Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-104

Proposal Title: Measure Nanoplastics in Drinking Water

Project Manager Information

Name: Larry Zazzera

Organization: CT Associates Inc.

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Project Basic Information

Project Summary: Minnesota's water resources community can leverage unique local measurement technology to help protect the state's drinking water from potentially toxic nanoplastic contaminants.

ENRTF Funds Requested: $429,000

Proposed Project Completion: December 31, 2027

LCCMR Funding Category: Water Resources (B)

Project Location

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

Region(s): Metro

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.

Nanoplastics are contaminants of emerging concern (CEC) in drinking water. Nanoplastics are smaller than microplastics so they are more likely to enter the blood and pose potential health risks to humans and animals. Nanoplastics are more difficult to measure than microplastics, so less is known about these contaminants. The problem is that communities cannot assess risk or develop prevention strategies for nanoplastics they cannot measure. A significant opportunity exists for Minnesota's water resource community to measure nanoplastics in drinking water by leveraging existing resources from Minnesota's microelectronics community. New measurement technology at CT Associates (Eden Prairie, MN) can help state agencies measure the smaller and potentially more toxic nanoplastics in Minnesota drinking water.

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 propose to use CT Associates' (CTA's) ULTRA-PURE WATER INFRATRUCTURE and UNIVERSAL SURFACE ENHANCED RAMAN SPECTROSCOPY (UNISERS) measurement technology to develop, publish and implement test methods to measure the size, chemical composition and amounts of nanoplastic contaminants in drinking water. We emphasize that a significant opportunity for our state is the potential to leverage the substantial nanoplastics contaminant test capability of Minnesota's microelectronics community. For over three decades CTA has invested in facilities and equipment to advance nanoparticle detection. CTA can leverage existing assets to provide expert, timely and cost-effective information to the state agencies responsible for protecting the state's water resources. This proposal seeks funding to hire and train personnel to conduct water research and to co-publish and co-present test results to potential beneficiaries in government and the wider scientific community. Dissemination of information is needed now to help communities understand, and if needed develop strategies to prevent nanoplastics contamination in drinking water.

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?

Improved detection of nanoplastics in drinking water can change the status of this contamination from "unknown risks" to "informed decisions". A whitepaper will report specific outcomes: 1) document development of new analytical methods to measure potential nanoplastics from water, 2) apply the new method to test incoming surface water and drinking water at a local production facility, and 3) assess initial capability to measure and protect drinking water.

Activities and Milestones

Activity 1: Initial test for nanoplastics in drinking water and develop a method for an appropriate "clean" analytical blank.

Activity Budget: $122,800

Activity Description:
CTA will conduct a preliminary analysis of drinking water from the production facility to estimate the types and amounts of contaminants in samples. Initial contaminant information will determine the nanoparticle analytical standards and the quality of the water blanks needed. Contamination in water blank samples impedes detection of nanoplastics in drinking water. CTA's ultrapure water (UPW) facilities can provide appropriately clean water blanks and improve detection. CTA UPW is specified for nanoparticles (<100 nm) versus typical analytical lab water which is specified for microparticles (>100nm). CTA will publish a method to produce an appropriately clean drinking water blank using criteria including particle number concentration (#/ml) for particles diameters >4 nm. Water blanks that meet purity specifications will then be measured by the UNISERS method to establish water blank baselines based on the number concentration (#/cm2) of individual particles (>12 nm) imaged on a silicon wafer and chemical composition of individual particles (>50 nm). Initial information comparing the drinking water samples to "clean" analytical blanks will help rank a list of potential nanoplastic contaminants. The Activity 1 milestones lay the foundation for development of an analytical to test for nanoplastics in drinking water

Activity Milestones:

Description	Approximate Completion Date
Drinking water sample analysis and descriptive list of potential nanoplastic contaminants.	August 31, 2025
Specify an appropriately "clean" analytical water blank.	September 30, 2025
Baseline drinking water versus a "clean" water blank and rank a list of nanoplastic contaminants.	December 31, 2025

Activity 2: Make analytical standards of contaminants and use standards to calibrate nanoplastic measurements from drinking water

Activity Budget: $154,200

Activity Description:
Development of contaminant analytical standards and spectra libraries, and calibration of the UNISERS method to measure nanoplastics. Nanoplastics standards of precise size and composition are typically limited to polystyrene latex (PSL) spheres. Commercially available PSL will be procured as needed, however standards for other potential nanoplastics in drinking water will be synthesized in house. CTA has experience developing the methods used to extract nanoplastics from the various materials used to produce and handle ultrapure water (UPW). Methods that define the materials and processes to produce contaminant standards of known size and composition will be developed and published. Information from comparing the initial drinking water test results to CTA's ultra-pure water, combined with the Water Research Foundation's 5088 results library will help rank a list of potential nanoplastic contaminants in drinking water. Analytical standards will be produced for the contaminants of highest prevalence and interest, and these standards will be analyzed by the UNISERS method to collect image, size and composition data from each nanoplastic type. This data is important because it will calibrate the UNISERS nanoparticle measurements for the drinking water application and provide Raman spectral libraries and other data that could be included to train future machine learning

Activity Milestones:

Description	Approximate Completion Date

Method to produce analytical standards with size, concentration and composition of prevalent nanoplastic contaminants.	March 31, 2026
Create image and spectra libraries of contaminant analytical standards.	June 30, 2026
Calibrate nanoplastics measurement tool with analytical standards and gage analytical test performance.	September 30, 2026

Activity 3: Measure nanoplastics in Minnesota drinking water and communicate results to state agencies and Minnesota's water resource community

Activity Budget: $152,000

Activity Description:

Water sampling will be guided by George Kraynick, Minneapolis Public Works, Water Treatment and Distribution department and others from Minnesota's drinking water community. Nanoplastics extraction from drinking water will be informed by ASTM 8333 which guides preparation of collected water samples with high, medium, or low suspended solids to determine the presence, count, polymer type, and physical characteristics of microplastic particles and fibers. UNISERS analysis is unique to this proposal, surface enhanced particle sizing (SEPS) has high throughput for finding sub 100nm particles, surface enhanced Raman spectroscopy (SERS) identifies the type of plastic, so UNISERS (SEPS+SERS) can quantify and correlate the size and type of nanoplastics from drinking water. Image analysis, spectral classification and interpretation of data aided by machine learning is expected to be a significant portion of activity 3 and is important for future implementation of the capability demonstrated in this RFP. Water researchers are already utilizing open access spectral analysis tools for plastic particle analysis and these resources will be leveraged to determine concentration, size and composition of nanoplastics in drinking water. The results of this work will be communicated to the appropriate state agency and Minnesota's water resource community.

Activity Milestones:

Description	Approximate Completion Date
Water sample collection and nanoplastic extraction, i.e. ASTM 8333.	September 30, 2026
Image number, size and shape of nanoplastics from drinking water.	December 31, 2026
Raman spectra types of nanoplastics from drinking water.	March 31, 2027
Image analysis and spectral interpretation aided by machine learning.	July 31, 2027
Publish "whitepaper" for nanoplastics test method and measurement from drinking water.	July 31, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Ali Altun	UNISERS AG, Zurich Switzerland	Ali Altun, UNISERS AG, Zurich Switzerland. Help establish, support and continually improve UNISERS measurement tool capability in Eden Prairie including new equipment and hardware, technical advice, software upgrades and materials that will assist the measurement of nanoplastics from drinking water.	No
George Kraynick	Minneapolis Public Works, Water Treatment and Distribution department	George Kraynick, Minneapolis Public Works, Water Treatment and Distribution. Initial contact from Minnesota's drinking water community. Help create project community, provide research overview to utility partners, serve as drinking water advisor as well as sample provider to CT Associates.	No

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?

Our "whitepaper" can influence water monitoring for contaminants of emerging concern (CEC). Future implementation needs to be lead and funded by state agencies like the Minnesota Department of Health (MDH) and the Public Health Laboratory (PHL) Special Project on Analytical Methodology Development. We are reaching out to people at MDH who are developing and evaluating new analytical methods for nanoplastics. We can provide more information to the MDH and PHL so in the future we might collaborate in any way these agencies deem necessary to meet the needs of the state, the public and the wider scientific community.

Project Manager and Organization Qualifications

Project Manager Name: Larry Zazzera

Job Title: Scientist and Principal Investigator

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

I am responsible for making sure the outcomes of the proposed project are consistent with the purpose of the Environment and Natural Resources Trust Fund. My personal, technical, and administrative experiences align well with the "Measure Nanoplastics in Drinking Water" project needs. I received a B.A. in Chemistry from the University of Delaware and moved to Minnesota for my first job in Chaska, MN in 1984. In Chaska I worked as an analytical chemist for five years, before pursuing a Ph.D in Chemistry. In 1994 I earned my doctorate degree in Materials Chemistry from the University of Minnesota. I have held technical positions in companies as a direct contributor in analytical science, and as a project leader and manager of global applications and development teams. As the Corporate Scientist at CT Associates, Inc., my job is to plan for and enable the measurement of organic nanoparticles in water and other process fluids. During my 40 years of electronic materials research and development experience, the semiconductor industry evolved from measuring micron sized particle contamination to measuring nanometer sized particles. I have enjoyed my work and life here in Minnesota, and very much want to give back in some way to the local communities that have supported me. I'm very confident the combined experiences, expertise and resources of our states water resources and microelectronics communities can benefit the Environment and Natural Resources Trust Fund's public purpose of protection, conservation, preservation, and enhancement of Minnesota's natural resources. This belief and strong motive will ensure the proposed project will get the most from my qualifications and experience.

Organization: CT Associates Inc.

Organization Description:

Since our founding in 1991, CT Associates, Inc. (CTA, ctassociatesinc.com) has built a reputation for innovative and high-quality research, development, testing and instrument development in support of the semiconductor and medical device industries. The company employees 5 full-time employees. One of our core competencies is the measurement of nanoparticles. Our ultrapure water facilities have constantly evolved to support the most demanding Semiconductor Equipment Materials International (SEMI) standards with respect to nanoparticle contaminants. The ultrapure water at CTAs facility is continually monitored for nanoparticles > 4 nm. Our particle measurement expertise helps our customers identify nanoparticle contamination and optimize cleanliness in a variety of high purity process fluids. CTA, in collaboration with UNISERS AG, has completed the installation of one of three existing prototype UNISERS nanoparticle measurement tools at our Eden Prairie facility. The tool's new home is our recently updated ISO Class 2 cleanroom. We are in acceptance and qualification testing of the UNISERS tool now and are scheduled to be operational by the end of 2024.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Principle Investigator		Manage project, design and conduct testing, analyze data, report results			24.7%	0.8		$146,406
Research Assistant 1		Conduct testing, analyze data, report results			24%	1.5		$155,397
							Sub Total	**$301,803**
Contracts and Services								
TBD	Professional or Technical Service Contract	Analytical testing on initial water samples.				0.1		$6,400
TBD	Professional or Technical Service Contract	Nanoplastic standards preparation or deposition				0.1		$6,400
							Sub Total	**$12,800**
Equipment, Tools, and Supplies								
	Equipment	CTA's analytical test equipment cost based on CTA's usage rates	Analytical test equipment to measure size and type of nanoplastic					$85,572
	Tools and Supplies	Consumables like bottles, filters, pure plastics, glass and crystal substrates	Collect and prepare water samples. Analyze water samples					$26,825
							Sub Total	**$112,397**
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-

Travel In Minnesota								
	Miles/ Meals/ Lodging	TBD	Travel to contacts within Minnesota's water resource communities and state agencies					$500
	Conference Registration Miles/ Meals/ Lodging	TBD	Communicating results to Minnesota's water resource communities and state agencies					$500
							Sub Total	**$1,000**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Printing	TBD	Semi annual reporting related to accomplishments					$500
	Publication	TBD	Semi annual reporting related to accomplishments					$500
							Sub Total	**$1,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$429,000**

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: $429,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 9945b99d-164.pdf

Alternate Text for Visual Component

"Nano plastics in drinking water – A semiconductor industry ultra-pure water perspective" 2024 American Water Works Association, Water Technology Conference Abstract....

Financial Capacity

Title	File
Financial Capacity Note	80f8578c-e06.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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:

Gary Van Schooneveld, CT Associates Inc.