Environment and Natural Resources Trust Fund

M.L. 2020 Approved Work Plan

General Information

ID Number: 2020-013

Staff Lead: Michael Varien

Date this document submitted to LCCMR: August 13, 2021

Project Title: Developing Strategies To Manage PFAS In Land-Applied Biosolids

Project Budget: $1,404,000

Project Manager Information

Name: Summer Streets

Organization: Minnesota Pollution Control Agency

Office Telephone: (651) 757-2761

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Web Address: https://www.pca.state.mn.us/

Project Reporting

Date Work Plan Approved by LCCMR: August 13, 2021

Reporting Schedule: April 1 / October 1 of each year.

Project Completion: June 30, 2024

Final Report Due Date: August 14, 2024

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 04d

Appropriation Language: $1,404,000 the second year is from the trust fund to the commissioner of the Pollution Control Agency to help municipal wastewater plants, landfills, and compost facilities protect human health and the environment by developing strategies to manage per- and polyfluoroalkyl substances (PFAS) in land-applied biosolids.

Appropriation End Date: June 30, 2024

Narrative

Project Summary: This project helps municipal wastewater plants, landfills, and compost facilities protect human health and the environment by developing strategies to manage per- and polyfluoroalkyl substances (PFAS) in land-applied biosolids.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Environmental contamination of PFAS is a widespread issue of concern, and concentrations commonly found throughout Minnesota pose known risks to human and ecological health. Elevated levels of PFAS have been measured in Minnesota municipal biosolids, landfill leachate, and compost contact water. While land application of these biosolids has benefits for farming, land application is a known source of PFAS to groundwater, soil, surface water, and crops. Human health can be impacted when PFAS-contaminated water and food is consumed by people. There is still a lot we don't know about how PFAS moves out of biosolids and into the environment and food supplies. This study will allow us to proactively manage biosolids in a way that prevents environmental contamination by PFAS.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

Waste managers in Minnesota are already facing urgent concerns related to disposal of PFAS-contaminated wastes. They have an immediate need of tools to evaluate and manage PFAS in their land-applied waste streams. This project will focus on developing cost-effective, real world approaches for preventing, treating, disposal, and destruction of PFAS-contaminated land-applied wastes. This study will allow us to develop tools to proactively-manage biosolids in a way that prevents environmental contamination by PFAS.

The goals of this study are to:

1) Evaluate and characterize PFAS concentrations in land-applied biosolids.
2) Evaluate and characterize PFAS leaching from land-applied wastes into groundwater.
3) Evaluate and characterize PFAS uptake in feed crops.
4) Analyze alternative disposal and treatment options to develop tools for managing PFAS-contaminated waste streams.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

This project will give much-needed insight and understanding of: 1) the role land-applied wastes play in introducing PFAS to the environment; and 2) how those PFAS move once released. We will also develop cost-effective, practical tools to help municipalities manage their PFAS-containing wastes to prevent environmental contamination and protect human health.

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Controlled plot study to evaluate leaching of PFAS

Activity Budget: $409,500

Activity Description:
A two year field study will be conducted at the Rosemount Research and Outreach Center in Rosemount, MN. To our knowledge, biosolids have never been applied to this area. The soil at this site is classified as a loess-derived Waukegan silt loam, with a silt loam texture in the top 90 cm and a sand to gravel glacial outwash subsoil. This soil is typically used for row crop production in Minnesota.
Controlled plots will be used to evaluate leaching and plant uptake under environmentally relevant conditions.
A total of 8 treatments will be evaluated, including:
Control (inorganic fertilizer)
Biosolids ash
Dried biosolids
Anaerobically digested biosolids
Aerobically digested biosolids
Polymer-stabilized biosolids
Yard waste compost
Food/household compost

These eight amendments were chosen because they survey the general types of biosolids amendments that might be applied to fields in Minnesota in order to boost agricultural production. We also selected two commonly used composts that are widely used as soil amendments and that have been shown to contain PFAS.

Activity Milestones:

Description	Completion Date
Secure partnerships with WWTP and Compost facilities	October 31, 2021
Sample controlled plot soils prior to land application of amendments.	November 30, 2021
Purchase supplies for suction tubes, sample collection, and PPE	November 30, 2021
Develop plan for controlled plot study prior to first summer growing season	March 31, 2022
Install suction tubes in controlled plots for groundwater sampling	April 30, 2022
Apply amendments to controlled plots	April 30, 2022
Plant first year corn	May 31, 2022
Collect soil, groundwater, and plant samples for PFAS analysis	October 31, 2022
Sample soil at controlled plots	April 30, 2023
Plant 2nd year soybeans	May 31, 2023
Collect soil, groundwater, and plant samples for PFAS analysis	October 31, 2023
Two years of controlled plot studies	June 30, 2024

Activity 2: Laboratory investigation of PFAS fate and transport, and identification of 325 novel PFAS compounds in relevant media

Activity Budget: $394,500

Activity Description:
An understanding of PFAS presence in, and movement through, biosolids will be achieved through a combination of targeted analysis (analogous to liquid chromatography-tandem mass spectrometry [LC-MS/MS]), high resolution mass spectrometry (HRMS) analysis, and laboratory column experiments. The latter will target a suite of biosolids that

represent different waste inputs (e.g. yard waste vs. food waste, municipal vs. industrial) and biosolids treatment types. Results will be used to evaluate which PFAS are prevalent in biosolids and related media, evaluate trends in sorption of PFAS based on PFAS structure and geochemistry, and estimate the fraction of PFAS that may leach into the saturated zone. The overarching benefit of this work will be the generation of information that can be used to develop best management practices related to PFAS in biosolids, thus reducing overall risks to human health and the environment.

Activity Milestones:

Description	Completion Date
Analyze preliminary (pre-application) samples from controlled plots for PFAS	December 31, 2021
Analyze soil, water, biosolids, and crops from 1st field study for PFAS	December 31, 2022
Setup and conduct soil leaching studies	December 31, 2022
Analyze soil, water, and crops from 2nd year field study	December 31, 2023

Activity 3: Quantitative analysis of PFAS in land-applied wastes and relevant media

Activity Budget: $300,000

Activity Description:
Analysis of 40 PFAS compounds and their breakdown products in biosolids, ash, compost, soil, water, and crops, to understand occurrence of PFAS in these wastes so that risk associated with land application can be characterized. Total oxidizable precursor (TOP) analysis will be performed to determine whether longer chain PFAS compounds that are present in these wastes can break down to PFOS and PFOA, two known PFAS compounds of concern. A total of 600 samples will be analyzed by SGS Axys Analytical Services.

Activity Milestones:

Description	Completion Date
Analyze preliminary samples of biosolids, compost, and fertilizer for PFAS	November 30, 2021
Analyze pre-application soil and groundwater samples	November 30, 2021
Perform total oxidizable PFAS precursor analysis in soil after biosolids application	July 31, 2022
Analyze post-application soil and groundwater samples throughout 1st growing season	December 31, 2022
Analyze 1st year corn harvest for PFAS	December 31, 2022
Analyze soil and groundwater before 2nd year planting	May 31, 2023
Analyze 2nd year soybean harvest for PFAS	December 31, 2023

Activity 4: Developing PFAS management solutions for biosolids, landfills and compost

Activity Budget: $300,000

Activity Description:
The Request for Proposals (RFP) will encourage the state and national design community to apply for funds to complete an analysis of PFAS treatment and destruction options. The RFP contracting process will be managed by the MPCA contract staff, reviewed by MPCA engineers, and will comply with all state and federal regulations. The final candidate will be selected by a committee of MPCA engineering staff and municipal wastewater engineers under the guidance of the MPCA contract unit. Once the best candidate is selected, funds and necessary design information will be delivered to the contractor by the MPCA. The contractor will have 24 months to complete the deliverable.

Activity Milestones:

Description	Completion Date
MPCA completes administration of competitive RFP to identify project consultant	March 31, 2022
Kick-off meeting with consultant	April 30, 2022

Regular meetings with consultant to ensure progress on deliverable	May 31, 2024
Deliverable of best management practices report to MPCA	June 30, 2024

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Carl Rosen	University of Minnesota - Twin Cities	Dr. Rosen will conduct a two-year controlled field plot study to evaluate leaching of PFAS from land-applied biosolids in typical Minnesota field conditions. In both years, multiple soil, groundwater, and vegetation samples will be analyzed for PFAS and soil and crop health.	Yes
Dr. Jennifer Guelfo	Texas Tech University	Dr. Guelfo will conduct a laboratory investigation of PFAS fate and transport mechanisms to evaluate leaching of PFAS from biosolids and other wastes into the environment. A standardized soil leaching method will be established for comparison of PFAS leaching between sites and waste types. Non-targeted analytical techniques will be used.	Yes
SGS Axys Analytical Services, Ltd.	State contract lab providing PFAS analysis	Analysis of 40 PFAS compounds and their breakdown products in biosolids, ash, compost, soil, water, and crops, to understand occurrence of PFAS in these wastes so that risk associated with land application can be characterized.	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
The results of this study will be compiled into a single final deliverable product report that will be freely available to the public on the MPCA webpage. The results of the study will also be submitted for publication into peer-reviewed journals and presented at conferences to make the results available to regulated authorities managing PFAS more broadly. We expect to generate at least two master degree level theses out of this project and these theses will be completed in publication ready journal format. We will disseminate the findings from the study to wastewater engineers, managers and operators through public presentations and publications in peer-reviewed journals. A key outcome from our work will be presentations at two local and statewide conferences.

Ultimately, this information will be used to guide Minnesota's PFAS policy and help wastewater plants select PFAS management strategies. The federal EPA has expressed interest in the findings of this study and would use the results of this study to inform their Clean Water Act wastewater permitting responsibilities on a nationwide basis.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?
This project will support the long-term implementation goals of Minnesota to ensure appropriate disposal of wastes in Minnesota and to safeguard drinking water for current and future needs. This is a one-time funding request and no additional future support is envisioned. The MPCA will use this information, in close collaboration with regulated parties, to develop permitting and policy decisions that protect human health and the environment from PFAS.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
							Sub Total	**-**
Contracts and Services								
University of Minnesota - Twin Cities	Sub award	A two-year controlled field plot study to evaluate leaching of PFAS from land-applied biosolids in typical Minnesota field conditions. In both years, multiple soil, groundwater, and vegetation samples will be analyzed for PFAS and soil and crop health.				0		$409,500
Texas Tech University	Sub award	Laboratory investigation of PFAS fate and transport mechanisms to evaluate leaching of PFAS from land-applied biosolids and other wastes into the environment. A standardized soil leaching method will be established for comparison of PFAS leaching between sites and waste types.Up to 325 novel PFAS will be identified.				0		$394,500
TBD	Professional or Technical Service Contract	The Request for Proposals (RFP) will encourage the state and national design community to apply for funds to complete an analysis of PFAS treatment and destruction options.				0		$300,000
SGS Axys Analytical Services, Ltd.	Professional or Technical Service Contract	Analysis of 40 PFAS compounds and their breakdown products in biosolids, ash, compost, soil, water, and crops, to understand occurrence of PFAS in these wastes so that risk associated with land application can be characterized.		X		0		$300,000
							Sub Total	**$1,404,000**
Equipment, Tools, and Supplies								
							Sub Total	**-**
Capital Expenditures								

							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
							Sub Total	**-**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$1,404,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Contracts and Services - SGS Axys Analytical Services, Ltd.	Professional or Technical Service Contract	Analysis of 40 PFAS compounds and their breakdown products in biosolids, ash, compost, soil, water, and crops, to understand occurrence of PFAS in these wastes so that risk associated with land application can be characterized.	SGS Axys is one of the very few labs in the world doing low-level PFAS analysis on biosolids. We have over a decade of experience working with SGS and know from experience that their data quality are second to none. SGS also has a unique analytical list and the lowest reporting limits available at a commercial lab. SGS Axys is on a state master contract with MPCA. **This is a single source contract.**

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	TBD	MPCA staff time equivalent to one FTE per study year.	Secured	$360,000
In-Kind	TBD	University of Minnesota overhead	Pending	$182,000
			State Sub Total	**$542,000**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$542,000**

Attachments

Required Attachments

Visual Component

File: 3cf35412-058.pdf

Alternate Text for Visual Component

PFAS containing wastes are sent to wastewater treatment plants, landfills, and compost facilities. Each of these waste conveyances produces its own solid or liquid waste that is often land applied (e.g., biosolids, leachate, compost and compost contact water, respectively). Land-applied wastes are often applied to fields where crops are grown for livestock feed. PFAS can be taken up by crops grown on these fields, and PFAS can move into groundwater and surface water following land application...

Optional Attachments

Support Letter or Other

Title	File
Letter of Support from MCES	1da1f538-e29.pdf
Background check	cc2558c3-7b6.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Budget changes to reflect amount of funds available. Removed landfill leachate from the work plan because it is being analyzed by MPCA in other programs.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

N/A

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

Project 098-B: Developing strategies to manage PFAS in land-applied biosolids