



BOARD OF SUPERVISORS AGENDA ITEM REPORT
CONTRACTS / AWARDS / GRANTS

Requested Board Meeting Date: 7/7/2015

or Procurement Director Award ☐

Contractor/Vendor Name (DBA): Water Environment Research Foundation (WERF)

Project Title/Description:

Sustainable Struvite Control Using Residual Gas from Digester Gas Cleaning Process

Purpose:

To receive a research grant of \$80,000 from WERF and collaboratively conduct a feasibility study of using waste CO₂ from digester gas cleaning process to reduce struvite formation in wastewater treatment system.

Procurement Method:

N/A

Program Goals/Predicted Outcomes:

Goals/Predicted Outcome:

To evaluate/establish the feasibility of using waste CO₂ to reduce struvite formation; to develop a protocol for the implementation of such project in a water reclamation facility.

Public Benefit:

This investigation will focus on the separation and reuse of CO₂ from anaerobic digester gas for control of in-plant Struvite formation. Reduce plant chemical consumption and cost. Reduce facility over all carbon footprint.

Metrics Available to Measure Performance:

Will follow the schedule and milestones defined in the Master Contract with WERF.

Retroactive:

Yes- documents not received until 6/10/2015

Original Information

Document Type: GTAW Department Code: WW Contract Number (i.e., 15-123): 15-099
Effective Date: 6/1/2015 Termination Date: 5/31/2017 Prior Contract Number (Synergen/CMS): _____
☐ Expense Amount: \$ _____ ☒ Revenue Amount: \$ 80,000
Funding Source(s): Water Environment Research Foundation

Cost to Pima County General Fund: \$128,185 matching already included in WW budget - 5008

Contract is fully or partially funded with Federal Funds? ☐ Yes ☐ No ☒ Not Applicable to Grant Awards
Were insurance or indemnity clauses modified? ☐ Yes ☐ No ☒ Not Applicable to Grant Awards
Vendor is using a Social Security Number? ☐ Yes ☐ No ☒ Not Applicable to Grant Awards
If Yes, attach the required form per Administrative Procedure 22-73.

Amendment Information

Document Type: _____ Department Code: _____ Contract Number (i.e., 15-123): _____
Amendment No.: _____ AMS Version No.: _____
Effective Date: _____ New Termination Date: _____
☐ Expense ☐ Revenue ☐ Increase ☐ Decrease Amount This Amendment: \$ _____
Funding Source(s): _____

Cost to Pima County General Fund: _____

Contact: Jackson Jenkins

Department: Regional Wastewater Reclamation Department Telephone: 520-724-6549
Department Director Signature/Date: [Signature] 6/19/15
Deputy County Administrator Signature/Date: [Signature] 6/22/15
County Administrator Signature/Date: [Signature] 6/23/15
(Required for Board Agenda/Addendum Items)

**WATER ENVIRONMENT RESEARCH FOUNDATION
Master Research Contract**

PROJECT NO. NTRY9T15

Sustainable Struvite Control Using Residual Gas from Digester Gas Cleaning Process

This Agreement ("Agreement") effective upon the signature of both parties between the Water Environment Research Foundation ("WERF"), a Virginia Not For Profit Corporation with a principal place of business at Suite G-110, 635 Slaters Lane, Alexandria, VA 22314 and Pima County Regional Wastewater Reclamation Department ("PCRWRD"), ("Contractor"), with a principal place of business at 201 North Stone Avenue, 3rd Floor, Tucson, Arizona 85701-1207.

Whereas, WERF is a non-profit organization dedicated to advancing science and technology that addresses water quality issues as they impact water resources, the atmosphere, the lands, and quality of life; and

Whereas, WERF has awarded Contractor research funding to provide independent scientific research; and

Whereas, WERF desires Contractor to perform certain work related to such scientific research under the terms and conditions set forth below, and the Contractor has expressed a willingness to perform such work;

Now, therefore, for mutual and valuable consideration the parties agree to the following terms and conditions:

1. DEFINITIONS

For the purposes of this Agreement, the terms and definitions stated below, and throughout this Agreement shall control:

- A. The term "Derivative Work" means a work of authorship that is based and that modifies, transforms, or recasts that pre-existing work so as to alter it in any way.
- B. The term "Intellectual Property" means all inventions, innovations, creations, works, reports, figures, tables, processes, designs, methods, formulas, drawings, plans, technical data, specifications, logos, computer programs, computer chips and circuits, whether or not protectable through patent, copyright, trademark, trade secret, or mask work, and whether produced in any medium now known or subsequently developed.

- C. The term "Contractor" means the named individual(s) and/or entity (ies) entering into this Agreement with WERF and shall include all officers, directors, employees, and agents of the Contractor.
- D. The term "Principal Investigator" or "PI" means the Contractor's employee or agent, as specifically designated by the Contractor, with primary responsibility for ensuring that all terms and conditions of this Agreement are met and to whom notice may be given by WERF.
- E. The term "Research" means the work described in the Scope of Work to be completed by the Contractor pursuant to the terms and conditions of this Agreement.
- F. The term "Task Order" means an individual order for Deliverables that includes a separate Scope of Work, Budget and time table for the Deliverables. Tasks Orders shall be sequentially numbered, separately executed in writing and considered as part of this Agreement.
- G. The term "Project Manager" or "PM" means the WERF employee(s), as specifically designated by WERF, with responsibility for reviewing all actions taken by the Contractor and as having authority to communicate all WERF decisions concerning the process, procedure, scheduling requirements, funding requirements, and outcome of the Research.
- H. The term "Subcontractor" means any individual or entity with whom the Contractor shall separately contract to complete one or more specific tasks required by the Research.
- I. The term "Object Code" means the machine readable code processed and understood by a computer.
- J. The term "Source Code" means the human readable code necessary for a person of ordinary skill in the art to build a copy of the software in Object Code format.
- K. The term "Collaborator" means a third-party that enters into a Collaborative Agreement with WERF and/or Contractor to perform the Research.
- L. The term "Deliverables" means written, electronic, or verbal Work Product(s) that communicate progress, data/results, interpretations, implications, outcomes, and/or applications of the Research.
- M. The term "Work Product" means those portions of the Deliverables that contain intellectual property that is assigned, or is assignable, under this Agreement.
- N. The term "WERF Cost" means the total contract allocated cost based on the estimated total cost to WERF of the Research including a fixed fee, if any.

2. SCOPE OF WORK

Contractor shall perform the work outlined in the Scope of Work which is incorporated as Attachment A. The Scope of Work shall be amended from time to time to include individual Task Orders and such Task Orders, upon execution, are incorporated into this Agreement.

3. DURATION

The period of performance of this Agreement shall start on June 1, 2015 and end on May 31, 2017 unless terminated as provided herein.

4. BUDGET, COSTS AND PAYMENTS

- A. Budget and Costs -- The Contractor shall be reimbursed for all eligible project costs, as determined by applicable cost principles and administrative requirements, upon receipt and acceptance of a properly completed invoice. **Funding is capped at \$80,000** as described in the Total Budget which is incorporated as Attachment B. WERF shall not be obligated to pay the Contractor for costs incurred in excess of the WERF Cost set forth in the Budget, unless the increase is approved in writing by WERF.
- B. Payment Terms - Invoices detailing expenses incurred during the term of this Agreement should be submitted upon completion of each task described in the Scope of Work. Invoices may be submitted quarterly or monthly at Contractor's discretion. Contractor's invoices must also detail all cost-share and third party in-kind (as applicable and available) for each reporting period. All invoices must be submitted using the form shown in Attachment C. WERF will only reimburse Contractor for completed work. WERF reserves the right to request a brief narrative describing the work performed and completed as of the date of the invoice. The Final Report must be delivered to and accepted by WERF in order for the final invoice to be paid. Further, WERF reserves the right to withhold up to ten percent (10%) of the Total Budget until the Final Report has been accepted by WERF.
- C. Unallowable Costs -- Contractor's invoice shall be subject to reduction for amounts included in any invoice or prior payment made which are determined not to constitute allowable costs on the basis of audits, reviews, or monitoring of this Agreement in accordance with WERF's standards and any applicable Federal Uniform Administrative Requirements (based upon Contractor's cognate agency). Further, in the event that an unallowable amount is identified following payment, Contractor shall reimburse WERF for such amount.
- D. Purchase of Property -- No equipment, material, or test apparatus shall be purchased with WERF funds, nor shall any improvement, modification or construction of real or personal property be made with WERF funds, unless such purchase or expenditure has been

specifically approved in writing by WERF. An itemized listing of such authorized purchases and expenditures shall be contained in the Contractor's budget. Contractor shall obtain title to any property purchased by Contractor within the budget approved by WERF. Any purchases or expenditures not authorized in the budget are not billable against this Agreement. If WERF determines (a) that specific equipment, material, or test apparatus has significant residual value as personal property or as an improvement, modification, or part of construction of real property, or (b) the property could be used for other WERF research projects, WERF will obtain title to the personal property, or an interest in the real property, when the purchase is proposed by Contractor and approved by WERF.

5. FINANCIAL RECORDKEEPING AND AUDITING

- A. Accounting -- The Contractor will maintain an accounting system and a set of accounting records that, at a minimum, allows for the identification of individual Projects by source of revenue and expenditures related to this Agreement. All costs will be supported by source documentation and available upon request by WERF. The Contractor's accounting records will be the basis for generating financial reports that must reflect accurate and complete data. Such accounting records shall include documentation for all cost sharing activities as required under Paragraph 4. B. of this Agreement. In addition, financial records must be properly closed out at the end upon termination of the Agreement and all reports submitted in a timely manner.
- B. Auditing in General-- The Contractor agrees to comply with the requirements of OMB Circular A-133. Contractor further agrees to provide WERF with copies of all independent auditors' reports, which cover the period of performance of this Agreement. Contractor will provide a copy of its response to auditors' reports and, in instances of non-compliance, a plan for corrective action. All records and reports prepared in accordance with the requirements of OMB Circular A-133 shall be made available for review or audit by appropriate officials of the Federal agency, WERF, or the General Accounting Office (GAO) during normal business hours.
- C. Auditing Requests by WERF -- Upon the request and at the expense of WERF, the accounting records maintained by Contractor in the performance of the Research shall be subject at all reasonable times to audit by WERF, or at WERF's option, by an independent public accounting firm designated by WERF and paid for by contractual funds. The Parties intend that such audits shall be performed not more frequently than once every twelve (12) months during the performance of the Project. WERF may also have an audit performed at any time within one (1) year following its final payment. If at any time during the course of the Research a budget line item is exceeded by ten percent (10%) or more of the CAP WERF may request a revised budget to be submitted.

6. FEDERAL FUNDING

No Federal Funds are being provided by WERF for this Research.

7. KEY PERSONNEL

Performance of the Research shall be supervised by a Principal Investigator (PI) designated by the Contractor with the periodic review of a Project Manager designated by WERF. These individuals are named in the Scope of Work and are considered essential to the Research. Substitution of the Principal Investigator or substantial increases or reductions in the Principal Investigator's efforts will not be made without the prior written approval of WERF. WERF may designate a new or alternate person for the Project Manager at any time by providing written notification to the Contractor.

8. NOTICES AND POINTS OF CONTACT

Any notices to WERF required under this Agreement shall be addressed to the Project Manager with a copy to the Contract Administrator. Any notices to Contractor will be sent to the parties designated below, as appropriate.

WERF Points of Contact for this Agreement are:

Project Manager: Christine Radke, Cradke@werf.org, (571) 384-2106

Invoices/Billing: David Morroni, DMorroni@werf.org, (571) 384-2103

Contract Admin.: Louise Pouliot, LPouliot@werf.org, (571) 384-2108.

Postal and courier deliveries to WERF points of contacts should be directed to the address first written above.

Contractor's Points of Contact for this Agreement are:

Principal Investigator: Jing Luo, Ph.D., PE, Jing.Luo@wwm.pima.gov, (520) 724-6537

Invoices/Billing: Jing Luo, Ph.D., PE, Jing.Luo@wwm.pima.gov, (520) 724-6537

Contract Admin: Jing Luo, Ph.D., PE, Jing.Luo@wwm.pima.gov, (520) 724-6537

Postal and courier deliveries to Contractor points of contacts should be directed to:

Jing Luo, Ph.D.
Civil Engineering Manager
Pima County WWRD
201 Tucson, AZ 85701-1207

9. DELIVERABLES, REPORTING and QAPP

- A. Quality Assurance Project Plan -- The Contractor shall submit a Quality Assurance Project Plan (QAPP) to WERF at least 30 days before data collection starts. The QAPP will be reviewed by the WERF technical advisory committee. The WERF Project Manager will provide guidance and a template for the QAPP. The QAPP will be the first deliverable under this Agreement and will be listed in Attachment D, "Schedule of Deliverables and Milestones".
- B. Timetable for Deliverables -- Deliverables shall be submitted to WERF in accordance with the timetable in Attachment D, "Schedule of Deliverables and Milestones." All Deliverables shall be in a format that may be uploaded to the Internet. Electronic versions of reports shall be submitted in PC format using commonly available word processing software or PDF. If a Deliverable is computer based, Contractor is required to provide software support and to update computer software as necessary and as negotiated in a separate Software Support Agreement with WERF. The Software Support Agreement shall be incorporated by reference into this Agreement.
- C. Interim Deliverables -- Contractor shall submit Interim Deliverables to the WERF Program Manager on the dates specified in Schedule of Deliverables. The Interim Deliverable may include, but not be limited to, summaries of findings/results of a task, annual reports, a report of recommendations for further research, progress summary presentations at Program Area Meetings or web profiles. The purpose of the Interim Deliverable is to communicate the progress on the Research to date and to document the successful completion of tasks. All Interim Deliverables will include the following disclosure language on the cover page:

Disclosure

(include on the bottom of the cover page of each Interim Deliverable)

This report has not been reviewed by WERF to determine whether it contains patentable subject matter, nor has the accuracy of its information or conclusions been evaluated. Accordingly, the report is not to be considered a published report and is not available for general distribution, and its distribution is limited to employees and advisors of WERF for the sole purpose of evaluating the progress and future course of the project described in the report. Until the report has been reviewed and evaluated by WERF, it should be neither disclosed to others nor reproduced, wholly or partially, without written consent of WERF.

The Interim Deliverable will receive a review from a group of volunteer subject matter experts (e.g., the Project Sub Committee). Upon completion of the review process, comments will be sent to the Principal Investigator who shall address all review comments. Contractor shall keep WERF informed including work performed by the

Contractor for its own account or by subcontractors and/or Collaborators. If work is considered proprietary and/or confidential to Contractor or others, the work shall be marked with an appropriate legend and shall be handled as Confidential Information pursuant to the terms of this Agreement.

- D. Final Deliverables -- Upon completion of the Research, Contractor shall submit to WERF a comprehensive draft final product covering all work on the Research accomplished and results achieved under this Agreement, including conclusions and practical applications that will be of benefit to WERF Subscribers ("Draft Final Product"). The Draft Final Product shall be in compliance with the most current edition of the Guidelines for Preparing WERF Research Reports and Products as set forth in the following link http://www.werf.org/i/Funding/Preparing_a_Report/a/o/PreparingaReport/Preparing_a_Report.aspx. The Draft Final Product shall be in full, clear, concise, and exact detail, and shall include data such as mathematical, graphic, and written descriptive materials, and other means of disclosure appropriate under the circumstances, to enable any person skilled in the art to achieve the results of the Research performed under this Agreement. The Draft Final Product must also include a clearly identified section explaining the practical benefits of the Research results. The Draft Final Product shall be a polished document ready for publication if the reviewers were to have no comments. The Draft Final Product should not be a preliminary report in any manner or form. It should be spell-checked, grammatically edited, fully formatted, technically complete, internally reviewed, and fully proofed for any and all errors prior to submittal for WERF review comments. If the Draft Final Product is computer based, all testing will have been done and all QA/QC met. The Draft Final Product will be briefly screened upon submission and will be returned to the authors with WERF review if significant deficiencies are identified.
- E. Acceptance of Draft Final Product -- Upon acceptance by WERF, the Draft Final Product will receive a review from a group of volunteer subject matter experts (e.g., the Project Sub Committee). Upon completion of the review process, comments and recommended actions will be sent to the Contractor. Contractor shall address all review comments made on the Draft Final Product and submit a revised Draft Final Product. (the "Final Product") WERF reserves the right to request (up until submission of the Draft Final Product) the Contractor to submit an alternate or additional Final Product) that may not be specified in attachments A and D. An alternate Final Product shall be at no additional cost to WERF. For alternate or additional Final Products(s), WERF will use commercially reasonable efforts to allow an equitable adjustment in the WERF Cost, or time of performance, or both. The alternate or additional Final Products(s) shall be prepared in the same manner as the Final Product as discussed in this section.

10. INTELLECTUAL PROPERTY

10.1 Copyrights

- A. Assignment of Copyrights -- Contractor hereby assigns to WERF copyrights owned by Contractor in the Work Products including Interim/Deliverables, Draft Final /Deliverables and Final Deliverables to publish, reproduce, and distribute in any medium now known or hereafter developed, and to use in any manner and for any purpose, without limitation, including the right to assign copyrights to third parties. Contractor shall execute written assignments of the copyrights and do all things necessary or proper to establish and enforce WERF's copyrights including obtaining assignment of any and all copyrights with employees, subcontractors and Collaborators. Contractor shall not enter into any agreement or take any action with respect to its rights in the copyrighted works that might jeopardize WERF's ownership of such copyrights in the Work Products.
- B. Incorporated Works -- If Contractor incorporates copyrighted or proprietary works of Contractor or third parties ("Incorporated Works") in the Final Product, Contractor shall obtain (at no expense to WERF and for an appropriate period of time) written permission for WERF to use Incorporated Works in Research Reports Interim Deliverables, the Draft Final Product, and the Final Product, and in the case of third party copyrighted or proprietary works, shall submit to WERF a copy of the document granting Contractor permission to use Incorporated Works.
- C. Articles -- Contractor may write, or WERF may request Contractor to write, papers related to the Research for publication. The Contractor may retain copyrights for any technical papers or articles for publication, presentation, or theses generated in connection with the **Research that do not substantially duplicate material intended to be contained in the Final Deliverable/Report**. Consequently, any works to be published or presented or otherwise used by or on behalf of Contractor other than the Interim Progress Reports, Draft Final Products and Final Products, may be so used only to the extent that any claim by a third party in rights to such works shall not impede upon WERF's rights in the works to be assigned by Contractor. Contractor shall submit Articles to WERF for review. WERF reserves the right to determine if a disclaimer shall be included with the Articles. To the extent allowable by third party publishers, Contractor hereby grants WERF a nonexclusive license to publish, make copies, prepare derivative works of, and to incorporate the Articles in collective and compilation works. Articles generated in connection with the Research under this Agreement, during the period of performance of the Agreement or in the future, shall give credit to WERF as the sponsor of the Research by including the following:

"This research was funded by the Water Environment Research Foundation (WERF)".

If an Article was not specifically requested by WERF, the author's time will not be charged to WERF under this Agreement.

10.2 Trademarks and Funding Attribution

Neither party will use the name or logo of the other in publications or in any form of publicity without the written permission of the other, in the case of WERF, the Project Manager.

10.3 Databases

Contractor hereby warrants and represents that it has all rights to the underlying facts in any database that is a deliverable as part of the Research Reports, Interim Deliverables, Draft Final Product, Final Product and that Contractor has the right to assign to WERF all copyrights in the underlying facts in the database, as well as, all copyrights in the compilation of the database. Facts included in any database shall be deemed "Data" pursuant to Section 10.4 of this Agreement. Contractor hereby assigns to WERF all copyrights in database(s) to publish, reproduce, and distribute in any medium now known or hereafter developed, and to use in any manner and for any purpose, without limitation, including the right to assign copyrights to third parties. Contractor shall execute written assignments of the copyrights and do all things necessary or proper to establish and enforce WERF's copyrights including obtaining assignment of any and all copyrights with employees, subcontractors and Collaborators.

10.4 WERF's Rights in Data.

- A. Data -- Contractor agrees to maintain data, for a minimum of 7 years from submission of the final invoice, in sufficient detail to properly reflect all work done on the Research and to document results achieved in the performance of this Agreement, including but not limited to, books, records, reports, research notes, charts, graphs, comments, computations, analyses, recordings, photographs, samples of materials, and other graphic or written documents generated in connection with the Research (the "Data").
- B. Preservation of Data -- All Data produced, generated or procured under this Agreement, including under any subcontracts or collaborative agreements, shall become the property of the Contractor and may be utilized by Contractor for its own purposes. Contractor shall retain Data in its original form during the term of this Agreement and shall deliver original or reproducible copies of Data to WERF upon request. Contractor shall deliver reproducible copies of Data to WERF prior to destruction. Until such delivery to WERF, the Contractor agrees to permit WERF representatives to examine and review at reasonable times all Data in Contractor's possession.
- C. License to Data -- Contractor hereby grants to WERF an irrevocable, worldwide, perpetual, nonexclusive fully-paid license to copyrights and other Intellectual Property rights owned by Contractor in the Data to publish, reproduce, distribute and use all or any part of the Data, in any manner and for any purpose, without limitation, and such license shall include the right to grant sublicenses to third parties similar in scope. Contractor shall do all things necessary or proper to establish and enforce WERF's license in the Data including obtaining assignment of any and all Intellectual Property rights from employees, subcontractors and Collaborators.

10.5 Confidential Information.

The Parties acknowledge that, in the performance of the Research, the Contractor may furnish, under mutually acceptable terms and conditions, proprietary and/or confidential information, which is generally related to the subject matter of the Agreement but has been developed by the Contractor or others apart from this Agreement. Prior to publication of the Final Report by WERF, Contractor shall take all appropriate steps to preserve the confidentiality of the Final Report and Data. Appropriate steps to be taken by the Contractor shall include, but not be limited to, entering into confidentiality Contracts with employees, subcontractors and Collaborators.

10.6 Computer Programs.

- A. Exclusive Computer Programs. If Computer programs are specified as part of the Scope of Work they shall be supplied to WERF in a form, which may be used by others independent of Contractor's proprietary programs or computer configurations (the "Computer Programs"). Contractor hereby grants to WERF an exclusive irrevocable, worldwide, perpetual, fully-paid license to Computer Programs in Source Code and Object Code, including the right to grant royalty-bearing sublicenses to third parties similar in scope and to distribute Computer Programs in any medium now known or hereafter developed, and to use in any manner and for any purpose, without limitation. Furthermore, the Contractor grants WERF the right to prepare, and to retain others to prepare, Derivative Works pertaining to the Computer Program, in which the Computer Program is updated or otherwise modified by, or at the direction of, WERF. Contractor shall do all things necessary or proper to establish and enforce WERF's license in the Computer Program including obtaining licenses from any and all subcontractors and Collaborators. The Computer Programs, test cases and their results will be transmitted to WERF in Object Code on computer disc in a format compatible with WERF's computer operating system or an operating system specified by WERF and in a form that is reproducible by WERF to create additional copies, if necessary. Adequate supporting documentation allowing a person of ordinary skill in the art to build the Object Code from the Source Code shall also be supplied to WERF. Any royalty income earned on licensing of Computer Programs by WERF under its exclusive license shall remain with WERF. Contractor shall not disclose or distribute Computer Programs without first obtaining a license from WERF.
- B. Nonexclusive Supporting Computer Programs. Contractor may, during the course of the Project, develop or substantially modify existing programs especially for use in this Research that are not specified in the Scope of Work but are supportive of the Research ("Supporting Computer Programs"). Contractor hereby grants to WERF an irrevocable, worldwide, perpetual, nonexclusive, fully-paid license to Supporting Computer programs in both Source Code and Object Code, including the right to grant sublicenses similar in scope, and distribute in any medium now known or hereafter developed. Contractor shall not use third party, royalty-bearing software to support Computer Programs.

10.7 Patents.

Contractor shall immediately, upon learning of its potential existence, report to WERF in writing any idea or concept that could result in a patentable idea, process, or formula (collectively "Inventions") resulting from the support, in whole or in part, from funds awarded by WERF under this Agreement.

If the Contractor has no patent policy, a patent policy and procedure shall be defined by subsequent negotiation as an Addendum to this Agreement ("Patent Policies & Procedures"). If the Contractor has established, pre-existing, patent policy and procedures for administering Inventions which are known and accepted by WERF, WERF may defer to Contractor's patent policy and procedures subject to WERF's Patent Policy requirements set forth below:

- a. Title to Inventions shall reside with Contractor to the extent such title can be properly claimed under its patent policies and procedures. WERF shall be allowed rights to use the patent pursuant to this patent policy.
- b. If the Contractor decides not to file a patent application, WERF shall be notified promptly (within one week of the decision not to file an application) and WERF shall have the sole right to determine the disposition of the Invention, taking into consideration possible rights of third parties.
- c. If the Contractor initiates a patent application, the patent application shall not be abandoned without prior written notice to WERF and WERF shall have a Right of First Refusal to a transfer of title to the Invention and assignment of the application.
- d. If a patent is issued to Contractor, the patent shall not be abandoned without prior written notice to WERF and WERF shall have a Right of First Refusal to a transfer of title to the Invention.
- e. If a patent is issued on the Invention, the Contractor shall make regular periodic reports to WERF with respect to its utilization of the Invention and issue regular payments to account for any income received resulting from licensing, sale, assignment or any other commercialization of the Invention (collectively "Exploitation").
- f. From the monies, if any, received from Exploitation of the Invention, WERF and the Contractor shall each receive an allocable share. The share shall take into consideration the relative contributions of each party, as well as possible rights of third parties.

The Contractor shall use best efforts to make the Invention available for commercial licensing upon reasonable terms and conditions.

WERF may request the grant of a worldwide, irrevocable, nonexclusive right and license to use the Invention without payment or royalties or license fees solely for the use by WERF for its own use or for public education purposes. Contractor shall not unreasonably oppose such a grant.

11. RELATIONSHIP OF THE PARTIES

The Contractor is an independent contractor to WERF in this agreement. WERF and the Contractor shall be solely liable for any claims, actions, demands or damages arising out of the performance of their respective obligations under this Agreement.

12. CLOSE-OUT PROCEDURES

- A. The Contractor shall submit a final expense report for the Contractor's work prior to final payment hereunder.
- B. Final payment may be withheld until the requirement of Subparagraph A of this Article has been fulfilled.

13. NON-ASSIGNMENT/NON-TRANSFER/SUBCONTRACTS/EOE

- A. Non-Assignment/Non Transfer -- Neither this Agreement nor any interest therein, or claim there under, shall be assigned or transferred by the Contractor to any party or parties without the written authorization of WERF.
- B. Subcontracts -- If additional subcontractors are required for completion of the Research subsequent to those contemplated in the Budget, the Contractor will select additional subcontractor(s) with the approval of the WERF Program Manager. Notwithstanding any such consent or concurrence, (a) WERF shall not bear any liability to the Contractor, subcontractor, or collaborator arising out of any act or omission of the Contractor, subcontractor or collaborator, and (b) any subcontracting by the Contractor shall not relieve the Contractor of any responsibility for the performance of this Agreement or the Research. Except as otherwise authorized in writing by the Parties, the Contractor will insert in all subcontracts and collaborative agreements provisions making the relevant portions of the following Sections applicable to any subcontractor, collaborators and its employees: FINANCIAL RECORDING KEEPING AND AUDITING, INTELLECTUAL PROPERTY, OVERSIGHT, INDEMNIFICATION, ARBITRATION and this section, NON-ASSIGNMENT/NON-TRANSFER/SUBCONTRACTS/EOE.
- C. Subcontractor and Collaborator Settlement -- In the event a subcontract and/or collaborative agreement hereunder is canceled or terminated, the Contractor will so advise WERF and obtain WERF's prior written consent in any subcontractor or collaborative agreement termination cost settlement for such costs to be allowable under this Agreement. WERF's consent will not be unreasonably withheld.
- D. Equal Opportunity Employer -- WERF is an Equal Opportunity Employer and WERF expects Contractor, its subcontractors and Collaborators to be Equal Opportunity

Employers who accept the goal of having a work force that generally reflects the minority composition of the community in which it is located. Contractor shall not discriminate on any basis. It is the policy of WERF to encourage proposals from qualified minority owned or directed institutions. Contractor shall use best efforts to ensure that fifteen percent (15%) of the total contract shall be made available to business concerns or other organizations owned or controlled by socially and economically disadvantaged individuals within the meaning of Section 8(a) (5) and (6) of the Small Business Act (15 U.S.C. 637 (a) (5) and (6). Such business entities may participate as, subcontractors, collaborators, or procurers of supplies, equipment, or services.

14. AMENDMENT AND TERMINATION OF AGREEMENT

- A. This Agreement may only be amended by a signed document duly executed by authorized representatives of the parties.
- B. If Contractor fails to comply with the terms and conditions of the Agreement, WERF may terminate this Agreement in whole or part, at any time by giving thirty (30) days written notice to the Contractor specifying the extent of termination and the effective date. If this Agreement is terminated pursuant to this article, the Contractor will stop work as specified in the notice and will be entitled to payment in accordance with the payment provisions of this Agreement only for those services furnished prior to the effective date of termination or non-cancellable works performed. The Contractor shall not place any orders or subcontracts for materials, services, or facilities, except as may be necessary for the completion of such portion of the work that is not terminated or non-cancellable.
- C. In the event that there is any change in Federal statutes, rules or regulations which materially alter Contractor's ability to perform its activities under this Agreement or there is a change in availability of funds from the Award, WERF reserves the right to alter this Agreement to conform to the changed circumstances or to terminate this Agreement if the work outlined in the Proposal is no longer technically or legally feasible.
- D. Upon termination for any reason, WERF shall not be liable for any general, special, incidental, consequential or any other damages of any description or amount. This provision shall survive the term of this Agreement.

15. INDEMNIFICATION

- A. The parties shall indemnify, defend and hold harmless each other, their officers, directors, agents, and employees from and against any and all liability for injury, including death to persons or damage to property to the extent caused by any negligent error, act or omission of the indemnifying party, its subcontractors, collaborators, agents, or employees, including any and all expense, legal or otherwise, incurred by the indemnified party, its officers, directors, agents, and employees in the defense of any claim or suit arising out of the activities performed under this Agreement.

- B. The parties shall indemnify, defend and hold harmless each other, their officers, directors, agents, and employees, and its licensees from and against any and all liability, damages, losses, costs, and expenses (including reasonable attorneys' fees, if the indemnifying party fails to defend the indemnified party as provided herein) incurred by the indemnified party in connection with any claim that the activities performed under this Agreement infringe upon or violate any patent, copyright, trademark, trade secret, or other proprietary right of any third party (collectively, an "Infringement Claim"). The indemnified party shall have the right to participate in, and shall have the right to give reasonable approval to, any settlements of any such Infringement Claim.
- C. Contractor and WERF shall each notify the other promptly in the event that any claim or suit arises out of the activities performed under this Agreement.
- D. These indemnification provisions shall survive the term of this Agreement.

16. INSURANCE

Contractor warrants that it is self-insured and maintains coverage in the manner and amounts described below:

- a. General liability insurance is maintained in accordance with the statutory requirements of the jurisdiction in which the Work will be performed. General liability includes bodily injury and property damage, contractual liability, personal and advertising injury, products and completed operations.
- b. Workers Compensation and/or all other Social Insurance in accordance with the statutory requirements of the jurisdiction in which the Work will be performed.
- c. Excess/Umbrella Liability insurance at \$10,000,000.
- d. Automobile liability insurance of \$1,000,000.

A statement of such self-insurance shall be provided to WERF within 5 business days upon request.

17. ARBITRATION

All dispute(s) arising out of, relating to or in connection with this Agreement, or any breach thereof, shall first be subject to the Parties using all best efforts to resolve the dispute(s) through discussions solely between themselves in an attempt to avoid the need for arbitration. If the above mentioned discussions fail to resolve the dispute(s), the dispute(s) shall be submitted to the American Arbitration Association ("AAA"), and finally settled under the Commercial Arbitration Rules of the AAA by one arbitrator appointed in accordance with the said rules. The location of any hearing or other arbitral proceedings shall be Alexandria, Virginia. The award rendered by the arbitrator shall be final and binding and judgment on the award may be entered in any court having jurisdiction thereof.

For the purposes of seeking Injunctive Relief (defined below) in aid of arbitration, each Party hereby irrevocably consents to the jurisdiction of the United States federal courts and Virginia state courts located in Alexandria, Virginia, in any action or proceeding arising out of, relating to, or in connection with this Agreement, and hereby irrevocably agrees that all requests or demands for Injunctive Relief in connection with claims and disputes arising out or related to this Agreement, and any orders for such Injunctive Relief, may be issued by such courts. "Injunctive Relief" means any claim seeking remedy in the form of a court order providing emergency, temporary, or permanent injunctive relief that either prohibits a Party from continuing a particular activity, omission, or action deemed to be in breach of this Agreement or otherwise compels a Party to perform a particular activity or action required by this Agreement.

Unless otherwise directed by WERF in writing, the Contractor shall continue to perform the Research during any arbitration proceeding.

18. CONTROLLING LAW AND SEVERABILITY.

This Agreement and the respective rights and obligations of the Parties hereto shall be governed by and construed in accordance with the laws of the Commonwealth of Virginia, and the federal laws of the United States of America applicable therein, without giving effect to any choice of law or conflict of law provision or rule (whether of the Commonwealth of Virginia or any other jurisdiction) that would cause the application of the laws of any jurisdiction other than the Commonwealth of Virginia and the federal laws of the United States of America applicable therein.

If any provision, or portion thereof, of this Agreement is found to be unenforceable, the remainder of the Agreement shall continue in full force and effect. If any provision of this Agreement is held to be unenforceable for any reason, such provision shall be reformed only to the extent necessary to make it enforceable, and such decision shall not affect the enforceability of such provision under other circumstances, or of the remaining provisions hereof under all circumstances.

19. DISCLOSURE REQUIREMENTS FOR ORGANIZATIONAL CONFLICTS OF INTEREST

Organizational Conflict of Interest Certification (EPAAR 1552.209-72), requires the Contractor to certify whether it is or is not aware of any potential organizational conflict of interest. If the Contractor is aware of a conflict, then Contractor must provide an Organizational Conflict of Interest Notification (EPAAR 1552.209-70), that requires the Contractor to provide a disclosure statement in its proposal describing all relevant information concerning any past, present, or planned interests bearing on whether it (including its chief executives and any directors, or any proposed consultant or subcontractors) may have a potential organizational conflict of interest.

20. COMPLIANCE WITH APPLICABLE LAW

Contractor shall comply with all applicable local, state and Federal laws and regulations in the performance of this Agreement, whether specifically referenced in this Agreement or not.

21. SURVIVABILITY

In the event that this Agreement is terminated for any reason, the following paragraphs shall survive Paragraph 4.C. - UNALLOWABLE COSTS, Paragraph 5 in its entirety - FINANCIAL RECORDING KEEPING AND AUDITING, Paragraph 10 in its entirety - INTELLECTUAL PROPERTY, Paragraph 12 in its entirety- CLOSE-OUT PROCEDURES, Paragraph 15 in its entirety - INDEMNIFICATION.

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed by their undersigned duly authorized representatives:

WATER ENVIRONMENT RESEARCH FOUNDATION

By: _____

Name and Title: Amit Pramanik, Ph.D., BCEEM, Director of Research

Date: _____

JUNE 4, 2015

FED TAX ID No. 54-1511635

In accepting this Award or amendment and any payments made pursuant thereto, (1) the undersigned represents that he is duly authorized to act on behalf of the recipient organization, and (2) the recipient agrees (a) that the Award is subject to the applicable provisions of 40 CFR Chapter 1, Subchapter B of the Environmental Protection Agency and of the provisions of this agreement (and all attachments), and (b) that acceptance of any payments constitutes an agreement by the payee that the amounts, if any found by WERF to have been overpaid will be refunded or credited in full to WERF.

~~PIMA COUNTY REGIONAL WASTEWATER RECLAMATION DEPARTMENT~~

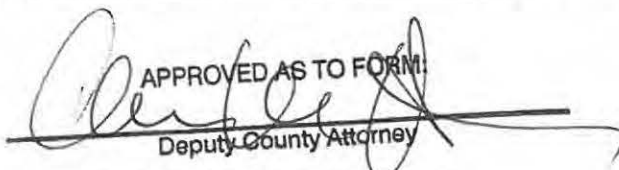
By: _____

Name and Title:

Date: _____

FED TAX ID No.

86-6000543

APPROVED AS TO FORM:

Deputy County Attorney

CHARLES WESSELHOFT

Schedule of Attachments

Scope of Work.....A

Total Budget.....B

Invoice Format.....C

Schedule of Deliverables and MilestonesD

Comments on NTRY9T15 "Sustainable Struvite Control Using Carbon Dioxide from Digester Gas" Scope of Work

1: General

To minimize the environmental consequences of water resource recovery facility (WRRF) operations like the Tres Rios Water Reclamation Facility (TRWRF), responsible municipal agencies are exploring innovative reuse opportunities for products and by-products of municipal wastewater treatment. In this investigation the focus is on the separation and reuse of carbon dioxide (CO₂) from anaerobic digester gas for control of in-plant struvite formation. In a few notable cases, commercial grade CO₂ has been used to mitigate struvite formation during wastewater/biosolids treatment. However, there is no known research leading to the use of residual gas (mostly CO₂) from digester gas for struvite control. Enrichment of CO₂ in the residual gas naturally occurs when methane is separated out and used as a renewable energy source.

Unintended struvite (MgNH₄PO₄·6H₂O) precipitation in digesters and associated solids process piping/equipment is a common and costly problem in WRRFs that practice biological phosphorus removal. PCRWRD recently started up a 50 MGD modified five-stage Bardenpho process at its TRWRF. In the first few months of operation until ferric chloride was added at key locations struvite formed rapidly in the solids process piping and equipment, forcing centrifuge dewatering shutdowns and frequent cleanout activities.

The prorated cost of chemical addition for struvite control is between \$ 1/2 and \$1 million per year. Ferric chloride addition also significantly increases biosolids production with related disposal costs. It is likely that struvite formation can be controlled more sustainably and cost effectively using internally produced CO₂ that is commonly wasted to the atmosphere. This practice will enhance the economic viability of high value digester gas utilization options.

Primary Goals of this Research are to:

- Establish the feasibility of using residual gas (primarily CO₂) following methane recovery to control struvite formation in WRRF
- Develop a protocol for implementation of similar struvite control methods at other WRRFs. That is, project results will include design and operational guidance that can be used in similar situations throughout the municipal wastewater treatment industry.

Proposed research is sponsored by WERF, Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), CH₂MHill, and endorsed by the WaterReuse Association, WaterReuse Research Foundation, National Association of Clean Water Agencies (NACWA), and AZ Water. This research is further supported by wastewater utilities on both the east coast and west coast.

2: Project Approach

2.1: Research Objectives

The guiding hypotheses for this research proposal are:

Hypothesis 1: Solubility of struvite is a function of solution pH and struvite components concentration (NH₄⁺, Mg⁺², PO₄⁻³). In principal, struvite precipitation can be avoided through pH control. This pH control can be achieved by CO₂ injection at the strategic locations in the facility.

Hypothesis 2: Typical digester gas from anaerobic digestion contains about 60% methane (CH₄), 40% CO₂ and trace impurities. During the digester gas purification, methane is separated, and CO₂ is rejected with other impurities. The residual gas is dominated by CO₂. Although the composition is a function of

the technology selected for methane recovery, the impurities do not significantly impact the performance of the system.

In order to verify these hypotheses, the following research objectives are proposed:

Objective 1: Determine target pH level and acid demand for mitigating struvite deposition.

Objective 2: Evaluate the effectiveness of pH adjustment in multiple points within solids processing, including the digested sludge and dewatering side-streams by CO₂ injection.

Objective 3: Determine the impacts of the impurities and variation in the residual gas, on the effectiveness of pH adjustment in digested sludge and dewatering side-streams.

Objective 4: Determine the impact of gas phase impurities and variation on equipment including: CO₂ injection equipment and automatic control systems. Meanwhile, assess potential to optimize the digester gas cleaning process to be more compatible with the utilization of the residual gas.

Objective 5: Estimate the lifecycle cost of using residual gas to mitigate struvite formation. And verify/quantify the environmental benefits of the proposed practice. Develop a framework to allow a rapid viability screening and implementation of the projects of the same nature.

2.2: Work Plan

It should be noted that this project will be divided into two phases: Phase 1 will be address Objectives 1, 2, 3, and 4, and Phase 2 will address Objective 5. Phase 2 is contingent on additional funding needed and will only begin when those funds are secured.

PHASE I

Task 1: Project Management and Reporting.

Pima County will provide the required Project Management for the successful completion of the proposed research. This will include periodic updates and meetings regarding project status, invoicing, and implementation of the various tasks. The project team will work closely with the WERF Project Manager, and other stakeholders throughout the entire project. The project team will prepare project progress reports per WERF requirements and shown in Attachment D Schedule of Deliverables and Milestones.

Task 2: Develop Stoichiometric and Kinetic Models relating CO₂ addition to pH change in chemically complex, aqueous solutions – e.g., digested sludge and side-streams (in support of Objective 1).

Subtask 2.1: Equilibrium Modeling

Parameters that influence struvite precipitation include: pH; temperature; solution ionic strength; total NH₄⁺, Mg²⁺, and PO₄³⁻; and presence/concentration of metals and ligands that are capable of forming complexes with free Mg²⁺, NH₄⁺, and PO₄³⁻. To better predict different equilibrium relationships in the liquid solutions, it is necessary to better characterize the aqueous-phase chemistry of digested sludge and the side-streams. Modeling tools, such as the struvite scale potential model and/or MINEQL⁺ will be used. The calibrated equilibrium model will be validated using independent data set gathered from bench scale experiments.

Subtask 2.2: Kinetic Modeling

A kinetic model that is capable of simulating the time-dependent pH change following CO₂ addition to batch or continuous flow reactors will be developed. In a well mixed system, the rate of carbonic acid formation from dissolved CO₂ limits the rate pH change due to CO₂ addition. The model will first be developed for deionized water, and then will be extended to digested sludge and the side-streams with

considerations of buffering potential of the liquid based on pH/alkalinity measurements, complexation reactions with metals, and the potential direct reactions between liquid CO₂ and NH₃. Experimental data necessary for model validation in the chemically complex liquids will be obtained in Task 3.

Task 3: Identify Optimum pH Level for Mitigating Struvite Deposition while minimizing over all process costs through the bench scale experiment (in support of Objective 1)

Digested sludge and dewatering side-stream samples will be obtained from TRWRF. The samples will first be acidified to a pH of approximately 6.0, preventing further precipitation of struvite, while avoiding undesired biomass lysis or chemical releases. Sodium hydroxide (NaOH) solution will then be added to the sample stepwise to raise pH level. At each stabilized pH, dissolved Mg²⁺, NH₄⁺, and PO₄-3 concentrations will be measured in order to calibrate/validate equilibrium modeling (Subtask 1.1). The validated model will be used to determine the pH control point to avoid struvite precipitation in each solution tested.

Task 4: Bench Scale Investigations

Subtask 4.1: Evaluate the effectiveness of pH adjustment in digested sludge and dewatering side-stream by CO₂ injection to a bench scale batch reactor (in support of Objective 2).

A bench scale batch reactor (Figure 2), will be designed and constructed. Commercial grade CO₂ will be pulsed into the reactor, and solution pH will be determined as a function of time and CO₂ dose. Independent variables will include the volume of CO₂ injected, reactor pressure, bubble size (determined by diffuser type and pressure), and the type of liquid being tested.

Solution pH will be measured as a function of time until equilibrium is achieved (indicated by constant pH). This experiment will be conducted initially in deionized water to validate the kinetic model proposed in Subtask 2.2. Then the experiment will be conducted with digested sludge and the side-streams from TRWRF. Bench scale data will be used to support the design of pilot scale experiment.

Subtask 4.2: Identify the impacts of the impurities in the residual gas on bench scale reactor performance (in support of Objective 3).

A gas mixture will be synthesized based on the anticipated residual gas composition following methane recovery from digested gas. The synthetic gas will be introduced into the completely mixed pressurized batch reactor containing deionized water, digested sludge, or the side-streams. Reactor pH will again be monitored until equilibrium (steady pH) is achieved. Problems specific to trace contaminants in the gas mixture will be determined via comparison with reactor performance when pure CO₂ is introduced in Subtask 4.1.

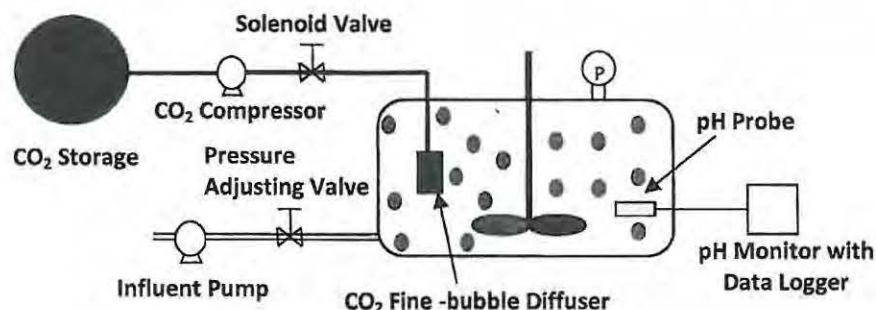


Figure 2: Completely Mixed Pressurized Batch Reactor

Task 5: Pilot Scale Investigations

Subtask 5.1: Evaluate effectiveness of pH adjustment in digested sludge / dewatering side-stream by CO₂ (residual gas) injection to a continuous flow pilot reactor (in support of Objectives 2 & 3).

A pilot scale system (Figure 3) will be constructed at TRWRF. The system will consist of a pipe segment, through which the tested liquid will be pumped at steady velocities. Pipe will be provided with a pressurized diffuser for gas injection, downstream pH probes, in-line pH controller, CO₂ or residual gas storage, control manifold, and other necessary ancillary equipment. Gas bubbles are released by the diffusers under pressure into the pipe. A pH probe installed downstream of the gas injection point will measure pH in the stream. In-line pH control will modulate gas flow automatically to maintain optimum pH in the pipe. Time of travel between the points of gas injection and pH measurement will be varied by controlling the liquid flow rate. Other independent variable of interest will be gas dosing rate and pressure. When the target pH control point is achieved, gas to liquid ratio will be calculated.

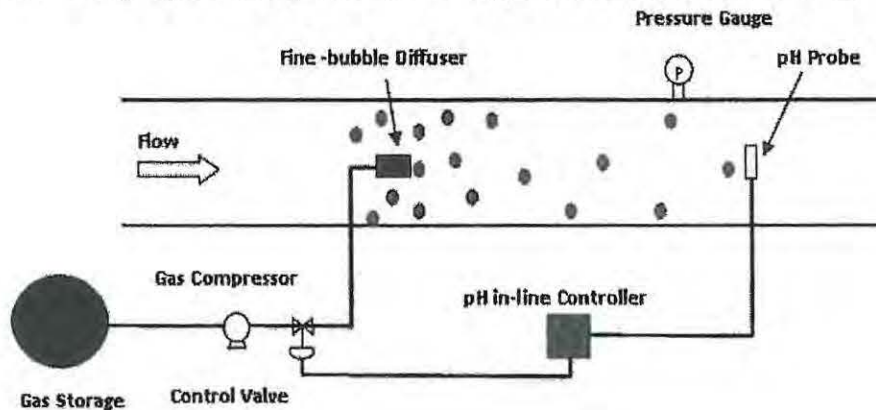


Figure 3: Pilot Scale System

First, commercial grade CO₂ will be used. And then either synthetic residual gas or residual gas (if available) will be used. The system performance using synthetic residual gas will be compared with the experiments using pure CO₂. Design parameters will be defined and determined based on the experiment results.

Subtask 5.2: Determine the impact of gas-phase impurities and variation in gas quality on process performance and equipment including (i) CO₂ injection equipment; and (ii) automatic control system (in support of Objective 4).

The pilot system for the introduction carbon dioxide to the subject stream will be used to study the impact of gas quality variation on injection equipment and the automatic control system. Again, a gas mixture will be synthesized based on the likely digester gas residual composition following methane recovery and system performance will be compared to experiments involving pure CO₂ addition. The CO₂ injection/control systems provided by TOMCO₂ Systems or ASTi will be considered for this phase of research. Diffuser selection will be varied to produce a range of bubble sizes. An automatic control system will be tested based on feedback from the downstream pH sensor.

Task 6: Assess Potential to Optimize Digester Gas Cleaning Process to be more compatible with the residual gas utilization (in support of Objective 4).

The result of this task will provide valuable feedback to the digester gas cleaning technology providers. Potential improvement may be made so that the cleaning technology and the residual gas utilization are more compatible, and/or less costly.

PHASE II (optional)

Optional task will not start without a written notice to proceed from WERF.

Task 7: Estimate Lifecycle Cost of using residual gas to mitigate struvite formation and verify/quantify environmental benefits of the proposed practice (in support of Objective 5).

A holistic approach will be taken to look at the impact of the proposed struvite control system on the overall life cycle cost of the system. GPS-X model will be used to facilitate the evaluation. Environmental benefits including carbon footprint reduction will be estimated based on full scale operation.

Task 8: Develop Framework for Rapid Viability Screening and Implementation of the projects of the same nature (in support of Objective 5).

A stand-alone protocol for rapid assessment of nuisance struvite deposition and viability of utilization of carbon dioxide for struvite control will be developed under this task. The protocol will be validated for a minimum of two WRRFs— one at Pima County, and a second from a WERF utility member. Additional validation will be proposed to WERF through its Leaders Innovation Forum for Technology (LIFT) program.

3: Research Deliverables and Communications Plan

The deliverables for each Phase of the research include:

PHASE I

- Quality Assurance Project Plan (QAPP)
- Interim Reports – project status reports for the WERF review group and associated stakeholders
- Final Report – with a 900-word executive summary
- Minimum of two presentations to be given at a major water/wastewater associated conference or webinar

PHASE II

- Stand-alone protocol and fact sheets for rapid viability screening and implementation of the utilization of residual gas to prevent nuisance struvite deposition in wastewater utilities

4: Team Qualifications

The project team has over 150 years of combined experience in wastewater treatment, biosolids processing, consulting engineering, academics and technical design/equipment. Team members include PCRWRD, the University of Arizona (UA), Greeley and Hansen. Key project members and their roles follow:

Dr. Jing Luo, PE serves as PI of this project. Dr. Luo is the manager of PCRWRD's Sustainability and Energy Management Office (SEMO). She leads the Department's Resource Recovery, Energy Management, and Research and Technology programs providing technical guidance for the operations of Pima County's two regional wastewater reclamation facilities and seven smaller sub-regional facilities with combined treatment capacity of 95mgd. She has over 15 years of active experience in wastewater nutrient removal processes, biosolids treatment and biogas utilization. Dr. Luo has successfully delivered over \$30 million worth of wastewater treatment projects. She is actively participating in numerous focus groups through the WERF LIFT program.

Dr. Dimitrios Katehis, PE serves as Co-PI of this project. Dr. Katehis is the Director for Process Engineering at Greeley and Hansen. He has served as technical Director for NYC's Applied Research

Program overseeing \$7M in nutrient removal research including the development of side-stream nitrification/denitrification with bio-augmentation technology in 2000-2004, and glycerin based denitrification/denitrification in 2009-2011. Dr. Katehis has led WERF Optimization Challenge efforts and has participated in other WERF research including the GHG emission measurement and characterization program. He is currently a Co-PI on WERF U-412 "Stabilization of Nitrification".

Dr. Robert Arnold serves as the Co-PI of this project. Dr. Arnold is a professor of Chemical and Environmental Engineering at the University of Arizona. He is experienced in water chemistry and wastewater microbiology with over 25 years in water and wastewater research. His research focus include advanced oxidation chemistry, physical-chemical treatment of hazardous substances, algal production for biofuel conversion, reductive dechlorination of heavily chlorinated organics, contaminants of emerging concern and beneficial utilization of digester gas.

Mr. Michael Gritzuk, PE serves as Project Manager of this project. He is a professional engineer in the State of Arizona as well as five other states. Mr. Gritzuk was Director of PCRWRD from 2005-2011. He had senior executive responsibility for managing all activities of the department which serves a population of approximately a million. Major areas of concentration were to implement a capital improvement program exceeding \$1.0 Billion, manage infrastructure rehabilitation and replacement projects, and fiscal management. Prior to PCRWRD, he served as the Director of the City of Phoenix's Water Services Department for 17 years, where he managed regional water and wastewater facilities and transmission and conveyance lines in a 520 square mile area. The regional wastewater treatment system served approximately 2.5 million residents in five cities. The wastewater treatment plants had a combined capacity of 250 million gallons a day.

Other project team members and their responsibilities in this project are listed in **Figure 4**.

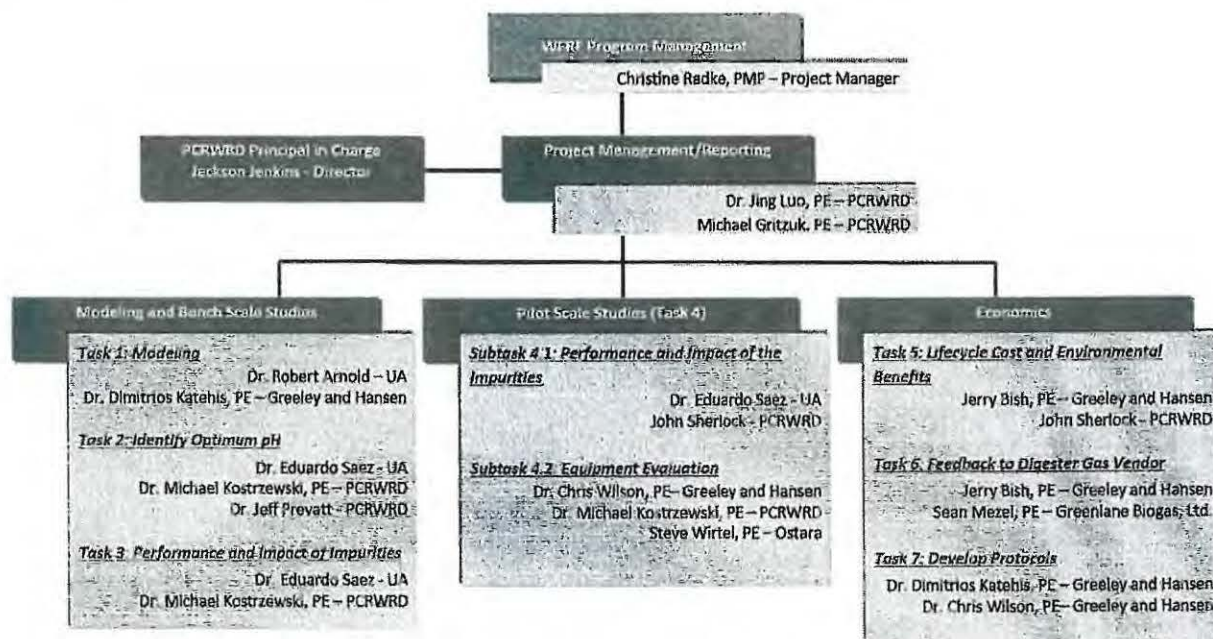


Figure 4: Project Team

NTRY9T15 Total Budget

See "Instructions" Worksheet

PERSONNEL (Applicant Organization Only)

| Name | Role | Annual Salary | % time | Salary Requested | Fringe Benefits | Total Cost | Other Funds | In-Kind | WERF Cost |
|--------------------|------------------|---------------|--------|------------------|-----------------|------------|-------------|---------|-----------|
| Jing Luo | PI | 77000 | 10% | 7700 | 2541 | 10241 | | 10241 | |
| Michael Gritzuk | Project Manager | 150000 | 2% | 3000 | 990 | 3990 | | 3990 | |
| Michael Kostrewski | Project Support | 95000 | 20% | 19000 | 6270 | 25270 | | 25270 | |
| Jeff Prevatt | Project Support | 95000 | 2% | 1900 | 627 | 2527 | | 2527 | |
| John Sherlock | Project Support | 120000 | 2% | 2400 | 792 | 3192 | | 3192 | |
| TBD | Project Engineer | 55000 | 100% | 55000 | 18150 | 73150 | | 73150 | |
| | | | | | | 0 | | | |
| Subtotal | | | | | | 118370 | 0 | 118370 | 0 |

OTHER DIRECT COSTS

| | Total Cost | Other Funds | In-Kind | WERF Cost |
|----------------------------------------------------------------------|------------|-------------|---------|-----------|
| EQUIPMENT (Use additional pages for itemization if necessary) | | | | |
| Equipment and materials to build bench scale reactor | 29000 | | | 29000 |
| Construction of pilot scale reactor | 58000 | | 29000 | 29000 |
| Subtotal | 87000 | 0 | 29000 | 58000 |

SUPPLIES (Use additional sheets if necessary)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| | 0 | | | |
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

TRAVEL

| | | | | |
|-------------|-------|---|---|-------|
| Domestic: | 10000 | | | 10000 |
| Foreign: | 0 | | | |
| Conference: | 0 | | | |
| Subtotal | 10000 | 0 | 0 | 10000 |

SUBCONTRACTS

| | | | | |
|-----------------------|--------|--------|-------|-------|
| University of Arizona | 109286 | 40978 | 62308 | 6000 |
| Greeley and Hansen | 167460 | 124768 | 36692 | 6000 |
| | 0 | | | |
| Subtotal | 276746 | 165746 | 99000 | 12000 |

DISADVANTAGED BUSINESSES (If none, steps taken by proposer must be described for justification to be accepted)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

Other Costs (Itemize)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

TOTAL DIRECT COSTS:

| | | | | | |
|----------------------|--------------------------------------|--------|--------|--------|-------|
| INDIRECT COSTS: | % (See instructions for calculation) | 492116 | 165746 | 246370 | 80000 |
| FEE (if applicable): | % x (Personnel + Indirect Cost) | | | | |
| Total Cost | | 492116 | 165746 | 246370 | 80000 |

Deliverables/

| Milestones | Duration in Months | Total Cost | Other Funds | In-Kind | WERF Cost |
|--------------------------------------------|--------------------|------------|-------------|---------|-----------|
| Milestone 1 | | 0 | | | |
| Milestone 2 | | 0 | | | |
| Milestone 3 | | 0 | | | |
| Milestone 4 | | 0 | | | |
| Additional milestones (add rows as needed) | | 0 | | | |
| Milestone __ - Final | | 0 | | | |
| Total Cost | | 0 | 0 | 0 | 0 |

NTRY9T15 Budget Year 1

See "Instructions" Worksheet

PERSONNEL (Applicant Organization Only)

| Name | Role | Annual Salary | % time | Salary Requested | Fringe Benefits | Total Cost | Other Funds | In-Kind | WERF Cost |
|--------------------|------------------|---------------|--------|------------------|-----------------|------------|-------------|---------|-----------|
| Jing Luo | PI | 77000 | 5% | 3850 | 1271 | 5121 | | 5121 | |
| Michael Gritzuk | Project Manager | 150000 | 1% | 1500 | 495 | 1995 | | 1995 | |
| Michael Kostrewski | Project Support | 95000 | 10% | 9500 | 3135 | 12635 | | 12635 | |
| Jeff Prevatt | Project Support | 95000 | 1% | 950 | 314 | 1264 | | 1264 | |
| John Sherlock | Project Support | 120000 | 1% | 1200 | 396 | 1596 | | 1596 | |
| TBD | Project Engineer | 55000 | 50% | 27500 | 9075 | 36575 | | 36575 | |
| Subtotal | | | | | | 59185 | 0 | 59185 | 0 |

OTHER DIRECT COSTS

| | Total Cost | Other Funds | In-Kind | WERF Cost |
|----------------------------------------------------------------------|------------|-------------|---------|-----------|
| EQUIPMENT (Use additional pages for itemization if necessary) | | | | |
| Equipment and materials to build bench scale reactor | 29000 | | 0 | 29000 |
| Subtotal | 29000 | 0 | 0 | 29000 |

SUPPLIES (Use additional sheets if necessary)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| | 0 | | | |
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

TRAVEL

| | | | | |
|-------------|------|---|---|------|
| Domestic: | 5000 | | | 5000 |
| Foreign: | 0 | | | |
| Conference: | 0 | | | |
| Subtotal | 5000 | 0 | 0 | 5000 |

SUBCONTRACTS

| | | | | |
|-----------------------|--------|-------|-------|------|
| University of Arizona | 60489 | 20489 | 37000 | 3000 |
| Greeley and Hansen | 87384 | 62384 | 22000 | 3000 |
| | 0 | | | |
| Subtotal | 147873 | 82873 | 59000 | 6000 |

DISADVANTAGED BUSINESSES (If none, steps taken by proposer must be described for justification to be accepted.)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

Other Costs (Itemize)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

TOTAL DIRECT COSTS:

| | | | | | |
|----------------------|--------------------------------------|--------|-------|--------|-------|
| INDIRECT COSTS: | % (See instructions for calculation) | 241058 | 82873 | 118185 | 40000 |
| FEE (if applicable): | % x (Personnel + Indirect Cost) | | | | |
| Total Cost | | 241058 | 82873 | 118185 | 40000 |

Deliverables/

| Milestones | Duration in Months | Total Cost | Other Funds | In-Kind | WERF Cost |
|--------------------------------------------|--------------------|------------|-------------|---------|-----------|
| Milestone 1 | | 0 | | | |
| Milestone 2 | | 0 | | | |
| Milestone 3 | | 0 | | | |
| Milestone 4 | | 0 | | | |
| Additional milestones (add rows as needed) | | 0 | | | |
| Milestone ___ - Final | | 0 | | | |
| Total Cost | | 0 | 0 | 0 | 0 |

NTRY9T15 Budget Year 2

See "Instructions" Worksheet

PERSONNEL (Applicant Organization Only)

| Name | Role | Annual Salary | % time | Salary Requested | Fringe Benefits | Total Cost | Other Funds | In-Kind | WERF Cost |
|--------------------|------------------|---------------|--------|------------------|-----------------|------------|-------------|---------|-----------|
| Jing Luo | PI | 77000 | 5% | 3850 | 1271 | 5121 | | 5121 | |
| Michael Gritzuk | Project Manager | 150000 | 1% | 1500 | 495 | 1995 | | 1995 | |
| Michael Kostrewski | Project Support | 95000 | 10% | 9500 | 3135 | 12635 | | 12635 | |
| Jeff Prevatt | Project Support | 95000 | 1% | 950 | 314 | 1264 | | 1264 | |
| John Sherlock | Project Support | 120000 | 1% | 1200 | 396 | 1596 | | 1596 | |
| TBD | Project Engineer | 55000 | 50% | 27500 | 9075 | 36575 | | 36575 | |
| | | | | | | 0 | | | |
| Subtotal | | | | | | 59185 | 0 | 59185 | 0 |

OTHER DIRECT COSTS

| | Total Cost | Other Funds | In-Kind | WERF Cost |
|----------------------------------------------------------------------|------------|-------------|---------|-----------|
| EQUIPMENT (Use additional pages for itemization if necessary) | | | | |
| Construction of pilot scale reactor | 58000 | | 29000 | 29000 |
| | 0 | | | |
| Subtotal | 58000 | 0 | 29000 | 29000 |

SUPPLIES (Use additional sheets if necessary)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| | 0 | | | |
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

TRAVEL

| | | | | |
|-------------|------|---|---|------|
| Domestic: | 5000 | | 0 | 5000 |
| Foreign: | 0 | | | |
| Conference: | 0 | | | |
| Subtotal | 5000 | 0 | 0 | 5000 |

SUBCONTRACTS

| | | | | |
|-----------------------|--------|-------|-------|------|
| University of Arizona | 48797 | 20489 | 25308 | 3000 |
| Greeley and Hansen | 80076 | 62384 | 14692 | 3000 |
| | 0 | | | |
| Subtotal | 128873 | 82873 | 40000 | 6000 |

DISADVANTAGED BUSINESSES (If none, steps taken by proposer must be described for justification to be accepted.)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

Other Costs (Itemize)

| | | | | |
|----------|---|---|---|---|
| | 0 | | | |
| Subtotal | 0 | 0 | 0 | 0 |

TOTAL DIRECT COSTS:

| | | | | | |
|----------------------|--------------------------------------|--------|-------|--------|-------|
| INDIRECT COSTS: | % (See instructions for calculation) | 251058 | 82873 | 128185 | 40000 |
| FEE (if applicable): | % x (Personnel + Indirect Cost) | | | | |
| Total Cost | | 251058 | 82873 | 128185 | 40000 |

Deliverables/

| Milestones | Duration in Months | Total Cost | Other Funds | In-Kind | WERF Cost |
|--------------------------------------------|--------------------|------------|-------------|---------|-----------|
| Milestone 1 | | 0 | | | |
| Milestone 2 | | 0 | | | |
| Milestone 3 | | 0 | | | |
| Milestone 4 | | 0 | | | |
| Additional milestones (add rows as needed) | | 0 | | | |
| Milestone ___ - Final | | 0 | | | |
| Total Cost | | 0 | 0 | 0 | 0 |

ATTACHMENT C

Project #

Invoice Date:

Invoice Number:

Dates Billed: (from - to)

[illegible]**OBE Expenditures ***

Notes: This invoice must be filled out completely before WERF will reimburse your current request for payment.

ATTACHMENT D

SCHEDULE OF DELIVERABLES AND MILESTONES

| DELIVERABLE / MILESTONE | DUE DATE |
|------------------------------------------------------------------------------------|---------------------------------------------------|
| Project Kick-Off Meeting | June 30, 2015 |
| Quality Assurance Project Plan (QAPP) | July 1, 2015 |
| PHASE 1 | |
| Interim Report #1 (Objective 1 - Tasks 2 and 3) | January 1, 2016 |
| Project Update Presentation #1 (Objectives 1 and 2 - Tasks 2, 3, and 4) | April 1, 2016 (conference or webinar) |
| Interim Report #2 (Objectives 2 and 3 - Tasks 4 and 5) | July 1, 2016 |
| Project Update Presentation #2 (Objectives 2, 3, and 4 - Task 5) | January 1, 2017 (conference or webinar) |
| Draft Final Report (Objectives 1, 2, 3, and 4 - Tasks 2, 3, 4, 5, and 6) | March 1, 2017 |
| Final Report (Objectives 1, 2, 3, and 4 - Tasks 2, 3, 4, 5, and 6) | April 1, 2017 |