Abandoned Mine Drainage Treatment Jobs Analysis

Pennsylvania Abandoned Mine Lands

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1. INTRODUCTION

This analysis estimates the number of jobs that would be supported by abandoned mine drainage (AMD) treatment at abandoned mine lands in Pennsylvania.

The estimates are for ongoing maintenance at 250 passive treatment sites throughout Pennsylvania. Although passive systems require minimal day-to-day upkeep, they must be monitored frequently to ensure that they operate effectively. Water quality samples must be collected periodically to confirm that treatment performance is optimal. The systems must be cleared of debris to be operational and repairs need to be made. Occasionally, more significant maintenance must be performed, such as sludge removal, limestone replacement, or system upgrades.

The number of jobs created is determined by first calculating the annual cost of ongoing maintenance at these sites. The amount of money spent is then used to calculate the number of jobs that would be supported by this work using a regional input-output model. The number of full-time positions to directly complete each of the tasks associated with maintenance is also calculated.

The estimated annual cost of ongoing maintenance at all modeled sites throughout Pennsylvania totals $2.8 million. This is an average of $11,200 per site per year. As documented below, these expenditures would support 34 jobs per year.

2. COST OF ABANDONED MINE DRAINAGE TREATMENT

The annual cost for the 250 passive treatment sites operating in Pennsylvania is calculated using information from Trout Unlimited (TU) through its facilitation of the Pennsylvania Department of Environmental Protection's Operation, Maintenance, and Rehabilitation Workgroup (PA DEP OM&R Workgroup) with other organizations, technical experts, and agencies.

Costs are divided into three categories: routine operations and maintenance (O&M), professional check-ups, and major system maintenance.

Routine O&M is performed at all sites four times per year. This includes site inspection, water quality sampling, flow measurements, and removal of debris. This work is completed by technical staff who are entry level, college-educated geologists or engineers. Other costs associated with this category include laboratory costs for sample analysis, field supplies, and travel. For one-quarter of these sites, routine O&M is completed by volunteers from local nonprofit groups. There are still expenses for O&M, but there is no labor cost at these sites.

Professional check-ups occur once every five years at all sites, and are staggered so that 20% of sites receive professional check-ups every year. This work is conducted by an engineer or environmental scientist and includes site inspection, maintenance of channels, repairing damage, and water sampling. Other costs associated with this category include laboratory costs for sample analysis, field supplies, and travel.

Major system maintenance is performed at each site once every 10 years, with 10% of sites undergoing major system maintenance each year. Work includes plan designs for updating the system by an engineer. A consultant/project manager oversees a construction crew (two unskilled laborers and three skilled laborers and supporting equipment) to replace limestone and organic substrate, remove sludge and sediments, repair the system, or modify the system to improve performance.

Table 1 summarizes the cost per site and the annual costs. The annual cost for AMD maintenance totals $2.8 million, with $2 million for major system maintenance alone.

Table 1: Annual costs (2015 dollars)

	Cost per site per visit	Annual cost
Routine O&M and sampling		
Technical staff	$410	$307,500
Lab analysis	$190	$190,000
Field supplies	N/A	$5,000
Travel	$150	$150,000
Total, routine O&M and sampling	**$750**	**$652,500**
Professional check-ups		
Consultant/Engineer	$1,600	$80,000
Lab analysis	$730	$36,500
Field supplies	N/A	$1,000
Travel	$150	$7,500
Total, professional check-ups	**$2,480**	**$125,000**
Major system maintenance		
Consultant/Engineer	$16,000	$400,000
Unskilled labor (2)	$6,000	$150,000
Skilled labor (3)	$12,000	$300,000
Consultant/Project manager (1)	$7,000	$175,000
Equipment	$10,350	$258,750
Travel	$150	$3,750
Materials	$28,500	$712,500
Total, major system maintenance	**$80,000**	**$2,000,000**
TOTAL		**$2,777,500**

Note: The numbers in parentheses after Unskilled labor, Skilled labor, and Consultant/Project manager indicate the number of workers in each of those positions. Technical staff perform routine O&M at three-quarters of the sites; volunteers perform these tasks at the other sites. Professional check-ups are performed at 20% of all sites each year, and major system maintenance is performed at 10% of all sites each year.

3. CALCULATING JOBS USING RIMS II

The Regional Input-Output Modeling System (RIMS II),[1] a regional economic model supported by the United States Department of Commerce, was used to assess the potential economic impact of the expenditures documented above. The model provides state-specific multipliers for 369 industries that show how spending on a project affects employment.[2]

It was assumed that the work would be managed and completed by contractors. The dollar amounts in Table 1 are assumed to be the amounts paid to the contractors for labor and expenses for each category of work.

There are two types of RIMS data: Type I and Type II. Type I data account for direct and indirect jobs. In this case, the direct jobs would be those created to perform O&M, professional check-ups, and major system maintenance—engineers, technicians, and laborers. Indirect jobs would be those that support this work—for example, via the purchase of supplies, laboratory analysis, and equipment rental. RIMS results include both full-time and part-time jobs, but RIMS does not specify how many of each are created.

Type II data add induced jobs to the direct and indirect jobs. Induced jobs refer to those created by the spending of workers included in Type I. Examples include jobs at grocery stores, gas stations, and retail stores. Type II jobs also includes full- and part-time jobs.

Results are calculated for both Type I and Type II data.

The version of RIMS II that is used is based on 2007 benchmark input-output data and 2013 regional data. The values in this version of RIMS II are in 2010 dollars, so all dollar amounts were devalued using a gross domestic product deflator from the Saint Louis Federal Reserve Bank.[3]

To calculate the total numbers of jobs supported annually by AMD treatment, the total amount of money spent annually for each labor and expense category presented in Table 1 was converted to millions of dollars, then reduced to 2010 dollars, and finally multiplied by the appropriate multiplier for Type I or Type II data.

According to RIMS II Type I data, a total of 22.5 direct and indirect full- and part-time jobs would be supported annually (Table 2). Using Type II multipliers, 34 direct, indirect, and induced jobs would be supported annually (Table 3).

[1] https://www.bea.gov/regional/rims/index.cfm

[2] The model also calculates total gross output and earnings, but only the employment results are used in this report.

[3] https://research.stlouisfed.org/fred2

Table 2: Number of direct and indirect annual jobs supported annually, using Type I RIMS multipliers

Position	Number of jobs
Routine O&M and sampling	
Technical staff	3.4
Lab analysis	2.1
Field supplies	0.1
Travel	1.8
Professional check-ups	
Consultant/Engineer	0.6
Lab analysis	0.4
Field supplies	0.0
Travel	0.1
Major system maintenance	
Consultant/Engineer	3.8
Unskilled laborer	1.1
Skilled laborer	2.3
Consultant/Project manager	1.3
Equipment	1.5
Materials	4.0
Travel	0.0
TOTAL	**22.5**

Table 3: Number of direct, indirect, and induced annual jobs supported annually, using Type II RIMS multipliers

Position	Number of jobs
Routine O&M and sampling	
Technical staff	4.8
Lab analysis	3.0
Field supplies	0.1
Travel	2.4
Professional check-ups	
Consultant/Engineer	0.9
Lab analysis	0.6
Field supplies	0.0
Travel	0.1
Major system maintenance	
Consultant/Engineer	5.9
Unskilled laborer	1.7
Skilled laborer	3.5
Consultant/Project manager	2.0
Equipment	2.6
Materials	6.3
Travel	0.1
TOTAL	34.0

4. CALCULATING FULL-TIME JOBS

Because RIMS II does not distinguish between full- and part-time jobs, an additional analysis was conducted to estimate the number of direct full-time jobs. Information about the amount of time to complete each activity and assumptions about salaries and company costs, such as administration and overhead, were used to estimate the total dollar amount of each person's salary that would be spent directly on AMD treatment tasks.

Information about salaries was determined from conversations with TU and through research on the job search website Indeed.com. Salary information was based on positions in Pennsylvania as similar as possible to the ones that would complete this work. Overhead and administrative costs were estimated using the author's knowledge managing a consulting firm.

Assumptions are provided in Table 5 and Table 6.

An estimated 13 full-time direct jobs would be supported annually by AMD treatment. This is almost 40% of the full- and part-time direct, indirect, and induced jobs estimated using RIMS II Type II multipliers.

Table 4: Number of direct full-time jobs supported by AMD treatment

Position	Number of jobs
Routine O&M and sampling	
Technical staff	2.0
Professional check-ups	
Consultant/Engineer	0.4
Major system maintenance	
Consultant/Engineer	1.9
Unskilled laborer	2.4
Skilled laborer	3.6
Consultant/Project Manager	1.2
Administrative staff	1.5
TOTAL	**13.0**

APPENDIX A: ASSUMPTIONS

The assumptions listed in Table 5 were provided by TU and Hedin Environmental, a collaborator in the PA DEP OM&R Workgroup, except for the hours for project installation for major system maintenance. This value was assumed by Downstream Strategies based on the total cost for project installation.

Table 5: General assumptions made for calculations

Assumption	Value
Number of systems	250
Routine O&M	
Annual cost at 75% of sites	$3,000
Annual cost at 25% of sites	$1,000
Average number of samples for routine O&M per site	5
Cost per water sample for laboratory analysis	$38
Professional check-ups	
Hourly charge rate for an engineer	$100
Hours per visit	16
Major system maintenance	
Cost of major system maintenance	$80,000
Hours per project installation for each laborer for major system maintenance	100
Annual frequency	
Routine O&M and sampling	4
Professional check-ups	0.20
Major system maintenance	0.10

Salary assumptions (Table 6) were determined by Downstream Strategies staff using information provided by TU and salary searches on Indeed.com.

Table 6: Salary assumptions per position

Position	Value
Total hours annually for full-time position	2,080
Consultant/Engineer (Routine O&M)	
Hours per visit	16
Hourly charge rate	$100
~~Annual salary~~	$80,000
Overhead percentage	28%
Annual cost to company	$102,400
Administrative staff	
Annual salary	$32,000
Overhead percentage	28%
Annual cost to company	$40,960
Percentage of overhead for admin staff	10%
Technical staff	
Hours per visit	5.47
Hourly charge rate	$75
Annual salary	$45,000
Overhead percentage	28%
Annual cost to company	$57,600
Unskilled laborer (2)	
Hours per visit	100
Hourly charge rate	$30
Annual salary	$35,000
Overhead percentage	28%
Annual cost to company	$44,800
Skilled laborer (3)	
Hours per visit	100
Hourly charge rate	$40
Annual salary	$50,000
Overhead percentage	28%
Annual cost to company	$64,000
Consultant/Project manager	
Hours per visit	100
Hourly charge rate	$70
Annual salary	$70,000
Overhead percentage	28%
Annual cost to company	$89,600
Consultant/Engineer (Major System Maintenance)	
Hours per visit	160
Hourly charge rate	$100
Annual salary	$80,000
Overhead percentage	28%
Annual cost to company	$102,400

Table 7 provides the codes and industries used in the calculations. Industry codes were assigned based on communication between Downstream Strategies and Dr. Alan Collins.

Table 7: Industry codes used in the RIMS II analysis

Pos	Code	Type II multiplier	Type I multiplier	Industry
Routine O&M				
Technical staff	5416A0	17.06	11.96	Environmental & technical consulting
Lab analysis	5416A0	17.06	11.96	Environmental & technical consulting
Field supplies	5416A0	17.06	11.96	Environmental & technical consulting
Travel	combination of 722000, 7211A0, & 532100	28.32,19.87, 10.33	23.32,15.29, 6.38	Food services (25%), hotels & motels (25%), and auto rental & leasing (50%)
Professional check-up				
Consultant/Engineer	562000	12.48	8.24	Waste management and remediation services
Lab analysis	5416A0	17.06	11.96	Environmental & technical consulting
Field supplies	5416A0	17.06	11.96	Environmental & technical consulting
Travel	combination of 722000, 7211A0, & 532100	28.32,19.87, 10.33	23.32,15.29, 6.38	Food services (25%), hotels & motels (25%), and auto rental & leasing (50%)
Major system maintenance				
Consultant/Engineer	541610	15.92	10.40	Management consulting services
Unskilled laborer	562000	12.48	8.24	Waste management and remediation services
Skilled laborer	562000	12.48	8.24	Waste management and remediation services
Consultant/Project manager	562000	12.48	8.24	Waste management and remediation services
Materials	3274A0	9.56	6.11	Lime product manufacturing
Equipment rental	532400	10.97	6.41	Commercial and industrial machinery and equipment rental and leasing
Travel	combination of 722000, 7211A0, &532100	28.32,19.87, 10.33	23.32,15.29, 6.38	Food services (25%), hotels & motels (25%), and auto rental & leasing (50%)