

INTERGOVERNMENTAL AGREEMENT COST REIMBURSABLE

ASU Reference No.
Sponsor Reference No.

FP00016978
CP0870

THIS INTERGOVERNMENTAL AGREEMENT ("Agreement") is made and entered into by and between:

The City of Mesa, an incorporated municipality in the state of Arizona ("Sponsor"), and the Arizona Board of Regents for and on behalf of Arizona State University ("ASU"), an institution of higher learning established by the laws of the State of Arizona, having a place of business at 660 S. Mill Ave., Tempe, AZ 85281. Sponsor and ASU may be individually referred to in this Agreement as "Party" or collectively as "Parties."

WHEREAS, Sponsor desires to fund research to be performed by ASU, as described in the scope of work attached hereto and incorporated herein as Exhibit A (the "Project"), and ASU desires to conduct such work, the Project contemplated by this Agreement is of mutual interest to Sponsor and ASU and furthers the educational, scholarship and research objectives of ASU as a tax-exempt, educational institution.

WHEREAS, the Parties are authorized to enter into this Agreement with one another pursuant to Arizona Revised Statutes ("A.R.S.") § 11-952 and other statutes.

WHEREAS, The Arizona Board of Regents (ABOR) is authorized to enter into agreements by the Arizona legislature (A.R.S. § 15-1625.B).

NOW, THEREFORE, in reliance on the commitments and obligations set forth herein, and with the intention of being legally bound hereby, the Parties agree as follows:

EFFECTIVE DATE. This Agreement will be effective as of the date of the last signature below.

SCOPE OF WORK. ASU will perform the services and deliver any reports or other items specified in **Exhibit A** for the Project.

KEY PERSONNEL. ASU will provide Dr. Bruce Rittmann, as Principal Investigator ("PI") for the Project and work contemplated and performed under this Agreement.

PERIOD OF PERFORMANCE. This Agreement will begin on October 1, 2018 and will terminate on September 30, 2019. This Agreement may be modified or extended at any time by mutual written consent of both Parties.

COMPENSATION. Compensation will be on a cost reimbursable basis. Sponsor will reimburse ASU in an amount not to exceed \$113,775 for ASU's services on the Project hereunder. Sponsor will remit not less than twenty five percent (25%) of the total contract price upon execution by both Parties of this Agreement, which ASU may hold as a reserve. Sponsor acknowledges and agrees that ASU is not obligated to commence

work until ASU has received this initial payment in the amount of \$28,444. The balance of the contract price due under this Agreement will be paid upon receipt of invoices from ASU issued monthly for the duration of the period of performance up to the contract value less the reserve. Invoices are due and payable within 30 days. Notwithstanding the preceding, the Sponsor may hold twenty five percent (25%) of the total contract price pending its receipt of all completed deliverables under Exhibit A.

ASU reserves the right to subject invoices not paid within thirty (30) days of the invoice date to a 1% per month late fee on the unpaid balance for any amounts not in dispute. ASU reserves the right to discontinue the services if Sponsor fails to make payments within 30 days of receipt of invoice.

In the event of non-payment, ASU may terminate all further work on the Project and seek full payment from the Sponsor for all work performed and all expenses incurred including allocable costs, pursuant to the termination clause of this Agreement including the collection of payment.

Please send checks or paper remittance advices to:

Office for Research & Sponsored Projects Administration
Arizona State University
PO Box 876011
Tempe, AZ 85287-6011

For overnight courier, please send to:

Office for Research & Sponsored Projects Administration
Arizona State University
Centerpoint, Suite 310
660 S. Mill Avenue
Tempe, AZ 85281

Wire transfers should be sent to:

Account #:	235335739
ACH (Within USA only) Routing#:	122101706
Routing # (if international):	0260-0959-3
Swift Code:	BOFAUS3N
Bank Name:	Bank of America
Acct Name:	Arizona State University Federal Depository Account

Questions regarding payment should be directed to the person issuing the invoice or to cashmanagement@asu.edu.

Invoices will be mailed to the Sponsor Financial Contact at the following address:

Department: Environmental Management and Sustainability Department
Attention: Niel Curley
Address: P.O. Box 1466, Mesa, AZ 85211-1466
Phone: 480-644-2625
Email: niel.curley@mesaaz.gov

PUBLICATIONS. Sponsor recognizes that under ASU policy the results of work performed under this Agreement must be publishable and agrees that ASU and its employees and students engaged in work under this Agreement will be free to present at symposia or professional meetings, and to publish in journals, theses or dissertations, or otherwise of their own choosing, methods and results of the work performed under this Agreement. Upon written request by Sponsor, copies of proposed manuscripts will be furnished to Sponsor for review prior to publication. In no event will ASU delay publication for more than thirty (30) days from date of submittal of manuscript for Sponsor review.

NOTICES. All official notices, by either party, required or permitted under this Agreement will be in writing and will be given by personal delivery against receipt (including private courier such as FedEx), email with "Read Receipt" or certified U.S. Mail, return receipt requested. All notices will be sent to the addresses below or such other addresses as the parties may specify in the same manner. Notices will be deemed to have been given and received on the date of actual receipt or on the date receipt was refused. Courtesy email copy of any notice is requested to be sent to the PI. Addresses are as follows:

For ASU: Office for Research & Sponsored Projects Administration
Arizona State University
P.O. Box 876011
Tempe, Arizona 85287-6011
e-mail: asu.awards@asu.edu
cc: rittmann@asu.edu

For Sponsor: Environmental Management and Sustainability Department
Niel Curley
P.O. Box 1466, Mesa, AZ 85211-1466
480-644-2625
niel.curley@mesaaz.gov

With copy to: Environmental Management and Sustainability Department
Scott Bouchie
P.O. Box 1466, Mesa, AZ 85211-1466
480-644-4366
scott.bouchie@mesaaz.gov

ENTIRE AGREEMENT; AMENDMENTS; COUNTERPARTS. This Agreement constitutes the entire understanding between the Parties relating to the subject matter hereof, and

supersedes any other agreement or understanding between the Parties with respect to the subject matter of this Agreement. No amendment or modification to this Agreement will be valid or binding upon the Parties unless made in writing and signed by each Party. This Agreement may be executed in counterparts, each of which will be deemed an original. Electronically transmitted and imaged copy signatures will be fully binding and effective for all purposes. The Parties agree that should any part of this Agreement be held to be invalid or void, the remainder of the Agreement will remain in full force and effect and will be binding upon the Parties.

WAIVERS. No waiver of this Agreement will be valid or binding unless written and signed by the Parties. Waiver by either Party of any breach or default of any clause of this Agreement by the other Party will not operate as a waiver of any previous or future default or breach of the same or different clause of this Agreement.

ASSIGNMENT. Neither Party may transfer or assign this Agreement or any of its rights or obligations hereunder, directly or indirectly, or by operation of law, without the other party's prior written consent, and any attempt to the contrary will be void.

GOVERNING LAW AND VENUE. This Agreement will be governed by the laws of the State of Arizona without regard to any conflicts of laws principles. ASU's obligations are subject to the regulations/policies of the Arizona Board of Regents. Any proceeding arising out of or relating to this Agreement will be conducted in Maricopa County, Arizona. Each Party consents to such jurisdiction, and waives any objection it may have to venue or convenience of forum.

FAILURE TO APPROPRIATE. In accordance with A.R.S. § 35-154, if ASU's performance under this Agreement depends on the appropriation of funds by the Arizona Legislature, and if the Legislature fails to appropriate the funds necessary for performance, then ASU may provide written notice of this to Sponsor and cancel this Agreement without further obligation of ASU. Appropriation is a legislative act and is beyond the control of ASU. Sponsor's expenditures, debts, obligations and liabilities are also limited to budgeted purposes in accordance with Arizona law, including the Arizona State Constitution and A.R.S. § 42-17106.

CONFLICT OF INTEREST. If within three (3) years after the execution of this Agreement, a Party hires as an employee or agent any representative of the other Party who was significantly involved in negotiating, securing, drafting, or creating this Agreement, then the other Party may cancel this Agreement as provided in A.R.S. § 38-511.

INDEPENDENT CONTRACTOR. ASU is an independent contractor and will be free to exercise its discretion and independent judgment as to the method and means of performance of its work hereunder. ASU employees will not be considered employees of Sponsor, and neither ASU nor Sponsor personnel will, by virtue of this Agreement, be entitled or eligible, to participate in any benefits or privileges given or extended by the other Party to its employees.

TERMINATION. Either Party may at any time terminate this Agreement by giving the other Party not less than thirty (30) days prior written notice. In the event this Agreement is canceled by Sponsor, Sponsor will remain responsible for payment to ASU for all work performed through the date of termination and for reimbursement to ASU of all non-cancelable commitments incurred in the conduct of the research. Non-cancelable commitments will include employment commitments to ASU personnel through the end of the semester following any such termination by Sponsor. In the event ASU terminates this Agreement any unused funds from the advance will be returned.

DISPUTE RESOLUTION. In the event of any dispute, claim, question, or disagreement arising from or relating to this Agreement or the breach thereof, the Parties hereto will use their reasonable efforts to settle the dispute, claim, question, or disagreement. To this effect, they will consult and negotiate with each other in good faith and, recognizing their mutual interests, attempt to reach a just and equitable solution satisfactory to both Parties. Further, pursuant to A.R.S. §12-1518, the Parties acknowledge and agree that they will be required to make use of mandatory arbitration of any legal action that is filed in the Arizona superior court concerning a controversy arising out of this Agreement if required by A.R.S. §12-133.

INSURANCE. ASU maintains general liability insurance and worker's compensation coverage as required by state law and pertinent federal laws and regulations under the State of Arizona Risk Management Plan.

NONDISCRIMINATION. The Parties agree to comply with all applicable state and federal laws, rules, regulations and executive orders governing equal employment opportunity, immigration and nondiscrimination, including the Americans with Disabilities Act. **If applicable, the Parties will abide by the requirements of 41 CFR §§ 60-1.4(a), 60-300.5(a) and 60-741.5(a). These regulations prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities, and prohibit discrimination against all individuals based on their race, color, religion, sex, or national origin. These regulations require that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, national origin, protected veteran status or disability.**

ADVERTISING, PUBLICITY, NAMES AND MARKS. A Party will not do any of the following, without, in each case, obtaining the other Party's prior written consent: (i) use any names, service marks, trademarks, trade names, logos, or other identifying names, domain names, or identifying marks of the other Party (Other Party's Marks), including online, advertising, or promotional purposes; (ii) issue a press release or public statement regarding this Agreement, except for documents used for internal consumption; or (iii) represent or imply any endorsement or support of any product or service in any public or private communication. Any permitted use of the Other Party's Marks must comply with the other Party's requirements, including using the ® indication of a registered mark.

ORDER OF PRECEDENCE . In the event of a conflict between the terms and conditions set forth in the body of this Agreement and any attachment hereto, the conflict will be

resolved by giving precedence in the following order: (i) the terms and conditions set forth in this Agreement and (ii) Exhibit A, Statement of Work. If any inconsistency exists, Sponsor will be responsible for notifying asu.awards@asu.edu.

****SIGNATURE PAGE FOLLOWS****

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed by their duly authorized representatives on the respective dates entered below.

**ARIZONA BOARD OF REGENTS,
FOR AND ON BEHALF OF
ARIZONA STATE UNIVERSITY**

CITY OF MESA

By: _____



By: _____

Name: Heather Clark

Name: _____

Title: Executive Director

Title: _____

Date: 9/5/18

Date: _____

IGA DETERMINATION - ASU

This IGA, which is an agreement between public agencies, has been reviewed pursuant to A.R.S. §11-952 by the undersigned, who has determined that it is in the proper form and is within the power and authority granted under the laws of the State of Arizona to those parties to the Agreement represented by Legal Counsel for Arizona State University.

APPROVED AS TO FORM:

 Associate General Counsel

Office of General Counsel for Arizona State University

IGA DETERMINATION - SPONSOR

This IGA, which is an agreement between public agencies, has been reviewed pursuant to A.R.S. §11-952 by the undersigned, who has determined that it is in the proper form and is within the power and authority granted under the laws of the State of Arizona to those parties to the Agreement represented by the Sponsor's Attorney.

APPROVED AS TO FORM:

Sponsor's Attorney

EXHIBIT A

Scope of Work and Budget

Background

The City of Mesa is contemplating collecting food waste from commercial establishments and feeding it to its anaerobic-digester systems at the Northwest Wastewater Reclamation Plant (NWWRP). The City will be contracting with an engineering consultant, Arcadis, to conduct a feasibility study that will evaluate the technical, operational, and financial feasibility of a food to energy program. Arcadis will be the lead agency in the feasibility study and will work directly with BSCEB on the experimental study through data sharing and update meetings. The Biodesign Swette Center for Environmental Biotechnology (BSCEB) will conduct one portion of the feasibility study to evaluate the potential benefits and risks of adding food waste to its digesters through an experimental study. The primary benefits are extra methane production from the digesters and reduced solid-waste flow to the landfill. The possible risks include upset of digester operation, more biosolids generation post digestion, and more N and P return to wastewater-treatment.

This scope of work lays out an experimental plan to evaluate the impact of food waste. BSCEB has extensive experience doing research on anaerobic digestion, and the plan builds directly on that foundation. The plan involves operation of bench-scale anaerobic digesters, comprehensive sampling of the parameters affected by addition of food waste, and interpretation of the results in terms of potential benefits and risks. The plan is for a one-year project that will culminate in a comprehensive final report.

Experimental Program

Three bench-scale anaerobic digesters will be operated in the semi-continuous mode. The reactor liquid volume will be ~ 1.5 L, and the gas headspace will be ~ 0.5 L. The reactors will be fabricated with gas and liquid sampling ports and a feeding / withdrawal port. The reactors will be well mixed and held at a temperature of 37°C.

The reactors will be inoculated with 1.5 L of anaerobic digester sludge and fed a relevant mixture of blended food waste (collected by the City) and thickened sludge (from the Mesa Northwest Water Reclamation Plant –NWWRP-- either from the holding tank or thickeners prior to the anaerobic digester) on a semi-continuous basis that establishes an average solids retention time (SRT) that is appropriate for the mixture. For example, if the SRT for primary + waste activated sludge is 25 days, the SRT will decrease in proportion to the extra volume present in the added food waste. Solids withdrawal and addition of an equal volume of feed material will occur every second or third day. Liquid samples will be taken from the withdrawn liquor, as well as the feed material at that time. Gas volume will be measured daily, and gas samples will be taken for composition analysis at the same time as liquid samples are taken. BSCEB will require approximately 5 L of anaerobic digester sludge supplied by Mesa

NWWRP at the project onset for reactor inoculation. For semi-continuous feedings, BSCEB will require 1 L of thickened sludge three times per week supplied by Mesa NWWRP and, once food waste treatment commences, 1 gallon (or 2 lbs) of food waste two times per week. BSCEB will coordinate food waste delivery once per week from ASU's cafeteria. The City will collect and provide all sludge samples to the post-Doctoral Associate assigned to the project. Samples will be provided weekly in the front lobby of the plant. All food waste samples will be delivered directly to the BSCEB Lab.

Influent samples to the digesters will be tested for pH (by probe), total alkalinity (by titration after filtration), volatile fatty acids (by liquid chromatography after filtration), total and volatile suspended solids (in lieu of total solids and volatile solids), lipids, proteins, carbohydrates, total and soluble COD (by Hach kit), total Kjeldahl- and NH_4^+ -nitrogen (by Hach kit), sulfate (by ion chromatography), and total and soluble phosphorus (by Hach kit).

Total gas production will be measured every one to two days, and gas samples will be routinely assayed for methane (CH_4), carbon dioxide (CO_2), hydrogen sulfide (H_2S), hydrogen (H_2), and nitrogen (N_2) using gas chromatography. At the end of each experimental phase, the gas also will be analyzed for siloxane.

Liquid samples will be assayed for a battery of components that provide complementary information on process performance. All samples will be measured immediately for pH (by probe), total alkalinity (by titration after filtration), and volatile fatty acids (by gas chromatography after filtration), and the bicarbonate alkalinity will be computed from those measurements. On a weekly basis, liquid samples will be assayed for total and soluble COD (by Hach kit), total Kjeldahl- and NH_4^+ -nitrogen (by Hach kit) and sulfate (by ion chromatography). At the end of each experimental phase, liquid samples will be analyzed for total and soluble phosphorus (by Hach kits), total sulfide, and siloxane.

Also at the end of each experimental period, biomass samples will be analyzed for total suspended solids and volatile suspended solids, total and fecal coliforms, lipids, proteins, and carbohydrates, and DNA will be extracted and used to assess the bacterial and archaeal communities by Illumina high-throughput sequencing.

Schedule

The twelve-month food waste program will follow this schedule:

Month 1:	Assemble the digesters and put on-line all analytical methods.
Months 2 thru 4:	Operate the three digesters with only primary + waste activated sludge at an SRT of 25 days. This will establish stable baseline operation without food waste.
Months 5 thru 7:	Operate one digester as a control (i.e., fed only primary + waste activated sludge) and two digesters with the same

ratio of food waste to primary + waste activated sludge. The ratio will be determined by an analysis of expected food-waste generation in Mesa. The SRT will decline a modest amount due to the added volume from the food waste. The City of Mesa will provide information on the generation rate of primary + waste activated sludge and the expected collection rate of food waste.

Months 8 thru 11: Operate one digester with a different food-waste loading rate, while the other digester maintains the original loading rate to be a control. The new loading rate will be higher or lower to reflect seasonal variations in food-waste collection. In addition, the "optimal" feeding conditions (based on analysis of results up to this time) will be operated for an additional month versus the original loading rate to evaluate long term performance of the "optimized" reactor.

Month 12: Complete in-depth analysis of all results and prepare a final report. The final report will: (1) document methods and experimental results; (2) evaluate the potential for increased gas production and reduced solid- waste flow to the landfill; (3) evaluate potential problems, such as impacts to volatile solids reduction, increased N and P flow to wastewater treatment, the possibility of digester upset, and the generation of hydrogen sulfide; and (4) identify an optimized operating strategy for co-digestion of food waste.

BSCEB's project team will maintain regular communication with the City and its engineering consultant, Arcadis, through:

- Bi-weekly meetings
- Monthly written progress reports with required data sent to both City and the engineering consultant Arcadis
- Monthly progress meetings with the City and Arcadis based on the progress reports

Required Data to be shared with the City and Arcadis:

- Composition of the anticipated food waste feedstock.:
 - Percent Total Solids or Total Suspended Solids
 - COD
 - Percent VS or Volatile Suspended Solids
 - pH
 - Proteins/Lipids/Carbohydrates fraction

- Description of waste quality and contamination levels
- Description of pre-processing steps (if any) prior to injection into bench scale digester
- Bench scale digester parameters to be tracked before and after feedstock addition for each combination evaluated (control, food waste):
 - Detailed description of sludge, food waste, and FOG feeding regimens, both for volumes and time frequencies
 - SRT
 - Digester pH and alkalinity
 - Volatile fatty acids (VFA)/Alkalinity ratio
 - Percent Total solids concentration/load in influent and digestate
 - Percent Volatile solids concentration/load in influent and digestate
 - Volatile Solids Reduction (VSR)
 - Total and soluble COD concentration/load in influent and digestate
 - Ammonia nitrogen (NH₃-N) concentration/load in digestate
 - Total Kjeldahl nitrogen (TKN) concentration/load in digestate
 - Ortho-P and Total P concentration/load in digestate
 - Description of any process upsets observed
- Biogas production:
 - Specific and overall biogas production rates
 - Biogas composition (CH₄ and H₂S content in particular)

Personnel and Budget Estimate

Dr. Bruce Rittmann will be the project's principal investigator. He will supervise the laboratory staff, communicate with the City, and ensure quality control over all aspects of the work.

The experimental work will be carried out by a full-time Post-doctoral Associate (Michelle Young) who has experience with anaerobic-process research. The Post-doc will be assisted by two undergraduate students. Benefits are included for the PI at 27.3%, the postdoc at a rate of 25.10%, and for the students at 2.10% for FY19.

Non-personnel costs will include materials, supplies, and services to carry out the experiments and analyses.

Project Costs	
Food Waste Bench-Scale Testing	
Personnel, including benefits	\$90,107
Materials, Supplies, and Services	\$18,250
Total Direct Costs (sub-total)	\$108,357
Indirect Costs (Based on City of Mesa CIP Overhead Rate)	\$5,418
Food Waste Bench-Scale Testing Total	\$113,775

