

Attachment XIV.B2 Appendix G
 Corrective Action Implementation Plan
 The Dow Chemical Company
 Michigan Operations, Midland Plant

Background

The Dow Chemical Company (Dow), Michigan Operations, Midland Plant (MID 000 724 724) is located within the City of Midland in Sections 27, 28, and 35 of Midland Township; Township 14N, Range 2E. The Michigan Operations, Midland Plant (Midland Plant) is an industrial manufacturing and research site comprised of approximately 1,900 acres.

Salzburg Landfill (MID 980 617 435) is located southwest of the intersection of Waldo and Salzburg Roads, in Section 35, of the City of Midland. The landfill is designed for disposal of non-hazardous and hazardous wastes. On-going environmental monitoring is in effect around the Landfill to detect releases. There have been no releases identified from Salzburg Landfill.

Hazardous waste management activities occur at these facilities and are regulated under Michigan’s Natural Resources and Environmental Protection Act, 1994 PA 451, Part 111 and the Federal Resource Conservation and Recovery Act (RCRA) found at 40 CFR Parts 260 through 270. Active regulated units include the following:

Surface Impoundments	Container Storage Areas	Tank Systems	Incinerators	Landfills
Tertiary Pond	Waste Storage Area I	V-101	32 Incinerator	Salzburg Landfill
	32 Building Pack Room	V-301		
	830 Building	V-302		
	Offload Spots at the Incinerator	V-303		
	703 Tank Farm Spots	V-401		
	Rail Car Spots	V-402		

Surface Impoundments	Container Storage Areas	Tank Systems	Incinerators	Landfills
		V-403		
		V-404		
		V-601		
		V-701		
		1163 Building		
		33 Building		

Licensed hazardous waste management facilities are required to conduct corrective action as necessary to protect the public health, safety, welfare and the environment for all releases of a contaminant from any waste management units at a facility, pursuant to Part 111. The purpose of the Part 111 Corrective Action Program is to address releases of hazardous wastes and hazardous constituents at hazardous waste management facilities in a timely manner. Corrective actions conducted pursuant to Part 111 are designed to be protective of human health and the environment both in the short-term and long-term. Short-term corrective action focuses on the implementation of interim actions to achieve stabilization and to control the source(s) of release to reduce or eliminate, to the extent practicable, further releases of hazardous waste or hazardous constituents that may pose a threat to human health or the environment. To be protective in the long-term, final remedies are designed and implemented to achieve media specific cleanup objectives, either through remediation and/or institutional controls, including identification of specific points of compliance and monitoring.

For the purposes of Part 111, corrective action applies to areas or units described as Waste Management Units (WMUs) or Areas of Concern (AOCs). WMUs are defined as any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at the Midland Plant at which solid wastes have been routinely and systematically released. AOCs are areas where hazardous waste, hazardous constituents, or hazardous substances may have been released to the environment on a non-routine basis, which may present an

unacceptable risk to public health, safety, welfare, or the environment, and are subject to the corrective action requirements of Part 111 of Act 451 and the remediation requirements of Part 201 of Act 451.

All currently identified WMUs and AOCs are listed in Table B2-1. WMUs and AOCs with ongoing Part 111 Corrective Action obligations are indicated in Table B2-1A. All Remaining WMUs and AOCs listed in Table B2-1 do not require corrective action at this time, other than the ongoing site-wide environmental monitoring and maintenance requirements described in Re-application Attachment XIV.B5.

Corrective Action Approach

The Michigan Operations, Midland Plant is a large site with an operating history of over 115 years and multiple historical sources of contamination. The entire Midland Plant is designated as a WMU and within the Midland Plant there are a number of individual WMUs and AOCs.

The generic RCRA corrective action process includes seven steps:

- Initial Facility Assessment;
- Site Characterization;
- Short-term (interim) Actions;
- Remedy Evaluation and Selection;
- Remedy Implementation;
- Remedy Completion; and
- Public Participation.

The above activities have been organized into a formal process. The Midland Plant has a number of WMUs and AOCs that are at different stages within this process. The generic RCRA corrective action process does not consider any site-specific information.

At the Midland Plant, corrective action is performed in a phased approach that focuses on areas that represent the greatest short-term risk to human health and/or the environment, which is consistent with site corrective action objectives.

Corrective action at the Midland Plant has been performed with a focus on five main approaches, being:

- Site-Wide Containment;
- Worker Exposure Control Program;
- Monitored Natural Attenuation;
- Contaminant Mass Reduction; and
- Off-site Corrective Action.

Achieving stabilization of the WMUs, meeting the Groundwater Contained Environmental Indicator, worker exposure control, and addressing off-site releases have been the driver for these actions. The next phase will include increased emphasis on meeting the Human Exposure Environmental Indicators.

Focused Oversight for Corrective Action

EPA created several mechanisms to facilitate implementation of corrective action using a results-based approach instead of a process-based scheme, including streamlined “cleanup only” RCRA permits, alternative land disposal restriction soil standards for cleanups, temporary units (TUs), corrective action management units (CAMUs) and staging piles. Consistent with this approach, Dow and Michigan Department of Environmental Quality (MDEQ) have worked collaboratively to incorporate site-specific provisions to facilitate corrective action at the Midland Plant, including:

- Generic RGIS Upgrade Work Plan;
- Site-Specific Treatability Variance for Corrective Action;
- One-time Staging Pile authorization;
- CAMU Authorization; and
- Focused Oversight.

In addition to focused oversight, summarized above, Dow is proposing a more comprehensive approach. Historically at the Midland Plant, AOCs and WMUs were handled individually as they were discovered, and investigation and/or remediation activities followed the generic RCRA corrective action steps on a site-by-site basis. Dow is proposing a strategic change in approach for the Midland Plant and intends to begin addressing potential impacts and risk in a comprehensive manner. The purpose of this approach is to assess and mitigate risks to human health and the environment and to expedite the development and implementation of long-term sustainable remedial solutions.

Midland Plant Corrective Action Goals

Dow intends to achieve the following goals during the next license period (~ 2015 to 2025):

1. Maintain status as ‘under control’ for the Migration of Contaminated Groundwater Environmental Indicator through on-going operation and maintenance of remediation systems.
2. By 2020, reach ‘under control’ status for the Human Exposures Environmental Indicator (HE EI) for the Midland Plant.
3. By 2025, define and implement remedy as required at AOCs located along the Midland Plant perimeter not contained by the Revetment Groundwater Interception System (RGIS); including the Northeast Perimeter, US-10 Tank Farm, Former Diesel Tank Farm, Ash Pond, Chemical Disposal Well 3, Pure Oil, and Brine Spill Sites 4M, 13S and 6 Pond Purge Wells.
4. Implement additional Source Control measures where mobile free phase liquids are identified, with priority given to those areas with potential to impact human health and the environment beyond the source area.

Each of the four goals are discussed further below.

Migration of Contaminated Groundwater

To maintain the status as ‘under control’ for the Migration of Contaminated Groundwater Environmental Indicator, corrective action would include activities such as maintaining RGIS

and other corrective action systems, completing system upgrades as necessary, monitoring groundwater, investigation and other remedial actions to address increasing trends in contaminants or indicator parameters identified during environmental monitoring. Based on age, design and current operating conditions; RGIS system upgrades may be necessary between CO #1 and the Dow Dam, as well as from LS #4 and #5. Engineering and operational evaluations of these systems are in progress and initial permitting activities have been initiated. At locations where engineering controls are not in place, such as the Northeast Perimeter, Former Diesel Tank Farm, Ash Pond, and Chemical Disposal Well 3, additional corrective actions may be required to stabilize migration of contaminated groundwater or demonstrate that the area of contamination is not expanding.

Human Exposures

Achieving the status of ‘under control’ for the Human Exposures Environmental Indicator (HE EI) will include updating the Worker Exposure Protection Plan to include indoor and ambient air protection, as well as completing on-going work addressing the direct contact to soils pathway. To fully address these exposure pathways, the work will involve an identification of appropriate pathway-specific target analytes, development of a sampling and analysis plan, development and implementation of a prioritized schedule for evaluation, and the identification of risk-based criteria and the area over which it may apply (such as an exposure unit). Once the criteria are identified, decision rules for remedy implementation may be developed to evaluate results and, if necessary, inform the design and implementation of remedial measures and establish effective monitoring and maintenance plans. In some cases, presumptive remedy may be implemented in lieu of characterization.

Perimeter Areas Not Contained by RGIS

Addressing AOCs that are not contained by RGIS will involve characterizing the sites, evaluating the risk and either eliminating it as an AOC based on the results of the characterization, or defining, designing and performing remedy that eliminates or controls all relevant and applicable pathways.

Source Control Measures

A number of source control measures have already been implemented at the Midland Plant. For new sources, or areas of free phase liquids that may be identified, additional measures may be needed. When implementing source control measures, priority is given to those areas where the sources are potentially mobile and present risk to human health and the environment beyond the source area (such as migration to a sewer or vapor migration), over where they are contained and stable.

Throughout the license period, routine status update work meetings will be held at a frequency agreed on by MDEQ and Dow. A Microsoft Sharepoint® website, or equivalent, will be utilized to provide data and other electronic deliverables to MDEQ, as needed for decision-making and help MDEQ fulfill their oversight function. As additional information becomes available, other corrective action goals may be identified in cooperation with MDEQ. The work planning process, described below, will be an iterative process that will incorporate changes, as warranted, through adaptive management.

Work Planning

Currently, the corrective action process is prescriptive with clearly defined timelines. The process for conducting corrective action and/or Response Activities occurs in compliance with the timelines and requirements listed below:

- If a new WMU or a release is identified, MDEQ must be notified within 30 days.
- If MDEQ notifies Dow that corrective action for the release is required, Dow must submit a Remedial Investigation (RI) Work Plan within 60 days.
- Upon MDEQ approval, Dow must implement the workplan within 45 days.
- Upon completion, Dow must provide an RI Final Report within 60 days.
- If MDEQ identifies deficiencies, Dow must provide formal responses and revisions to the RI Final Report within 45 days.

During the upcoming license period, MDEQ has the authority to require Dow to conduct corrective action by the process described above. However, by working cooperatively with

MDEQ to identify issues and goals up front, there are opportunities to streamline the process and achieve the corrective action objectives more efficiently and quickly than through the prescriptive process. This approach allows Dow and MDEQ to focus more on critical issues and less on those that are not critical to achieving remedial goals. Focusing oversight will enable a more expedited approach to characterization and remedy design. By working collaboratively with MDEQ during development of the work plan, Dow hopes to avoid the comment and response phases of the current corrective action timeline.

To streamline the corrective action process, each year Dow will prepare an Annual Midland Plant Corrective Action Work Plan. The initial work plan will be provided in December 2015. The first Annual Corrective Action Summary Report will be provided in December 2016. Subsequent Annual Midland Plant Corrective Action Summary Reports and Work Plans will be submitted each December.

Work Plans will be developed collaboratively with MDEQ and will summarize the specific objectives for that year, including the following key reporting concepts:

- Milestones;
- Oversight Plan;
- Performance Standards;
- Focused Data Collection;
- Facility-lead (or Voluntary) Corrective Actions; and
- Presumptive Remedy.

During each calendar year, the proposed work will proceed to address the prioritized and specific objectives that support the Midland Plant Corrective Action Goals. Activities will be designed to achieve the goals within the timeframe proposed in the Annual Site Corrective Action Work Plan, which will fulfill Dow's corrective action obligations.

The high level plan that depicts the anticipated projects needed to meet the Midland Plant Corrective Action Goals through 2020 (for the HE EI) and 2025 for the remaining goals is included as Attachment 1. This overview presents the prioritization of the focus area, with an

anticipated duration. Each year, new information may require adaptation of the priorities and a revision to the high level plan.

Milestones

Milestones will be defined each year. Examples of annual milestones may include activities that Dow intends to complete, response actions, approvals or authorizations, permits, data collection and the effective communication of results.

Oversight Plan

Project-specific factors that influence oversight will be considered as the Annual Site Corrective Action Work Plans are developed. Proceeding through corrective action, Dow must continue to demonstrate that the environmental objectives and Performance Standards are being met. The oversight plan will consider the work identified for completion during the year, identifying critical stages where input, concurrence or approval are necessary. At a minimum, quarterly meetings will be planned for review of progress and discussion of results.

Performance Standards

Standards will be consistent with requirements of Part 111 of Michigan Act 451, and as appropriate, Part 201.

Focused Data Collection

Data quality objectives (DQOs) will be developed for the focused data collection activities identified in the work plan. A review of historical information and current status will be used to facilitate a targeted approach of focused data collection to address risk, uncertainties or design features.

Facility-Lead (or Voluntary) Corrective Actions

As necessary, voluntary corrective action may be implemented. Voluntary corrective action will be disclosed prior to implementation, with the understanding that Dow is accountable for achieving the environmental results and assumes the risk that additional work may be required in the future by MDEQ if the environmental results are not achieved or demonstrated.

Presumptive Remedies

Dow may voluntarily implement a presumptive remedy if a source at the Midland Plant is identified that is similar to others that have previously been addressed, and a similar remedy can successfully be implemented to achieve the same objective.

Reporting and Communication

A plan for focused oversight for corrective action does not change the required outcome of corrective action process, nor does it remove Dow's obligation to provide documentation that summarizes the work that was completed. Formal reporting will include an Annual Midland Plant Corrective Action Work Plan. During remedy construction or operation and maintenance, a summary of progress will be provided in an Annual Midland Plant Corrective Action Summary Report along with records of additional monitoring, inspections and maintenance.

Formal reporting will complete the operating record by clearly establishing the nature and extent of contamination, relevant exposure thresholds and pathways and a description of the remedy. Upon completion of the work, reports will also include documentation of compliance with the cleanup objectives, and verification that any applicable institutional controls were filed.

At a minimum, the required or additional environmental monitoring data generated by corrective action activities will be provided to MDEQ, as needed via a Microsoft Sharepoint® website (or equivalent) or as part of routine status update meetings. At a minimum, monitoring data will be included with the Environmental Monitoring Reporting required by the license.

Throughout each year, additional reporting requirements may be identified, as additional information becomes available. Additional reporting needs will be identified cooperatively with MDEQ through adaptive management.

Attachment 1
Corrective Action Implementation Plan
High Level Overview

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
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Direct Contact	█									
Indoor Air	█									
Ambient Air			█							
HE EI Met					◆					
Ash Pond	█									
Diesel Tank Farm (7th St Purge Wells Area)			█							
Chemical Disposal Well 3	█									
Pure Oil				█						
US-10 Tank Farm						█				
4M Brine Well Site								█		
13S Brine Well Site								█		
6 Pond Purge Wells									█	
Northeast Perimeter	█		- - - -							

Attachment XIV.B2
Appendix H
Corrective Action Cost Estimates
The Dow Chemical Company
Midland Plant Facility

The administrative rules promulgated pursuant to Part 111, Hazardous Waste Management, of Michigan's Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), R 299.9713 establishes requirements for providing financial assurance for corrective action. Specifically, R 299.9712 prescribes the preparation of associated cost estimates and this attachment has been prepared pursuant to those requirements.

This Attachment is organized as follows:

H.A	CORRECTIVE ACTION COST ESTIMATE
H.A.1	Corrective Action Cost Estimate Breakdown
Table H.A.1	Facility Corrective Action Cost Estimate Breakdown
Table H.A.2	Remediation Operation and Maintenance Cost Estimate
Table H.A.3	Environmental Monitoring Cost Estimate
Table H.A.4	Wastewater Treatment Cost Estimate
Table H.A.5	Remediation System Replacement Cost Estimate

H.A CORRECTIVE ACTION COST ESTIMATE

An owner or operator is required to establish financial assurance for the cost of performing corrective action at the facility in accordance with the provisions of R 299.9629 and the site operating license. The financial assurance is based on a detailed written estimate, in current dollars, of the cost of hiring a third-party to complete the corrective action measures required pursuant to the provisions of R 299.9629 and the site operating license. Postclosure care for all units, active and previously closed (i.e., Container Storage Areas, Tank Systems, 32 Building Incinerator, WSA IIA & IIB, Closed Diversion Basin, Open Waste Water Conduits A, B, C-1, C-2, & C-3, and 703 & 830 Incinerators), located within the footprint of the closed 1925 Landfill will be included in the Corrective Action cost estimate section of this license reapplication. Postclosure monitoring and maintenance for all units located within the footprint of the 1925 Landfill will be consistent with the approved 1925 Landfill Corrective Action Monitoring and Maintenance Plan.

The cost estimate provided below has been prepared for the corrective actions that are currently required as defined by the operating license. If during the license period, it is determined that additional corrective measures are required and what those corrective measures will be, the corrective action cost estimate may be updated to reflect significant or long term corrective measures. Financial assurance can be adjusted as work is conducted or as the costs and scope of possible future work becomes known.

The cost for corrective action over thirty years for The Dow Chemical Midland Operations Plant Facility is estimated at **\$ 160,560,000**. The estimate was prepared assuming an average thirty year time period, but corrective action is expected to continue until established cleanup criteria are achieved and corrective action can be terminated, which in some cases may take more than thirty years and in others may take less. The corrective action cost estimate breakdown by function is provided in Section H.A.1. Function-specific work sheets are

provided, as applicable, in Tables H.A.1 through H.A.5. Total costs include a 10 percent contingency for miscellaneous operating costs.

Financial assurance is provided separately for off-site corrective actions to address historic releases to Midland Areas Soils, the Tittawabawasee and Saginaw Rivers and associated floodplains. Financial assurance for the City of Midland has not yet been established, but will be provided as described in the Remedial Action Plan. Financial assurance for the Tittabawassee and Saginaw Rivers and associated floodplains are provided for each approved CERCLA order, and are updated upon closure of an order, or issuance of a new order.

H.A.1 Corrective Action Estimate Breakdown

Provide a breakdown of the closure cost estimate for the facility by completing the following tables, as appropriate.

The following categories:

1. Remediation Operations and Maintenance
2. Environmental Monitoring
3. Wastewater Treatment
4. Remediation System Replacement
5. Wastewater Treatment Replacement

Table H.A.1 Facility Corrective Action Cost Estimate Breakdown

1.	Annual Remediation Operation and Maintenance Cost	\$ 1,350,100
2.	Annual Environmental Monitoring Cost	\$ 410,600
3.	Annual Wastewater Treatment Cost	\$ 552,000
4.	Annual Remediation System Replacement Cost	\$ 1,708,230
5.	Subtotal	\$ 4,020,930
6.	Corrective Action Program Management Allowance (10% of Subtotal Costs – Line 5)	\$ 402,100
7.	Annual Subtotal	\$ 4,423,030
8.	Subtotal of Annual Costs over 30 Year Period	\$ 132,690,900
9.	Wastewater Treatment Replacement Cost	\$ 13,269,090
10.	Subtotal of All Costs Over 30 Year Period	\$ 145,959,990
11.	Contingency Allowance (10% of corrective action costs)	\$ 14,600,000
Total Facility Corrective Action Cost Estimate (rounded to the nearest thousand)		\$ 160,560,000

Table H.A.2 Remediation System Operations and Maintenance

Remediation Operation and Maintenance general discussion.

Activity		Estimated Cost
1.	Annual Cap Maintenance Cost (Mowing, nuisance vegetation removal, re-grading and seeding as necessary)	\$ 173,000
2.	Annual Site Security	\$ 1,600
3.	Annual Groundwater Pumping System Operation Labor Cost	\$ 318,000
4.	Annual Remediation System Maintenance Service Cost	\$ 282,000
5.	Annual Remediation System Replacement Parts and Materials Cost	\$ 89,000
6.	Annual Groundwater Remediation System Electrical Cost	\$ 111,000
7.	Annual Remediation System Nitrogen Cost	\$80,000
8.	Annual Groundwater Pumping System Maintenance Cleaning Cost (tile jetting or well re-conditioning)	\$ 78,000
9.	Annual Snow Removal Cost	\$ 32,500
10.	Annual Soil and Groundwater Exposure Control Program Cost	\$ 75,000
11.	Annual Environmental Health and Safety Oversight Cost	\$29,000
12.	Annual Operating Waste Disposal Cost	\$37,000
13.	Annual Administration and Recordkeeping	\$44,000
Total Annual Operation and Maintenance Cost		\$ 1,350,100

Table H.A.3 Environmental Monitoring

Environmental Monitoring general discussion of corrective action only required programs.

Activity		Estimated Cost
1.	Annual East Side RGIS Chemical Monitoring Analysis Cost	\$ 8,700
2.	Annual West Side RGIS Chemical Monitoring Analysis Cost	\$ 1,500
3.	Annual 6 Pond Tile System Chemical Monitoring Analysis Cost	\$ 700
4.	Annual River Corrective Action Chemical Monitoring Analysis Cost	\$ 100
5.	Annual 7 th Street Purge Wells Chemical Monitoring Analysis Cost	\$ 14,000
6.	Annual Ash Pond Area Groundwater Monitoring Analysis Cost	\$ 3,500
7.	Annual Former 47 Building Area Monitoring Analysis Cost	\$ 500
8.	Annual Northeast Perimeter Groundwater Monitoring Analysis Cost	\$ 23,500
9.	Annual West Plant Perimeter Groundwater Monitoring Analysis Cost	\$ 800
10.	Annual Poseyville Landfill Corrective Action Monitoring Analysis Cost	\$ 4,000
11.	Annual Tertiary Pond Recovery Monitoring Analysis Cost	\$ 200
12.	Annual Overlook Park Monitoring Analysis Cost	\$ 600
13.	Annual US-10 Tank Farm Monitoring Analysis Cost	\$ 100
14.	Annual Soil Box Monitoring Program Analysis Cost	\$ 8,400
15.	Annual Sampling Labor Cost	\$ 59,000
16.	Subtotal Annual Chemical Monitoring Program Cost	\$ 125,600

Table H.A.3 Environmental Monitoring, cont.

Activity		Estimated Cost
17.	Annual RGIS East Hydraulic Monitoring Cost	\$ 7,600
18.	Annual RGIS West Hydraulic Monitoring Cost	\$ 38,000
19.	Annual 6 Pond Tile Hydraulic Monitoring Cost	\$ 16,200
20.	Annual River Corrective Action Hydraulic Monitoring Cost	\$ 200
21.	Annual 7 th Street Purge Well Hydraulic Monitoring Cost	\$ 6,500
22.	Annual Former 47 Building Area Hydraulic Monitoring Cost	\$ 1,100
23.	Annual Facility Shallow Hydraulic Monitoring Cost	\$ 34,600
24.	Annual South Saginaw Road Tile Hydraulic Monitoring Cost	\$ 1,500
25.	Annual Poseyville Landfill Corrective Action Hydraulic Monitoring Cost	\$ 5,800
26.	Annual LEL I Hydraulic Monitoring Cost	\$ 3,200
27.	Annual LEL II Hydraulic Monitoring Cost	\$ 2,800
28.	Annual LEL III Hydraulic Monitoring Cost	\$ 3,700
29.	Annual 1925 Landfill Hydraulic Monitoring Cost	\$ 3,700
30.	Annual Tertiary Pond Slurry Wall Hydraulic Monitoring Cost	\$ 1,700
31.	Subtotal Annual Hydraulic Monitoring Program Cost	\$ 126,600
32.	Annual Monitoring Point Inspections and Maintenance Cost	\$ 32,400
33.	Annual Reporting Cost (Production of 5 Environmental Monitoring Reports)	\$ 126,000
34.	Subtotal Annual Environmental Monitoring Program Administration Cost	\$ 158,400
Total Annual Environmental Monitoring Cost (Add lines 16, 31, and 34)		\$ 410,600

Table H.A.4 Wastewater Treatment

The cost of Wastewater Treatment is estimated for two million gallons per day (2 MGD), in accordance with *Operation and Maintenance Costs for Municipal Wastewater Facilities* (EPA, 1981).

Total Operation and Maintenance Cost (TOMC) can be estimated for a facility with advanced secondary treatment by:

$$\text{TOMC (1981 US dollars)} = (1.24 \times 10^5) * Q^{0.758}$$

From the TOMC, the major component costs can be estimated as a percentage of the total (EPA, 1981). Estimates produced from the above equation must be adjusted to current dollars, due to the age of the baseline reference. The costs provided below only include wastewater treatment, and do not include any operation or maintenance cost for running the groundwater remediation system. Those are included separately in Table I.A.2.

Activity		Estimated Cost
1.	Total Annual Personnel Costs	\$ 220,000
2.	Wastewater Treatment Utilities	\$ 166,000
3.	Chemical Additive Costs	\$ 39,000
4.	Equipment & Material Costs	\$ 72,000
5.	Contractual & Other Costs	\$ 55,000
Total Annual Cost of Wastewater Treatment		\$ 552,000

Table H.A.5 Remediation System Replacement

During the License Period (2015 to 2025), the reliable life expectancy of groundwater extraction systems currently in place will potentially be reached. Monitoring and replacement of systems prior to failure is a guiding principle of corrective action for the Midland Plant. The total replacement cost for all of the existing groundwater extraction systems has been estimated at **\$ 51,246,800**. Over the next thirty years, replacement of these systems are assumed to be completed incrementally; therefore an annual allotment replacement cost is obtained by dividing the total cost by the time period, resulting in an annual remediation system replacement allotment cost of **\$1,708,230**. This figure represents the average cost of replacing a remediation system each year for the next thirty years. Depending on actual circumstances each year, more or less cost may be incurred but on average, the annual allotment is anticipated to be consistent when averaged over the next thirty years.

Activity		Estimated Cost
1.	RGIS East from Cleanout 1 to Manhole 8E Replacement Cost	\$ 9,235,000
2.	RGIS East from Manhole 8E to Manhole 8G Replacement Cost	\$ 589,000
3.	South Saginaw Road Replacement Cost	\$1,506,000
4.	RGIS West from Lift Station 16 to Manhole 11 Replacement Cost	\$ 4,375,000
5.	RGIS West from Lift Station 10 to Manhole 11E Replacement Cost	\$ 756,000
6.	RGIS West from Cleanout 14 to Lift Station 10 Replacement Cost	\$ 1,256,000
7.	RGIS West Lift Station 109 Section Replacement Cost	\$ 343,000
8.	6 Pond Tile from Manhole 14H to Manhole 11E Replacement Cost	\$ 4,251,000
9.	Overlook Park Tile from Cleanout A to Manhole 3A Replacement Cost	\$ 490,000
10.	Poseyville Landfill Perimeter Collection Tile Replacement Cost	\$ 8,076,000
11.	Sludge Dewatering Facility Collection Tile Replacement Cost	\$ 9,018,000
12.	US-10 Tank Farm Collection Tile Replacement Cost	\$ 955,660
13.	Poseyville Landfill Purge Well 2961 Replacement Cost	\$ 26,000
14.	Poseyville Landfill Purge Well 2690A Replacement Cost	\$ 26,000
15.	Poseyville Landfill Purge Well 2960 Replacement Cost	\$ 26,000
16.	Poseyville Landfill Purge Well 2917 Replacement Cost	\$ 26,000
17.	Purge Well #1 Replacement Cost	\$ 46,000
18.	Purge Well #2 Replacement Cost	\$ 56,000
19.	Purge Well #3 Replacement Cost	\$ 51,000
20.	Purge Well #4 Replacement Cost	\$ 55,000
21.	Deep Well #5964 Replacement Cost	\$ 79,000
22.	Johnston Well #1 Replacement Cost	\$ 38,000
23.	Johnston Well #2 Replacement Cost	\$ 38,000
24.	Johnston Well #3 Replacement Cost	\$ 38,000

Table H.A.5 Remediation System Replacement, cont.

Activity		Estimated Cost
25.	8 Pond Well A Replacement Cost	\$ 1,318,000
26.	8 Pond Well B Replacement Cost	\$ 1,275,000
27.	Sand Bar Horizontal Well Replacement Cost	\$ 1,400,000
28.	7 th Street Horizontal Well Replacement Cost	\$ 1,239,000
29.	Subtotal of Replacement Costs (Add Lines 1 through 28)	\$ 46,588,000
30.	Engineering Allowance (10% of Subtotal)	\$ 4,658,800
Total Cost of Remediation System Replacement (Add lines 29 and 30)		\$ 51,246,800

Table H.A.6 Wastewater Treatment Replacement

The existing Wastewater Treatment Facility at the Midland Plant Facility is designed to treat roughly 20 MGD. To estimate worst-case costs, the following scenario is considered. In this scenario, the wastewater treatment facility would need to process roughly two million gallons per day (2 MGD), to manage all groundwater pumping capacity and infiltration into the existing plant sewers. Total construction costs have been estimated in accordance with *Construction Costs for Municipal Wastewater Plants* (EPA, 1980).

Costs for construction of a new Wastewater Treatment Facility are estimated using cost data from 48 plants with similar treatment and capacity in 1978 to 1979.

Total Construction Cost (TCC) can be estimated for a facility with advanced secondary treatment by:

$$TCC \text{ (1981 dollars)} = (2.36 \times 10^6) * Q^{0.77}$$

Activity		Estimated Cost
1.	Total Construction Cost	\$ 13,480,000
Total Cost of Wastewater Treatment Replacement		\$ 13,480,000