



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-081

Proposal Title: Plasma System for Economically Viable PFAS Remediation

Project Manager Information

Name: Kyle Pillatzki

Organization: Cottonwood County

Office Telephone: (507) 832-8814

Email: Kyle.Pillatzki@co.cottonwood.mn.us

Project Basic Information

Project Summary: Per- and polyfluoroalkyl substances (PFAS) or forever compounds pose a health threat to Minnesotans. Plasma technology can be utilized to economically remove these dangerous compounds restoring water quality.

ENRTF Funds Requested: \$868,000

Proposed Project Completion: December 31, 2028

LCCMR Funding Category: Water (B)

Project Location

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

Region(s): SW

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

Narrative

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

Per- and poly-fluoroalkyl substances (PFAS)-Forever Chemicals in water- pose a threat to the health of Minnesotans, and protecting communities from these chemicals is a key goal of agencies like Cottonwood County Public Works. At relatively low concentrations, PFAS can lead to serious health conditions such as kidney and testicular cancers, liver damage, immunotoxicity, neurotoxicity, and endocrine dysfunction. Studies indicate similar PFAS-related health problems for companion pets and wildlife and these compounds are highly toxic to fish (Break et al., 2023; Hamad et al., 2024). The astronomical cost of removing these chemicals, estimated to cost between \$2.7 million to \$18 million/kg, makes this goal unobtainable. Ali Ling, at Minnesota's University of St. Thomas, determined at current costs, removal of PFAS would exceed global GDP. Plasma Blue and the University of Minnesota, with assistance from LCCMR, have developed a technology to destroy PFAS. This technology has been deployed at landfills and has demonstrated a cost which is less than one half of the nearest competing technology. We believe that this can be reduced by 50 times. This equates to a cost to treat moderately a contaminated water stream (PFAS at 6000ppt) at a cost of around a penny per gallon allowing

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

We have worked with Plasma Blue to develop a first gen commercial product that, today, appears to be as economically efficient or better than other competing on-site destruction technologies for removing PFAS from aqueous streams. There are, however huge opportunities to improve the technology which can drive the cost down further.

Focus to drive costs down include:

1. Designing and implementing concentrating technology
2. Improving PFAS destruction in reactor
 - 2a. Better reactor design
 - 2b. Optimized power supply
3. Introducing low levels of benign ions to improve mineralization of PFAS
4. On-site demonstration

The liquid-phase plasma reactor at the core of the proposed system for PFAS destruction was developed at the University of Minnesota and verified and scaled up to 10 gallons per hour. Under LCCMR Project 2022-265, the system demonstrated removal of PFAS with 99% or greater efficacy rate. This system exceeded our expectation for efficiency, but when dealing with materials that are dangerous at parts per trillion-- one ounce in 12,000 Olympic sized swimming pools, cost per volume treated material is of paramount importance.

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?

We are pursuing cost reduction for PFAS treatment to make cleaning up of these dangerous compounds economically feasible. Other destruction technologies are CapEx and OpEx intensive, effectively priced out of reach for communities. Sequestration technologies still leave communities with the cost of disposal. Plasma technology is low pressure and low temperature and so can be deployed in existing facilities without the need for increased infrastructure or expanded workforce. If successful, this project will offer community water systems an easily implementable approach for the destruction of PFAS on-site.

Activities and Milestones

Activity 1: Design and Integrate Concentrator

Activity Budget: \$168,000

Activity Description:

The pre-treatment concentration of PFAS, dramatically reduces the volume that needs plasma treatment while also increasing the efficiency of treatment per unit volume- Plasma works better on higher concentrations of PFAS. As a result, this step in the process is extremely impactful to overall process economics. We will accomplish this through air flotation or filtration, and the post-treatment using a CaF₂ precipitator to remove fluorine ions will be investigated and evaluated on a lab scale. PFAS concentrations, ranging from low to high, will be prepared in the lab using leachate water to simulate expected levels in leachate. Tests will determine the optimal operating parameters for PFAS treatment at each level of contamination on a benchtop scale. These parameters will include system configuration, treatment time, energy consumption, the necessity of introducing a gas (air, argon, or other) into the flow stream, the number of passes through the system to achieve the desired standard, operating cost estimates, and water quality analysis.

Activity Milestones:

Description	Approximate Completion Date
Determination of best off the shelf system for concentrating	October 31, 2027
Design and integration with Plasma Blue system	April 30, 2028
Real world testing at landfill	October 31, 2028

Activity 2: Improving plasma reactor geometry and materials of construction and power supply

Activity Budget: \$285,000

Activity Description:

Reactor design and materials of construction improve the throughput and longevity of the reactor, leading to operational efficiency. In this activity we will build and test 5-10 new reactor designs. Once we have identified the ideal design, we will experiment with a range of materials for the body, electrodes and physical separators (disks which shape the plasma field), to identify the optimal combination of component materials.

The power supply is a crucial aspect of the cold plasma technology. The transformer we utilize provides good performance when conditions are stable. In the field, however, conditions change based on rainfall, temperature and other conditions we cannot control. A “smart” transformer, one that can monitor the quality of the plasma field and adjust in real-time protecting the system and ensuring the quality of water treatment despite changing conditions.

Activity Milestones:

Description	Approximate Completion Date
Testing and scaling to full size unit	January 31, 2027
Identify appropriate engineers and establish contract	August 31, 2027
Test system in 750 hour pilot run	October 31, 2028
Final report back	December 31, 2028

Activity 3: Introducing low levels of benign ions to leachate to improve PFAS mineralization

Activity Budget: \$77,000

Activity Description:

When fluorine molecules are freed from PFAS, they are highly reactive, and can potentially bind back onto carbon-reforming PFAS. The goal of this activity is to identify those cations (positively charged atoms) which are 1. Environmentally benign, and 2. Can bind the fluorine before it has a chance to reform the PFAS.

Activity Milestones:

Description	Approximate Completion Date
Develop experimental design particularly with a focus on cations know to water treatment facilities.	August 31, 2027
Identify those concentrations and combinations of cations which best work to remove fluorine ions	April 30, 2028
Integrate system to add in appropriate ions to leachate post concentration step	September 30, 2028

Activity 4: On-site Demonstration of Integrated System

Activity Budget: \$338,000

Activity Description:

Laboratory research is an essential component of innovation, but what will truly move the needle for Minnesota stakeholders is the actual on-site destruction of PFAS. This work will be conducted at Cottonwood Sanitary Landfill. We plan to allow other interested parties to view the operations as well as produce Youtube videos as a way to disseminate information about the plasma approach.

Activity Milestones:

Description	Approximate Completion Date
Site prep	September 30, 2027
Initial unit on location	April 30, 2028
Full data package for analysis	October 31, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Tom Slunecka	Plasma Blue	CEO Tom Slunecka will serve as Co-Project Manager for this project. He has been the Chief Executive Officer of Minnesota Soybean since August 2012. During this time, he has overseen the creation of several new non-profit and for-profit entities, including Plasma Blue and Ag Management Solutions	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.

Cottonwood County and Plasma Blue view dissemination as crucial. We have and are presenting the results of 2025 field trials at water treatment conferences, most recently at SWAA in St. Paul. Additionally, the Plasma Blue website <https://plasma-blue.com/> has a great deal of information available. We intend to present at multiple conferences in 2026 and 2027 and intend to present the results of this work in 2028.

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 work be funded?

PFAS destruction in compromised water streams is a well know issue. The current destruction technologies such as supercritical water or HALT treatments have costs that exceed \$1.00 per treated gallon. There is, today, a market demand for a technology that can accomplish PFAS removal economically. In discussing the plasma approach with waste water treatment professionals, there seems to be agreement that a system that can reach a treatment costs in the low pennies per gallon range will be commercially viable. We anticipate that further deployment of this technology will be market driven.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Innovative Technology for PFAS Destruction in Drinking Water	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 04k	\$445,000

Project Manager and Organization Qualifications

Project Manager Name: Kyle Pillatzki

Job Title: Solid Waste Administrator

Provide description of the project manager's qualifications to manage the proposed project.

Kyle Pillatzki serves as the Solid Waste Administrator for Cottonwood County, Minnesota. He has been employed by Cottonwood County since 2002 and has overseen landfill operations and solid waste management programs since 2012. In his role, he is responsible for the operation, regulatory compliance, and long-term planning of the County's solid waste system, including management of the Cottonwood County Landfill and associated environmental programs. His experience includes oversight of landfill operations, leachate management, regulatory coordination, and implementation of programs to ensure safe, efficient, and environmentally responsible waste management for the community.

Organization: Cottonwood County

Organization Description:

The Cottonwood County Landfill is a critical public infrastructure asset serving approximately 11,500 residents and businesses throughout Cottonwood County and the surrounding region. The facility operates on a 200-acre site with a permitted fill area of approximately 46 acres and provides environmentally responsible disposal of municipal solid waste, construction and demolition debris, and other materials, while also supporting recycling, reuse, and household hazardous waste programs. The landfill also manages leachate that is ultimately treated through regional wastewater systems.

With an estimated remaining operational life of approximately eight years under current conditions, the County is actively planning for long-term waste management needs, including potential expansion to ensure continued service for future generations. Cottonwood County is committed to operating the landfill safely, efficiently, and in full compliance with state regulations. However, emerging contaminants such as PFAS have introduced new challenges, including increased monitoring requirements and uncertainty surrounding future regulatory expectations from the Minnesota Pollution Control Agency (MPCA). These challenges directly impact landfill operations and downstream wastewater treatment systems, reinforcing the need for practical and cost-effective PFAS management solutions.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
On Site Manager		Manage day to day research activities			25%	0.25		\$125,000
Engineer		Lead engineer			25%	0.2		\$175,000
Manager		Manages Plasma Blue			25%	0.2		\$175,000
Lab Associate		Lab and Field support of PFAS removal			25%	0.5		\$95,000
							Sub Total	\$570,000
Contracts and Services								
Minnesota Valley Testing Lab (MVLT)	Service Contract	PFAS testng				-		\$56,000
Power Consulting Doherty Designs	Service Contract	Mike Doherty Designs, LLC develops innovative high voltage power supplies for the photonics, healthcare, semiconductor capex, test, X-ray, homeland security, scientific, consumer and industrial markets worldwide and offers consulting services, leveraging many decades in the industry. Mr. Doherty has 35 years of experience				-		\$75,000
							Sub Total	\$131,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab supplies, chemicals, disposable labware, PPE, Shipping	For laboratory and field work					\$29,000
	Equipment	Pilot Concentrator	Used to concentrate landfill leachate and increase plasma removal efficiency					\$62,000
	Equipment	Reactors	5 x non-thermal reactor designs to optimize PFAS removal					\$58,000
							Sub Total	\$149,000
Capital Equipment								

							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	9 trips, 1,700, 2 people. 40 days in hotel	Plasma Blue staff on site in Cottonwood					\$12,000
	Conference Registration Miles/ Meals/ Lodging	3 conferences in MN 2 people per conference, \$750 per person per conference	To disseminate information on landfill treatment progress					\$5,000
							Sub Total	\$17,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Printing	Reports	Reports for stakeholders and interested 3rd parties (e.g. other landfill operators)					\$1,000
							Sub Total	\$1,000
Other Expenses								
							Sub Total	-
							Grand Total	\$868,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
---------------	---------------------	-------------	--

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$868,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [c5c137ef-b28.pdf](#)

Alternate Text for Visual Component

This image shows the processes we intend to implement to reduce the cost of PFAS removal. Concentrations should reduce cost by 85%, Plasma optimizations by 75% and enhanced mineralization by 50%. This should reduce the cost to destroy PFAS by 50x, making it economical for communities....

Financial Capacity

Title	File
Cottonwood County 2024 Audit	2d13d924-bab.pdf

Board Resolution or Letter

Title	File
Cottonwood Letter For Submission Approval	1d9444e7-d6c.pdf

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Budget Summary 2027-081	53f7776d-6bf.xlsx
Minnesota Soy Letter of Support	74f54302-4bc.pdf
Rock Leaf Letter of Support	f63577fd-ead.pdf
St. Louis County Letter of Support	fed45807-a22.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the Commissioner's Plan applies.

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

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?

No

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

Nathan Danielson BioCognito, Tom Slunecka Plasma Blue

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand