



# U.S. Department of Energy

## Categorical Exclusion Determination Form

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Proposed Action Title: General Electric Research -- ULTIMATE (Ultrahigh Temperature Impervious Materials Advancing Turbine Efficiency) Refractory Alloy Innovations for Superior Efficiency (RAISE)

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): Niskayuna and Schenectady, NY; Greenville, SC; Dayton and Cleveland, OH; Santa Barbara, CA; Albany, OR

Proposed Action Description:

SECOND AMENDED NEPA DETERMINATION: (See attached original Determination, dated February 23, 2021 and the First Amended Determination dated March 25, 2021). This Second Amended Determination follows the approval of additional funds and an extended period of performance to support the project team's small-scale, research and development activities to continue refining their turbine blade alloy composition initially developed under the ULTIMATE program. If successful, the materials developed will be able to withstand the high temperatures in a natural gas turbine and the extreme stresses imposed on turbine blades, and increase gas turbine efficiency up to 7%.

Project activities will be conducted at existing facilities at General Electric (GE) Research (Niskayuna, NY), GE Gas Power (Schenectady, NY and Greenville, SC), Air Force Research Laboratory, UES (Dayton, OH), Case Western Reserve University (Cleveland, OH), University of California, Santa Barbara. (Santa Barbara, CA), ATI Specialty Alloys and Components (Albany, OR) designed for the proposed work. Project tasks continue to fit within the class of actions identified under the DOE Categorical Exclusion identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the project. This assessment was based on a review of the proposed scope of work and the potential environmental impact of the project. Project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and local regulatory requirements. No modifications will be made to the existing facilities to accommodate the proposed work.

Categorical Exclusion(s) Applied:

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

A9 - Information gathering, analysis, and dissemination

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of [10 CFR Part 1021](#).

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

The proposal 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 proposal that may affect the significance of the environmental effects of the proposal.

The proposal 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.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: **GEOFFREY GOODE** Digitally signed by GEOFFREY GOODE  
Date: 2023.03.20 11:54:24 -04'00'

Date Determined:



# U.S. Department of Energy Categorical Exclusion Determination Form

Submit by E-mail

Proposed Action Title: Ultrahigh Temperature Impervious Materials Advancing Turbine Efficiency (ULTIMATE & ULTIMATE SBIR/STTR) (FOA Nos. DE-FOA-0002337 & DE-FOA-0002338) Program

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Location(s) (City/County/State): AL; CA; CT; FL; IA; IL; IN; KY; MA; MD; MN; NE; NY; OH; OR; PA; RI; SC; TN; TX; UT; VA; WA; WI; WV

Proposed Action Description:

AMENDED PROGRAMMATIC NEPA DETERMINATION (See the attached original Programmatic Determination, dated February 23, 2021). This Amended Determination follows ARPA-E's receipt of required information and certifications from 11 additional Prime Recipients (See Attachment A in Bold) that were not covered under the original Programmatic Determination. The ULTIMATE Program is composed of 17 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This Amended Programmatic Determination along with the initial Programmatic Determination covers all 17 of the projects (See Attachment A). All 17 projects fit within the class of actions identified under the DOE Categorical Exclusions identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the projects. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements.

Categorical Exclusion(s) Applied:

- A9 - Information gathering, analysis, and dissemination
- B3.6 - Small-scale research and development, laboratory operations, and pilot projects
- B3.15 - Small-scale indoor research and development projects using nanoscale materials

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of [10 CFR Part 1021](#).

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

The proposal 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 proposal that may affect the significance of the environmental effects of the proposal.

The proposal 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.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: **GEOFFREY GOODE** Digitally signed by GEOFFREY GOODE  
Date: 2021.03.25 12:23:45 -04'00'

Date Determined:



# U.S. Department of Energy Categorical Exclusion Determination Form

Submit by E-mail

Proposed Action Title: Ultrahigh Temperature Impervious Materials Advancing Turbine Efficiency (ULTIMATE & ULTIMATE SBIR/STTR) (FOA Nos. DE-FOA-0002337 & DE-FOA-0002338) Program

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Location(s) (City/County/State): CA; CT; IN; KY; MN; NY; OH; OR; PA; SC; TN; UT; WA; WI

Proposed Action Description:

The ULTIMATE Program seeks to develop ultrahigh temperature materials for gas turbines, enabling them to operate continuously at 1300° C in stand-alone material tests, or 1800° C or higher with coatings. ULTIMATE teams will demonstrate proof of concept of alloy compositions, coatings, and manufacturing processes through modeling and lab testing. If successful, materials developed by ULTIMATE teams will be able to withstand the high temperatures in a turbine and the extreme stresses imposed on turbine blades, and potentially increase gas turbine efficiency up to 7%.

The ULTIMATE Program is composed of 17 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This Determination covers 6 of the 17 projects (listed in Attachment A). All 6 projects fit within the class of actions identified under the DOE Categorical Exclusion identified below and do not involve any extraordinary circumstances that may affect the significance of the environmental effects of the projects. This assessment was based on a review of the proposed scope of work and the potential environmental impacts of each project. All project tasks will be conducted in accordance with established safety and materials/waste management protocols and pursuant to applicable Federal, State, and Local regulatory requirements.

Categorical Exclusion(s) Applied:

A9 - Information gathering, analysis, and dissemination

B3.6 - Small-scale research and development, laboratory operations, and pilot projects

B3.15 - Small-scale indoor research and development projects using nanoscale materials

For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, including the full text of each categorical exclusion, see Subpart D of [10 CFR Part 1021](#).

Regulatory Requirements in 10 CFR 1021.410(b): (See full text in regulation)

The proposal 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 proposal that may affect the significance of the environmental effects of the proposal.

The proposal 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.

Based on my review of the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: **GEOFFREY GOODE** Digitally signed by GEOFFREY GOODE  
Date: 2021.02.23 09:18:13 -05'00'

Date Determined:

**Attachment A: Projects in the ULTIMATE (FOA No. DE-FOA-0002337) & ULTIMATE SBIR/STTR (FOA No. DE-FOA-0002338) Programs**

Full Application Control Number	Lead Organization	Project Title	Categorical Exclusion
2337-1501	General Electric Company, GE Research	ULTIMATE Refractory Alloy Innovations for Superior Efficiency (RAISE)	A9; B3.6
<b>2337-1503</b>	<b>Oak Ridge National Laboratory</b>	<b>Facility for Evaluating High Temperature Oxidation and Mechanical Properties</b>	<b>A9; B3.6</b>
2337-1506	Raytheon Technologies Research Center	ARPA-E ULTIMATE:ARPA-E: ULTIMATE Additive Manufactured OSD High Entropy Alloys (P.E00.0456)	A9;B3.6; B3.15
2337-1507	Raytheon Technologies Research Center	Environmental Protection Coating System for Refractory Metal Alloys (EPCS for RMA) (P.E00.0473)	A9;B3.6; B3.15
<b>2337-1512</b>	<b>University of Maryland College Park</b>	<b>New Environmental-Thermal Barrier Coatings for Ultrahigh Temperature Alloys</b>	<b>A9; B3.6</b>
<b>2337-1530</b>	<b>University of Virginia</b>	<b>High Entropy Rare earth Oxide (HERO) Coatings</b>	<b>A9; B3.6</b>
2337-1531	University of Utah	Designing Novel Multicomponent Niobium Alloys for High Temperature Integrated Design, Rapid Processing & Validation Approach	A9; B3.6
<b>2337-1535</b>	<b>Texas A&amp;M Engineering Experiment Station</b>	<b>Batch-wise Improvement in Reduced Design Space using a Holistic Optimization Technique (BIRDSHOT)</b>	<b>A9; B3.6</b>
<b>2337-1538</b>	<b>West Virginia University Research Corporation</b>	<b>High-Throughput Computational Guided Development of Refractory Complex Concentrated Alloys-based Composite</b>	<b>A9;B3.6; B3.15</b>
<b>2337-1564</b>	<b>The Boeing Company</b>	<b>Ultra-High-Performance Metallic Turbine Blades for Extreme Environments</b>	<b>A9;B3.6; B3.15</b>
2337-1568	National Energy Technology Laboratory	Rapid Design and Manufacturing of High-Performance Materials for Turbine Blades Applications above 1300 Celsius	A9; B3.6
<b>2337-1570</b>	<b>University of Wisconsin – Madison</b>	<b>Additive Manufacturing of Ultrahigh Temperature Refractory Metal Alloys</b>	<b>A9; B3.6</b>
<b>2337-1585</b>	<b>Oak Ridge National Laboratory</b>	<b>DEVELOPMENT OF NIOBIUM-BASED ALLOYS FOR TURBINE APPLICATIONS</b>	<b>A9;B3.6; B3.15</b>

**Attachment A: Projects in the ULTIMATE (FOA No. DE-FOA-0002337) & ULTIMATE SBIR/STTR (FOA No. DE-FOA-0002338) Programs**

2337-1590	Pacific Northwest National Laboratory	SELECTIVE THERMAL EMISSION COATINGS FOR IMPROVED TURBINE PERFORMANCE	A9; B3.6
2337-1601	Massachusetts Institute of Technology	Additive Manufacturing of Oxygen-Resistant Gradient Refractory Composites	A9;B3.6; B3.15
2337-1619	Pennsylvania State University	Design and Manufacturing of Ultrahigh Temperature Refractory Alloys	A9; B3.6
2338-1507	Questek Innovations LLC	Concurrent Design of a Multimaterial Niobium Alloy Systems for Next-generation Turbine Applications	A9; B3.6