



U.S. Department of Energy

Categorical Exclusion Determination Form

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Proposed Action Title: NK Labs, LLC -- Conditions for High-Yield Muon Catalyzed Fusion

Program or Field Office: Advanced Research Projects Agency - Energy

Location(s) (City/County/State): Cambridge, Massachusetts; Jamaica and Rochester, New York; Batavia, Illinois

Proposed Action Description:

FOURTH AMENDED NEPA DETERMINATION: (See attached original Determination, dated April 30, 2020, first amended Determination, dated June 16, 2020, second amended Determination, dated June 25, 2020, and third amended Determination, dated August 17, 2020.)

This Amended Determination follows the approval of two new project locations in Rochester, New York and Batavia, Illinois and additional funds to support the project team's small-scale, research and development activities to obtain new experimental data that would enable the design of novel muon-catalyzed fusion reactors. Specifically, the project team will complete previously disclosed project milestones for testing and development of a fusion energy system.

Project activities will be conducted at existing facilities at NK Labs, LLC (Cambridge, MA), City University of New York (Jamaica, NY), Laboratory for Laser Energetics, University of Rochester (Rochester, NY), and Fermilab (Batavia, IL). 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.

Categorical Exclusion(s) Applied:

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

A9 - Information gathering, analysis, and dissemination

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: 2022.11.16 11:45:52 -05'00'

Date Determined:



U.S. Department of Energy Categorical Exclusion Determination Form

Submit by E-mail

Proposed Action Title: The Breakthroughs Enabling Thermonuclear-fusion Energy (BETHE) (FOA No. DE-FOA-0002212) Program

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

Location(s) (City/County/State): AL; CA; MA; MD; MN; NJ; NM; NV; NY; PA; TN; TX; VA; WA; WI

Proposed Action Description:

THIRD AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original, First, and Second Amended Programmatic Determinations, dated April 30, 2020, June 16, 2020, June 25, 2020, respectively). The BETHE Program seeks to fund the development of timely, commercially viable, fusion energy. If successful, the Program will enable abundant, reliable, highly dispatchable fusion power and could help enable a cost-effective, global low-carbon energy economy.

The BETHE Program is composed of 16 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This Third Amended Determination adds 2 projects (University of Wisconsin-Madison & Type One Energy Group, Inc.) to the Determinations signed on April 30, 2020, June 16, 2020, and June 25, 2020 (see Attachment for all 16 projects covered by this and the prior Determinations). These projects are covered by and 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 impact of the projects. 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. No modifications will be made to the existing facilities to accommodate the proposed work

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: 2020.08.17 13:51:09 -05'00'

Date Determined:

Attachment A: Projects in the BETHE (FOA No. DE-FOA-0002212) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
University of Washington (2212-1525)	Demonstration of low-density, high-performance operation of sustained spheromaks and favorable scalability toward compact, low-cost fusion power plants	A9; B3.6
Virginia Polytechnic Institute and State University (2212-1575)	Capability team in theory, modeling, and validation for a range of innovative fusion concepts using high-fidelity moment-kinetic models	A9; B3.6
Oak Ridge National Laboratory (2212-1516)	Magnetic Field Vector Measurements Using Doppler-Free Saturation Spectroscopy	A9; B3.6
Los Alamos National Laboratory (2212-1526)	Electromagnetic and Particle Diagnostics for Transformative Fusion-Energy Concepts	A9; B3.6
University of Rochester (2212-1512)	A Simulation Resource Team for Innovative Fusion Concepts	A9
Sapentai, LLC (2212-1543)	Data-enabled Fusion Technology	A9
University of Maryland, Baltimore County (2212-1546)	Centrifugal Mirror Fusion Experiment	A9; B3.6
University of Rochester (2212-1514)	Advanced IFE Target Designs with the Next-Generation Laser Technologies	A9; B3.6
Zap Energy, Inc. (2212-1531)	Sheared Flow Stabilized Z-Pinch Performance Improvement	B3.6
NK Labs, LLC (2212-1576)	Conditions for High-Yield Muon Catalyzed Fusion	A9; B3.6; B3.15
Princeton Plasma Physics Laboratory (2212-1556)	Stellarator Simplification Using Permanent Magnets	A9; B3.6
Los Alamos National Laboratory (2212-1507)	Target Formation and Integrated Experiments for Plasma-Jet Driven Magneto-Inertial Fusion	A9; B3.6

Attachment A: Projects in the BETHE (FOA No. DE-FOA-0002212) Program

Prime Recipient (Control No.)	Project Title	Categorical Exclusion
Massachusetts Institute of Technology (2212-1530)	Radio Frequency tools for Breakthrough Fusion Concepts	A9
Commonwealth Fusion Systems (2212-1544)	Pulsed High Temperature Superconducting Central Solenoid For Revolutionizing Tokamaks	A9; B3.6
University of Wisconsin-Madison (2212-1532)	An HTS Axisymmetric Magnetic Mirror on a Faster Path to Lower Cost Fusion Energy	A9; B3.6
Type One Energy Group, Inc. (2212- 1508)	Demonstration High Temperature Superconducting Non-Planar Stellarator Magnet with Advanced Manufactured Assemblies	A9; B3.6



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Proposed Action Title: The Breakthroughs Enabling Thermonuclear-fusion Energy (BETHE) (FOA No. DE-FOA-0002212) Program

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

Location(s) (City/County/State): AL; CA; MA; MD; NJ; NM; NV; NY; TN; TX; VA; WA

Proposed Action Description:

SECOND AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original and First Amended Programmatic Determinations, dated April 30, 2020 & June 16, 2020, respectively)

The BETHE Program seeks to fund the development of timely, commercially viable, fusion energy. If successful, the Program will enable abundant, reliable, highly dispatchable fusion power and could help enable a cost-effective, global low-carbon energy economy.

The BETHE Program is composed of 16 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This Second Amended Determination adds 3 projects (Los Alamos National Laboratory 2212-1507, MIT, and Commonwealth Fusion Systems) to the Determinations signed on April 30, 2020 and June 16, 2020 (see Attachment for all 14 projects covered by this and the prior Determinations). These projects are covered by and 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 impact of the projects. 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. No modifications will be made to the existing facilities to accommodate the proposed work

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: 2020.06.25 09:39:56 -04'00'

Date Determined:



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Proposed Action Title: The Breakthroughs Enabling THERmonuclear-fusion Energy (BETHE) (FOA No. DE-FOA-0002212) Program

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

Location(s) (City/County/State): AL; MA; MD; NJ; NM; NV; NY; TN; TX; VA; WA

Proposed Action Description:

FIRST AMENDED PROGRAMMATIC NEPA DETERMINATION (See attached original Programmatic Determination, dated April 30, 2020)
The BETHE Program seeks to fund the early stage development of timely, commercially viable, fusion energy. If successful, the Program will enable abundant, reliable, highly dispatchable fusion power and could help enable a cost-effective, global low-carbon energy economy.

The BETHE Program is composed of 16 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This First Amended Determination adds 6 projects (Sapentai, LLC, UMBC, University of Rochester, Zap Energy, Inc., NK Labs, LLC & Princeton Plasma Physics Laboratory) to the Determination signed on April 30, 2020 (see Attachment for all 11 projects covered by this and the prior Determination). These projects are covered by and 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 impact of the projects. 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. No modifications will be made to the existing facilities to accommodate the proposed work.

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: 2020.06.16 12:06:13 -05'00'

Date Determined:



U.S. Department of Energy Categorical Exclusion Determination Form

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Proposed Action Title: The Breakthroughs Enabling Thermonuclear-fusion Energy (BETHE) (FOA No. DE-FOA-0002212) Program

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

Location(s) (City/County/State): NJ; NM; NV; NY; TN; VA; WA

Proposed Action Description:

Projects funded under the BETHE Program supports the development of commercially viable fusion energy. Specifically, the BETHE projects will work to deliver higher-maturity, lower-cost fusion options via three research categories: (1) Concept Development to advance the performance of inherently lower-cost but less-mature fusion concepts; (2) Component Technology Development that could significantly reduce the capital cost of higher-cost, more-mature fusion concepts; and (3) Capability Teams to improve/adapt and apply existing capabilities (including theory/modeling, machine learning, and diagnostics) to accelerate the development of multiple concepts. If successful, the Program will enable abundant, reliable, highly dispatchable fusion power and could help enable a cost-effective, global low-carbon energy economy.

The BETHE Program is composed of 16 small-scale research and development projects that will be conducted by universities, non-profit entities, for-profit entities, and federal laboratories. This Determination covers 5 of the 16 projects (listed in Attachment A). These 5 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

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: 2020.04.30 08:30:49 -05'00'

Date Determined: