

PMC-ND

(1.08.09.13)

**U.S. DEPARTMENT OF ENERGY
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
NEPA DETERMINATION**

**RECIPIENT:** Worcester Polytechnic Institute**STATE:** MA**PROJECT TITLE:** Harvesting Energy from Wastewater by Converting Sewage Sludge to Renewable Natural Gas

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0002336	DE-EE0009507	GFO-0009507-001	GO9507

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Policy 451.1), I have made the following determination:

CX, EA, EIS APPENDIX AND NUMBER:

Description:

A9 Information gathering, analysis, and dissemination Information gathering (including, but not limited to, literature surveys, inventories, site visits, and audits), data analysis (including, but not limited to, computer modeling), document preparation (including, but not limited to, conceptual design, feasibility studies, and analytical energy supply and demand studies), and information dissemination (including, but not limited to, document publication and distribution, and classroom training and informational programs), but not including site characterization or environmental monitoring. (See also B3.1 of appendix B to this subpart.)

B3.6 Small-scale research and development, laboratory operations, and pilot projects Siting, construction, modification, operation, and decommissioning of facilities for smallscale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to Worcester Polytechnic Institute (WPI) to recover the energy trapped in sewage sludge using an integrated hydrothermal liquefaction (HTL), supercritical salt precipitation (SCSP), and hydrothermal gasification (HTG) process, collectively referred to as supercritical-sludge-to-gas (SC-S2G). Project participants would design, develop, and test an auto-thermal hydrothermal liquefaction (AT-HTL) reactor system for the conversion of sewage sludge to bio-oil product. The project would be completed over two Budget Periods (BPs) with a Go/No-Go decision point between each BP. This NEPA determination is applicable to both BPs.

Small amounts (approximately 1-10 kg) of sewage sludge would be collected from wastewater treatment plants (WWTPs) in close proximity to WPI. These would be transported on ice or dry ice and either shipped or transported personally by project recipients. Studies would be conducted on these small samples to understand effects of sludge variability on performance. Larger amounts (more than 100 kg) would be collected from Great Lakes Water Authority (GLWA) in Detroit, MI and transported to WPI and PNNL using a dedicated delivery truck. These amounts would be used for larger scale continuous flow testing. Sewage sludge from all WWTPs would be obtained from regularly produced flow streams.

Bio-oil would be separated from the solids and aqueous phase products using AT-HTL. SCSP would be used to remove sulfates, nitrites, and phosphates from the AT-HTL product stream which would then be assessed as feedstock. The bio-oil would be converted to renewable methane using HTG technology.

AT-HTL, SCSP, and HTG processes would be evaluated at lab-scale using a range of sewage sludge feeds of varying compositions to identify performance characteristics. Machine learning models would be developed to reduce product variability. The processes would be designed to run continuously, scaled-up, and optimized to generate sufficient volumes of AT-HTL liquids for verification of downstream steps. During continuous testing, approximately 1000lbs of sludge would be processed. Technoeconomic analysis and technology-to-market analysis would be run throughout and would lead to the creation of a detailed commercialization plan for the SC-S2G process to treat wastewater.

Proposed project activities by location are listed below:

Worcester Polytechnic Institute – Worcester, MA

- Lab-scale testing.
- AT-HTL of sewage sludge in batch and flow reactors; bio-oil separations; removal of sulfites, nitrates, and phosphates from the AT-HTL product stream using SCSP; bio-oil and char characterization.
- Techno-economic analysis.

Pacific Northwest National Laboratory – Richland, WA

- Sourcing, pretreatment, and storage of sewage feedstocks.
- Pilot scale operation of the continuous AT-HTL, SCSP-HTG processes and implement configurational and safety modifications required to perform AT-HTL in continuous reactor system.

Syracuse University – Syracuse, NY

- Use lab scale flow reactors to perform gasification of bio-oil to renewable methane; solid catalysts would be synthesized and characterized for this process; gas products would be characterized using gas chromatography.

AICHE/RAPID Manufacturing Institute – New York, NY

- Technoeconomic analysis, lifecycle analysis, and technology-to-market analysis.

Existing pilot plant facilities at PNNL would be modified to accommodate AT-HTL, SCSP, and HTG reactors. No changes in the use, mission, or operation of existing facilities would be required as part of this project and no additional permits would be required in order to conduct any of the work activities.

Project activities would involve the use and handling of sewage sludge feedstocks, solvents, and toxic gases as well as work under high pressure and temperature. Any risks associated with the handling of these materials would be mitigated through adherence to established health and safety policies and procedures. Waste product collection would be safely coordinated with the production sites and transported within safety procedures and guidelines. Waste materials would be autoclaved to kill pathogens and stored in a freezer. Fume hoods and ventilation systems would be used to remove off-gases. Additional protocols would include personnel training, the use of personal protective equipment, internal assessments, engineering controls, and monitoring. All waste products would be disposed of by licensed waste management service providers. Worcester Polytechnic Institute and its project partners would observe all applicable Federal, state, and local health, safety, and environmental regulations.

Any work proposed to be conducted at a federal facility may be subject to additional NEPA review by the cognizant federal official and must meet the applicable health and safety requirements of the facility.

NEPA PROVISION

DOE has made a final NEPA determination.

Notes:

Advanced Manufacturing Office

This NEPA determination does not require a tailored NEPA provision.

Review completed by Shaina Aguilar on 7/13/21.

FOR CATEGORICAL EXCLUSION DETERMINATIONS

The proposed action (or the part of the proposal defined in the Rationale above) fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D. To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the

environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects of the proposal.

The proposed action has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

The proposed action is categorically excluded from further NEPA review.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature:  Electronically Signed By: Casey Strickland Date: 7/16/2021
NEPA Compliance Officer

FIELD OFFICE MANAGER DETERMINATION

- Field Office Manager review not required
- Field Office Manager review required

BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :

Field Office Manager's Signature: _____ Date: _____
Field Office Manager