



ENVIRONMENTAL MANAGEMENT SYSTEM Project Financial Assistance Form

Project Title: PFAS/PFOS Pilot Study
 EMS: Dubuque Metropolitan Area Solid Waste Agency Contact Person: Kenneth Miller
 Email: kmiller@cityofdubuque.org Phone: 563-589-4354
 Assistance Request: \$37,500.00 Matching Cash: \$12,500.00 Total Project: \$50,000.00

A. EMS Objective Association

Check the box that best describes your grant proposal.

- One or more tasks/milestones with the action plan of a **new** objective/target.
 One or more tasks/milestones with the action plan of an **existing** objective/target.
 Other, please explain: _____

Please either complete the table below or provide the same information in the format of your choice in an attachment.

Objective Description			
Action	Subject	Adoption Date	
Improve	Improve Water quality by reducing/removing PFAS/PFOS	4/1/202	
		2/7/2024	
Target 1 Description (Add sections or attachments for additional targets as needed.)			
Action	Subject	Qty to	Metric
Reduce	Reduce PFAS/PFOS in leachate destined for the wastewater treatment plant Need a target qty PPT/ of what ml? of what constituent -PFAS/PFOS?	1%	PPT - PFAS
Target Time Period	Time Period Type	Component Area	
TBD	Annual	Water Quality	
Baseline data, if applicable	Baseline Time Period	Qty for Period	Narrative Description (Optional)
		PPT - PFAS	Initial Testing will be conducted during spring sampling.

B. Project Proposal (30 points)

1. Concisely summarize the proposed project and its expected outcome.
 The Agency is proposing to conduct a PFAS Removal Pilot Study to evaluate the scale/scope and costs related to installation of a full scale Pretreatment System. The evaluation data will allow the Agency to include the Capital Costs for a full system build out in our 5-Year Capital Budget.

2. List project related items that have been completed such as estimates, audits, feasibility studies, plan adoptions, board approvals, etc. Also, outline tentative tasks or activities for the project proposal.

Task/Activity	Start Date	End Date	Associates (partners, contractors, vendors)
Execute Contract with Pilot Vendor	5/1/2024	5/31/2024	HDR/Legal/Staff
Prep Area for Pilot Skid	6/1/2024	6/30/2024	Staff
Install and Operate Pilot	6/1/2024	8/31/2024	HDR
Data Evaluation	9/1/2024	10/31/2024	HDR
Evaluate Full System Costs	11/1/2024	12/31/2024	Staff

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3. Provide a more detailed narrative of the project proposal and the reasoning for its associated target. In the narrative, identify the need or problem the proposal will address, elaborate on the milestones in the table above and describe strategies for project implementation.

The solid waste industry is a known passive receiver of PFAS containing materials. The DMASWA's leachate system is tied directly into the City of Dubuque's sanitary sewer system. In discussions with the City's Water Resource and Recovery Center (WRRRC), it is highly likely the Agency will be required by the WRRRC to do Industrial Pretreatment for PFAS in the future. While PFAS removal is not currently required, the Agency seeks to be proactive in implementing a system to reduce these forever chemicals from the environment, similar to their approach with installation of a methane gas capture system, which was not required but provided environmental benefits. The Agency is proposing to conduct a PFAS Removal Pilot Study to evaluate the scale/scope and costs related to installation of a full scale Pretreatment System. The evaluation data will allow the Agency to include the Capital Costs for a full system build out in our 5-Year Capital Budget.

During Strategic Planning with the Board of Director's they were supportive of the inclusion of a full scale pretreatment system in the next 5-year capital budget.

Costs for baseline testing are not included in this grant request. The only testing costs are associated with the Pilot itself, to demonstrate the effectiveness of the removal method.

C. Project Impact & Monitoring (40 points)

4. Explain the expected environmental impact of completing the grant project and achieving its associated EMS objective/target. Identify the geographic region in which the environmental impact is expected to be realized, such as a facility fenceline, municipality, service area, etc. Also, describe the methodology to be used for measuring environmental impact.

Removal of PFAS constituents from the leachate and properly managing them, reduces their presence in the environment, including the Mississippi Watershed.

5. Identify who is expected to benefit from the completion of the grant project proposal and/or EMS objective and describe what benefits are projected. Benefits may be environmental, economic, service-related, etc.

Having greater control over these costs will allow the Agency to have greater control of tipping fee increases.

6. As applicable, explain how the associated EMS objective fits into a long-range plan or has environmental impacts beyond the target end date.

Improving water quality is a key component of the EMS System, and reducing/eliminating the concentrations of forever chemicals in the leachate, before it enters the sanitary sewer system decrease the likelihood of these chemicals entering the environment. A full scale operational system would provide a long-term safeguard.

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D. Project Budget & Economic Sustainability (30 Points)

7. Enter budget information in the table below. A minimum cash match of 25% is required for items in which financial assistance is requested.

Budget Item	Assistance Request \$	Local Share – Cash	Total
Pilot Skid	\$37,500	\$12,500	\$50,000
TOTALS:	\$37,500	\$12,500	\$50,000

8. Are three quotes or estimates for each budget item attached? Yes No
If not, provide the reason(s). Note: Project proposals may be rejected for not including three quotes or estimates for budget items.

There are two documents attached. A quote for a proprietary system from HDR and a sheet with multiple vendors and options provided by SCS.

9. Provide a detailed budget narrative related to this project and specify how grant funds will be used. Grant funds will be used to cover Project Initiation, Setup, Operation, Closeout and reporting. See attached proposal from HDR for additional information.

10. Identify how the project will be financially sustained once project funds are expended. Include an explanation for the continuance of such items as labor, equipment maintenance, service contracts, etc.
As a pilot project, no expense is expected after the completion of the pilot project.

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11. Describe any expected economic benefits, resulting from the completion of the associated EMS objective, such as cost avoidance or revenue generation. As applicable, estimate the payback period for the project cost and explain how it was calculated.

Having greater control over these costs will allow the Agency to have greater control of tipping fee increases.

12. As applicable, describe how economic benefits, either immediate or after a payback period, will in turn, benefit members of your service area.

Having greater control over these costs will allow the Agency to have greater control of tipping fee increases.

Please Note: Unallowable costs for financial assistance or local cost-share include, but are not limited to:

1. Taxes, legal costs, or contingency funds.
2. Passenger vehicles, vehicle registrations, or vehicle/equipment leases.
3. Proposal preparation or contractual project administration.
4. Land acquisition or real estate leases.
5. Office furniture, office equipment, or software.
6. Costs for which payment has been or will be received under another federal, state, or private financial assistance program.
7. Costs incurred before a written agreement between the applicant and the department has been executed.

E. Signature

I affirm the information provided on this Application is true, and that I will provide all other information requested for further substantiation. I agree that if awarded financial assistance for a project(s), I will execute the contract the DNR provides for conveying those funds, which contract will include but not be limited to conditions for expending those funds, and for making reasonable accounting of those expenditures and matching funds or in-kind expenses.

In order to determine funding eligibility, the Department reserves the right to verify any information presented in the application and to determine the applicant's compliance status with applicable Local, State and Federal statutes and regulations. If an applicant is selected to receive financial assistance, an offer of financial assistance may be rescinded if the applicant is determined to be out of compliance with applicable Local, State and Federal regulations.

Kenneth Miller

Digitally signed by Kenneth Miller
DN: c=US, ou=DMAISWA, o=City of Dubuque, CN=Kenneth Miller,
email=k.miller@cityofdubuque.org
Reason: I am the author of this document
Location: your signing location here
Date: 2024.03.29 15:32:05
Foxit PhantomPDF Version: 9.7.5

3/29/2024

Signature, Title

Date

F. Forms

Include signed copies of required forms with your application. Forms may be found on the EMS website:

<http://www.iowadnr.gov/Environmental-Protection/Land-Quality/Waste-Planning-Recycling/Solid-Waste-EMS/EMS-Participants>

- Minority Impact Statement

Minority Impact Statement

Pursuant to 2008 Iowa Acts, HF 2393, Iowa Code Section 8.11, all grant applications submitted to the State of Iowa which are due beginning January 1, 2009 shall include a Minority Impact Statement. This is the state's mechanism to require grant applicants to consider the potential impact of the grant project's proposed programs or policies on minority groups.

Please choose the statement(s) that pertains to this grant application. Complete all the information requested for the chosen statement(s).

- The proposed grant project programs or policies could have a disproportionate or unique **positive** impact on minority persons.

Describe the positive impact expected from this project

Indicate which group is impacted:

- Women
- Persons with a Disability
- Blacks
- Latinos
- Asians
- Pacific Islanders
- American Indians
- Alaskan Native Americans
- Other

- The proposed grant project programs or policies could have a disproportionate or unique **negative** impact on minority persons.

Describe the negative impact expected from this project

Present the rationale for the existence of the proposed program or policy.

Provide evidence of consultation of representatives of the minority groups impacted.

Indicate which group is impacted:

- Women
- Persons with a Disability
- Blacks
- Latinos
- Asians
- Pacific Islanders
- American Indians
- Alaskan Native Americans
- Other

- The proposed grant project programs or policies are **not expected to have** a disproportionate or unique impact on minority persons.

Present the rationale for determining no impact.

I hereby certify that the information on this form is complete and accurate, to the best of my knowledge:

Name: _____

Title: Solid Waste Agency Administrator

Definitions

“Minority Persons”, as defined in Iowa Code Section 8.11, mean individuals who are women, persons with a disability, Blacks, Latinos, Asians or Pacific Islanders, American Indians, and Alaskan Native Americans.

“Disability”, as defined in Iowa Code Section 15.102, subsection 5, paragraph “b”, subparagraph (1):

b. As used in this subsection:

(1) “*Disability*” means, with respect to an individual, a physical or mental impairment that substantially limits one or more of the major life activities of the individual, a record of physical or mental impairment that substantially limits one or more of the major life activities of the individual, or being regarded as an individual with a physical or mental impairment that substantially limits one or more of the major life activities of the individual.

“*Disability*” does not include any of the following:

- (a) Homosexuality or bisexuality.
- (b) Transvestism, transsexualism, pedophilia, exhibitionism, voyeurism, gender identity disorders not resulting from physical impairments or other sexual behavior disorders.
- (c) Compulsive gambling, kleptomania, or pyromania.
- (d) Psychoactive substance abuse disorders resulting from current illegal use of drugs.

“State Agency”, as defined in Iowa Code Section 8.11, means a department, board, bureau, commission, or other agency or authority of the State of Iowa.

EXHIBIT A
TASK ORDER

This Task Order pertains to an Agreement by and between the Dubuque Metropolitan Area Solid Waste Agency (DMASWA), ("OWNER"), and HDR Engineering, Inc. (HDR), ("ENGINEER"), dated February 18, 2015, ("the Agreement"). Engineer shall perform services on the project described below as provided herein and in the Agreement. This Task Order shall not be binding until it has been properly signed by both parties. Upon execution, this Task Order shall supplement the Agreement as it pertains to the project described below.

ORDER NUMBER: **021**

PROJECT NAME: **PFAS Removal Pilot Study**

PART 1.0 PROJECT DESCRIPTION:

Per- and Polyfluoroalkyl Substances (PFAS) are contaminants posing regulatory and public health concerns. They are a class of synthetic organic, long carbon chain compounds with at least one fluorinated carbon bond. This bond is the strongest organic bond in nature and is responsible for the unique and useful characteristics of these compounds but is also what makes them resistant to degradation. PFAS have found widespread application in nonstick surfaces, adhesives, paper products, textiles, plastic/resin/rubber manufacturing, personal care and cleaning product manufacturing, electronics and semiconductor manufacturing, fire suppression systems, and in a variety of industrial applications. The materials manufactured with these compounds are widely distributed in the environment and are contained within the waste stream received at landfills. The United States Environmental Protection Agency (EPA) is addressing PFAS aggressively with a Council specifically focused on research, funding, and regulations. On the regulatory front, a federal drinking water health advisory limit of 70 parts per trillion (ppt) has been in place since 2016, but many states have developed more stringent standards.

On January 10, 2020, the U.S. House passed H.R. 535, a broad PFAS bill with several safe drinking water act (SDWA) amendments. The bill directed EPA to promulgate drinking water regulations for PFAS (with standards for at least PFOS and PFOA) within two years. H.R. 535 would have established a drinking water regulatory process and schedule specifically for PFAS. It would have also directed EPA to issue a health advisory within a year of finalizing a toxicity value for a single PFAS or class of PFAS. The bill was not approved by the US Senate.

In July 2021, the U.S. House passed H.R. 2467 which establishes requirements and incentives to remediate and limit the use of PFAS. The bill directs the EPA to designate PFOA and PFOS as hazardous substances under comprehensive environmental response, compensation, and liability act (CERCLA) within one year and establishes standards to limit discharges of PFAS from industrial sources. Among the other requirements, the EPA is also directed to add PFOA and PFOS to the list of hazardous air pollutants. Grants and other incentives are also provided help community water systems treat PFAS. The bill now awaits consideration in the Senate.

In October 2021, the EPA released its PFAS Strategic Roadmap to Action that includes conducting research, implementing restrictions on use and discharges, and developing remediation strategies for PFAS impacts. Solid waste landfill operation will be impacted by the roadmap strategies that will emphasize clean drinking water and reducing impacts from PFAS impacts on source waters.

The common methods to remove PFAS include adsorption (e.g., ion exchange resin or activated carbon) and membrane filtration (e.g., reverse osmosis and nanofiltration). These methods transfer the PFAS

from a dilute water stream to another medium, such as an ion exchange resin, activated carbon on a reject stream from a reverse osmosis (RO) system. Although these processes can reduce concentrations, they have limited applicability for the treatment of wastewater that has substantial amounts of competing ions or organics. In the case of RO, PFAS is concentrated in a reject stream along with all other leachate parameters. The reject would need to be recirculated into the landfill waste, if permissible, or solidified and disposed in the landfill. Spent ion exchange media would be landfilled and spent carbon media would be landfilled or regenerated, if applicable.

Through our internally funded research and development program, HDR has developed the capability to separate PFAS from wastewater through the process of froth flotation. In this process, a flotation reagent is added to the leachate being treated, and it is contacted with air bubbles. The flotation reagent aids the PFAS compound in attaching to the air bubble surface. Since one end of the PFAS molecule is hydrophilic, it wants to stay in solution in water. However, most of the compound is hydrophobic, and is drawn to the air in the bubble preferentially. Laboratory bench scale testing has demonstrated over 95% removal of measurable PFAS from leachate in one stage of treatment, and 99% of measurable PFAS using more than one stage of treatment. The froth is removed and then it can be reintroduced to the landfill as a liquid or solidified with waste materials or cement to stabilize prior to disposal. HDR has developed a pilot system to validate the process on landfill leachate.

While your landfill has not yet been requested to evaluate pre-treatment of leachate to remove PFAS compounds, we believe that it may be of interest to you and your wastewater treatment partner to better understand the potential for removal of these compounds from the leachate using this simple treatment approach.

This task order will consist of conducting a pilot study to demonstrate the froth flotation process and to determine applicability for full scale implementation at the DMASWA landfill. The pilot study will be conducted on a discreet discharge stream of < 1 gpm of leachate. Full scale systems are believed to be capable of treating up to 100,000 gallons per day.

PART 2.0 SCOPE OF SERVICES TO BE PERFORMED BY ENGINEER ON THE PROJECT:

Task Series 100 – Project Initiation:

HDR Activities:

Task 100 will include coordination and startup assistance for the pilot test, including kickoff meeting (virtual), project management and reviews, client communication and coordination with subcontractors and vendors for the supply of laboratory sampling supplies and reagents. HDR will also assist with communication to other County/City Departments if necessary and Iowa Department of Natural Resources (IDNR) regarding the proposed pilot program.

Task Deliverables:

- None anticipated.

Planned Meetings:

- One (1) virtual kickoff meeting.

Task Series 200 – Pilot Setup and Operation:

HDR Activities:

This task includes supply of the pilot system for demonstration of the froth flotation process, set up and operation of the system, have sample analysis performed, and on completion of the pilot to demobilize and ship the pilot to the next pilot location. The pilot skid is anticipated to be available for mobilization in early spring 2024. We will provide a schedule for mobilization within 14 days following notice to proceed.

Pilot System Description:

The pilot system will be shipped to the site on a 4 ft by 6 ft skid. The skid will need to be placed on a flat area, prepared by DMASWA, near a point where leachate can be extracted from the leachate sanitary line and delivered to the pilot skid using the skid mounted pump.

The pilot system will have all pumps necessary for leachate conveyance into and out of the system. Leachate will be pumped at a rate of about 0.3 to 0.5 gallons/minute (1.9 L/minute). It will flow to an initial aerated column, which overflows to a second and a third column. These are termed the separation columns, as their intent is to move PFAS from the liquid phase to the froth, followed by collapse of the froth. The effluent from the third column is the effluent from the system. The froth will be mechanically collapsed in the top of the two columns, with air or water sprays used on the third column noted above and will flow to a small tank by gravity. The collected froth is then pumped to a series of three concentration columns. The treatment of froth is the same as the treatment of the raw water. It is aerated in each column to separate the PFAS into a smaller volume. It is expected that the flow of concentrated PFAS from the final column will total less than 2% of the total flow. Thus, for an 8-hour operating period a total of 240 gallons of leachate will be treated, and less than 5 gallons of concentrate will be generated. The treated effluent and any remaining concentrate after sample collection will simply be discharged back to the leachate conveyance or storage system.

Air captured from above the flotation columns will be conveyed to a scrubber, where a recirculating water spray will be used to capture any fugitive droplets. While it is not expected that there will be a substantial amount of PFAS carryover in the air leaving the column, the use of a scrubber will (1) protect operator safety, and (2) allow monitoring of the amount of PFAS if any carried out of the flotation columns in the air stream.

The skid as delivered to the site will contain the flotation columns (three for leachate treatment, three for froth concentration), the scrubber, and associated pumps and blowers. Much of the conveyance in the system will be through Masterflex peristaltic pumps using flexible silicone tubing. All equipment will use 110V power, and all motors are under 1 HP.

HDR also plans to bring to the site a bench scale supercritical water oxidation apparatus. This device will be used to evaluate PFAS destruction by increasing the temperature of a sample to the supercritical point of water. This unit also functions on 11V power. It is expected that two or three tests may be conducted over the course of the test program.

System Operation:

The system operation will include the following:

- Two days for system setup and minor modifications.
- One day for start-up and initial operation of the system.
- Operate the system for testing for a period of five days.
 - Each day will consist of 8 hours of run time, plus time for startup and shutdown of the system.
 - Operations will assess different dosages of reagents and performance of the three stages of concentration.
- HDR will provide personnel to operate the system.
- HDR will collect samples of raw and treated leachate and froth concentrate for laboratory analysis by Eurofins Environment Testing North Central, LLC.
- HDR will provide generator to supply 110V power to operate the skid.

At the end of the study, HDR will prepare the skid for shipment, and demobilization.

Task Deliverables:

- None anticipated.

Planned Meetings:

- None anticipated.

Key Understandings:

- DMASWA will prepare a flat area for the skid to be set up near the leachate sanitary line.
- DMASWA will provide a clean water source (non-potable is acceptable) for system cleanout before and after pilot testing.
- HDR will provide personnel to operate the system.
- HDR will collect the samples of raw and treated leachate and handle shipping of the samples to the laboratory. A total of 50 samples are anticipated to be collected.
- Equipment costs include shipping of units and minor system adjustments to improve mixing and air distribution to improve performance.
- Analytical samples will be transported by courier when possible. Shipping of coolers may need to occur when the courier is not in service. Eurofins Environment Testing North Central, LLC shipping account number will be used when shipping coolers and shipping costs will be direct billed to DMASWA with an analytical sample invoice.
- Analytical costs for all environmental monitoring will be direct billed by the testing company to DMASWA.
- HDR will have access to the landfill outside of landfill operating hours to conduct pilot study.

Task Series 300 – Report and Closeout:**HDR Activities:**

Once the data is available from the laboratory testing, HDR will complete a review of the results, prepare a report describing the results, the implications for design of a treatment system, and an estimate (AACE Class IV) for the capital and operating cost for a full-scale treatment system. The report will include statistical evaluation of PFAS data, conclusions regarding treatment system performance based on reagent and dosages and comparison of PFAS removal efficiencies.

Task Deliverables:

- One (1) final report delivered electronically.

Planned Meetings:

- One (1) virtual meeting is planned for HDR to present the results from the report to DMASWA.

Key Understandings:

- The performance of the pilot study will only be evaluated on the reduction of the PFAS compounds detected. Analysis of other leachate parameters and potential reductions via this treatment process will not be evaluated under this scope of work.

PART 3.0 OWNER'S RESPONSIBILITIES:

DMASWA and others will provide HDR with all necessary documents and records pertinent to the project in general accordance with applicable regulatory deadlines.

PART 4.0 PERIODS OF SERVICE:

Services will occur from March 1, 2024, through August 31, 2024.

PART 5.0 PAYMENTS TO ENGINEER:

Compensation for the services described herein shall be on a time and materials basis, plus reimbursable expenses. If changes to the scope are requested by DMASWA that changes the fees, the not-to-exceed



(NTE) amount may be increased by a supplemental agreement. No payment above the NTE limit shall be made without prior approval of an amendment, supported by proper justification, by DMASWA.

Reimbursable expense shall mean the actual expenses incurred directly or indirectly in connection with the Project for travel, subconsultants, subcontractors, shipping and express delivery, and other incurred expense. ENGINEER will pass through invoices received by ENGINEER from subconsultants and subcontractors with no additional markup.

Task Description	Labor Budget	Direct Expenses	Total Budget
Task Series 100 – Project Initiation	\$2,886	\$114	\$3,000
Task Series 200 – Pilot Setup and Operation¹	\$24,437	\$12,563	\$37,000
Task Series 300 – Report and Closeout	\$9,971	\$29	\$10,000
Total Approved Pilot Program Budget	\$ 37,294	\$ 12,706	\$ 50,000

1 Analytical samples and shipping costs for all environmental monitoring to be direct billed by the testing company to DMASWA.



This Task Order is executed this _____ day of _____, 2024.

Dubuque Metro Area Solid Waste Agency

HDR ENGINEERING, INC.

"OWNER"

"ENGINEER"

BY: _____

BY: 

NAME: Harley Pothoff

NAME: Matthew B. Tondl, PE

TITLE: Chairperson

TITLE: Senior Vice President

ADDRESS: 925 Kerper Court
Dubuque, IA 52001

ADDRESS: 1917 S. 67th Street
Omaha, NE 68106

Table 1- PFAS Pilot Study Quotes Summary

	Leachate Management Specialists (LEEF)		Allonia (OPEC)		ECT2			Dynatec
Technology	Foam Fractionation		Foam Fractionation		Foam Fractionation			Ultra Filtration followed by Reverse Osmosis
Test Type	Bench	Pilot (trailer)	Bench	Pilot (Conex Box)	Bench	Pilot	Pilot (Conex Box)	Pilot
Location	On-site	On-site	Vendor Lab	On-site	Vendor Lab	Vendor Lab	On-site	On-site
Power	120V	120V	N/A	480V	N/A	N/A	480V	480V
Concrete Slab requirement	No	No	N/A	Yes	N/A	N/A	Yes	Yes
Sample Shipment	N/A	N/A	Yes, 40 gals	N/A	Yes, 50 gals	Yes, 8 x 325 gal tote	No	N/A
Mechanical Contractor Requirement	No	No	No	Yes	No	No	Yes	Yes
Electrical Contractor Requirement	No	No	No	Yes	No	No	Yes	Yes
Test Cost	\$17,900	\$22,900	\$20,000	\$2,000/day	Included in the total cost	Included in the total cost	Included in the total cost	\$8,500/month
Membrane Cost	N/A	N/A	N/A	N/A	N/A	N/A	N/A	\$8,500
Disposal Fee	N/A	N/A	\$3,000	N/A	Not included	Not included	N/A	N/A
Estimated Analytical Cost	\$6,800	\$6,800	\$5,000	\$5,000	Included	Included	Included	\$5,000
Total Freight Cost	Included	Included	N/A	\$10,000	N/A	N/A	Included	Included
Site Establishment & Training Cost	N/A	N/A	N/A	\$30,000/month	N/A	N/A	Included	\$1,500/day/technician + expenses
Decontamination Cost	Included	Included	N/A	\$15,000	N/A	N/A	Included	Not included
Total Estimated Vendor Fee (Subcontractor fees are not included)	\$24,700	\$29,700	\$28,000	\$120,000 (recommended 30 days pilot testing)	\$20,000	\$33,000 - \$71,000	\$148,000 - \$318,000	\$29,500 with 5-day onsite support.
Vendor Expenses	\$2,700	\$2,700	N/A	Included	N/A	N/A	Included	\$2,500
Estimated Consultant Fee	\$8,000 on-site support + \$15,000 engineering support	\$8,000 on-site support + \$15,000 engineering support	\$5,000 on-site support + \$15,000 engineering support	\$15,000 on-site support + \$15,000 engineering support	\$5,000 on-site support + \$10,000 engineering support	\$5,000 on-site support + \$15,000 engineering support	\$15,000 on-site support + \$15,000 engineering support	\$40,000 site operation + \$15,000 engineering 5support
Consultant Deliverable	A report summarizing the test results, operational considerations, Simplified Process Flow Diagram, Conceptual Layout, Class 5 Cost Estimate							
Total Estimated Pilot Cost Excluding Subconsultant and Freight Fees	\$53,100	\$55,400	\$48,000	\$150,000	\$35,000	\$53,000-\$91,000	\$178,000-\$348,000	\$87,000
Other Requirements/Comments	5-day testing including mobilization and demobilization	5-day testing including mobilization and demobilization		30-day testing including mobilization and demobilization, crane	5-day testing	5-day testing	30-day to 60-day testing including mobilization and demobilization, crane	-Clean water for clean-in-place operations. -30-day testing including mobilization and demobilization
Additional Cost (not included)	N/A	N/A	Sample Freight Cost	Subcontractor Cost	Sample Freight Cost	Sample Freight Cost		Subcontractor Cost, Equipment Freight