease	Daily	Lab Analysis
8	Coliform	Daily	Lab Analysis
9	EC	Daily	Field Analysis
10	Iron	Daily	Lab Analysis
11	Arsenic	Daily	Lab Analysis
12	Turbidity	Daily	Lab Analysis
13	Heavy Metals(Cr, As, Pb, Fe etc)	As per requirements	
Air analysis:			
1	SPM	Daily	Field Analysis
2	SO ₂	Daily	Field Analysis
3	NO _x	Daily	Field Analysis
4	PM ₁₀	Daily	Field Analysis
5	PM _{2.5}	Daily	Field Analysis
Sound Analysis:			
1	Sound Measurement	Daily	During Sampling
2	Sound Measurement	Routine Monitoring	Different Locations of the city
3	Sound Measurement	Upon Request from DoE Ctg Metro and Ctg District Office	Different Locations
4	Sound Measurement	During Mobile Court	Routine Work

Table-2: List of Field equipment and sampling facility

Sampling Equipment (Consumables)	List of Field Based Equipment (Number)
1. Glass Bottles	1. Multi meter (1) Functional
2. Ice Box	2. Sound Meter (1) Functional
3. Ice Tube	3. Dust Meter (1) Functional
4. Gloves, Mask	4. Low Volume Air Sampler (1) Functional
5. Plastic Bottles	5. High Volume Air Sampler (1) Functional

Table-3: List Analytical Instrument

Sl. No.	Equipment Description	Source	Model	#of Unit	Status	Comments
1	Micro Balance	Japan	BM 22, A& D Company Ltd,	2	Active	
2	AAS [Combined and Flame] Mono Chromatic Lamp(Continuum Radiation Source Xenon Short-Arc Lamp) for Analytikjena Contra A700.	Germany	Contra 700, Analytikjena	1	Active	
3	BOD unit	Germany	BD 600 & TC135S, Tinometer GmbH	1	Active	
4	COD unit	Germany	RD125 and MD100, Tinometer GmbH	1	Inactive	Under repairing
5	Laboratory Incubator	Spain	Incudigit, JP selecta	1	Active	
6	Drying Oven	Spain	Digitheat, JP selecta	1	Active	
7	Digital Analytical Balance	Japan	HR250AZ , A& D Company Ltd ,	1	Active	
8	Water Distillation Plant	UK	WSC004, Fistreem	1	Active	
9	ION Chromatographs	Germany	IONUS, Membrapure	1	Inactive	Need an extensive servicing. Column is required. IC Standards such as Chloride, Phosphate, Sulfate and Nitrate are required.
10	UV-VIS Spectrophotometer	Germany	Specord 200 Plus, Analytikjena	1	Active	
11	GCMS/MS system with Capillary column and three detector FID,ECD, FTD	USA	TSQ Duo, Thermoscientific	1	Active	Helium Gas is required. DDT and other important standards are required. UPS 10KVA is required.
12	TOC Analyzer	Germany	Multi N/C, Analytikjena	1	Active	Oxygen Gas is required. UPS

Sl. No.	Equipment Description	Source	Model	#of Unit	Status	Comments
						3KVA is required.
13	Ultrasonic Bath	Spain	Ultrasons HD, JP selecta	1	Inactive	
14	Sieve Shaker	Germany	Analysette 3 pro, Fritsch	1	Active	
15	Compound Microscope(optical)	Italy	B 192, Optika	1	Inactive	
16	Fume Hoods	Korea	Jeiotech	1	Active	
17	Bio-safety Cabinet	Spain	BIO II Advance 4, Telster	1	Active	
18	Muffle Furnace	Germany	Thermconcept	1	Active	
19	Microwave digester	Germany	Topwave, Analytikjena	1	Active	
20	PH meter	Romania	HI 2211, Hanna Instruments	1	Active	
21	Temperature Controlled Rotary Shakers	Germany	3017, GFL	1	Active	
22	Ultra –pure Water purification system	Spain	QRP180UV, Chmlab Group	1	Active	
23	Hot Plate with Magnetic Stirrer	USA	MS7-H550-Pro, SCIOGEX	1	Active	
24	Triple Quadruple UPLC-MS/MS system with accessories	USA	TSQ Quantum Access Max, Thermoscientific	1	Active	LC System active but MS system is not working. UPS 10KVA for LC-MS/MS is required.
25	FTIR Spectroscopy	USA	Nicolet iS5, Thermoscientific	1	Inactive	ID7 ATR detector for FTIR machine. DTGS Detector for FTIR machine
26	Water quality Checker/sampler	Japan	U-52, Horiba	1	Inactive	
27	Solid phase Extraction system	Italy	ChromaliaSrl	1	Active	
28	Vacuum Rotary Evaporator	Italy	EV311, Labtech	1	Active	
29	Filtration unit with vacuum pump	Spain	FR3x500, ChmLab Group	1	Active	
30	Bench Top Centrifuge Machine	Germany	Z 306, Hermle	1	Active	
31	Homogenizer	USA	D 160, SCIOGEX	1	Active	
32	Vortex Mixture	USA	MX-S, SCIOGEX	1	Active	
33	Digital Micro pipette	France	Gilson	1	Active	

Capacity Building on Laboratory Management and Accreditation for DOE Laboratory, Chattagram

Sl. No.	Equipment Description	Source	Model	#of Unit	Status	Comments
34	Digital Milk Analyzer	Germany	Lactostar, Funke Gerber	1	Active	
35	Autoclave	Japan	ES-315, Tomy Digital	1	Active	
36	High Volume Sampler	India		1	Active	
37	Dehumidifier	Local (Media Brand)	Local (Media Brand)	9	Active-5 Inactive-4	
38	Multi sensor based Air Quality monitors [for Sox, Nox, CO, HC]		New Zealand	1	Active	
39	Air sampler for SPM		UK	1	Active	
40	SPME Air Sampler (for Volatile Organic Compound):		USA	1	Inactive	
41	Refrigerator	Rangs	Thailand	1	Active	
42	Multi meter	Hach HQ 40D	USA	1	Active	
43	Opacity Meter/Smoke Meter		India	1	Active	
44	Stack Emission Sampler	PEM SMS4	India	1	Active	
45	UV Spectrophotometer	Hach DR-1900	USA	1	Inactive	