

**The Department of Homeland Security (DHS)
Notice of Funding Opportunity (NOFO)
Countering Weapons of Mass Destruction (CWMD)
Academic Research Initiative (ARI)**

All entities wishing to do business with the Federal Government must have a unique entity identifier (UEI). Currently, the Data Universal Numbering System (DUNS) number, which is a unique nine-character identification number provided by Dun & Bradstreet (D&B) free of charge, is the official UEI. D&B assigns UEI (DUNS) for each physical location of a business. Requesting a UEI (DUNS) takes about 10 minutes. Receiving a UEI (DUNS) takes 1-2 business days (under normal circumstances) when using the D&B web form. Sam.gov information can be found at: <https://sam.gov/content/entity-registration>.

Grants.gov registration information can be found at: <https://www.grants.gov/web/grants/register.html>. Detailed information regarding DUNS and SAM are also provided in Section D of this NOFO.

Planned UEI Updates in Grant Application Forms: On April 4, 2022, the DUNS number will be replaced by a “new, non-proprietary identifier” requested in, and assigned by, SAM.gov. This new identifier will continue to be called the UEI.

Additional Information can be found on Grants.gov:
<https://www.grants.gov/web/grants/forms/planned-uei-updates.html>

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A. Program Description

1. Issued By

U.S. Department of Homeland Security (DHS) Countering Weapons of Mass Destruction (CWMD) Research and Development Division

2. Assistance Listings Number

97.077

3. Assistance Listings Title

Homeland Security, Research, Development, Testing, Evaluation, and Demonstration of Technologies Related to Nuclear Threat Detection

4. Funding Opportunity Title

CWMD: Academic Research Initiative (ARI)

5. Funding Opportunity Number

DHS-22-CWMD-077-001

6. Authorizing Authority for Program

Section 1928 of the Homeland Security Act of 2002 Pub. L. No. 107-296 as amended by the Countering Weapons of Mass Destruction Act of 2018 Pub. L. No. 115-387. Codified at 6 U.S.C. §§ 592 (a)(6), 596

7. Appropriation Authority for Program

Consolidated Appropriations Act, 2022, Pub. L. No. 117-103, Division F, Department of Homeland Security, Title IV, Research Development, Training, Countering Weapons of Mass Destruction Office, Federal Assistance

8. Announcement Type

Initial

9. Program Category

N/A

10. Program Overview, Objectives, and Priorities

a. Program Overview

DHS is committed to using cutting-edge technology and scientific talent in its mission to make the United States safer. On December 21, 2018, the Countering Weapons of Mass Destruction Act of 2018, (Pub. L. No. 115-387) was signed into law, amending the Homeland Security Act of 2002, to establish the DHS CWMD Office by consolidating the Domestic Nuclear Detection Office and majority of the Office of Health Affairs. The CWMD mission is to counter attempts by terrorists or other threat actors to carry out an attack against the United States or its interests using a

weapon of mass destruction, and protect the United States against chemical, biological, radiological, and nuclear (CBRN) threats. The DHS CWMD Research and Development appropriation provides resources necessary to identify, explore, and demonstrate new technologies and capabilities that will help enable DHS and stakeholders to prevent, protect against, respond to, and mitigate CBRN threats and incidents. The CWMD ARI Program seeks novel cross-cutting research that will enhance the nation's capabilities to detect and prevent the illicit entry, transport, assembly, or potential use of unauthorized CBRN materials, devices, or agents within the United States, and otherwise help protect against an attack using such materials, devices, or agents. The CWMD ARI Program aligns with and supports the FY2020-24 DHS Strategic Plan, Goal 1: Counter Terrorism and Homeland Security Threats, and Objective 1.4: Counter Weapons of Mass Destruction and Emerging Threats.

Objectives

The ARI Program has two primary objectives: 1) Engage with the academic community to advance fundamental knowledge in CBRN sciences applicable to CWMD with emphasis on basic and applied research to solve long-term, high-risk challenges; and 2) Develop human capital for CBRN science and engineering professions. Furthermore, the program works to sustain a long-term commitment to basic research in these fields and coordinates related research efforts across the Federal Government.

b. Priorities

CWMD has prioritized the following research topics for release in this solicitation. These topics address technical challenges focused on improving capabilities to detect, identify, and provide notifications regarding CBRN threats. The full solicitation research topic descriptions are listed in Appendix A. Summaries of the topics are as follows:

- i.** Topic 1: High-Performance and Cost-Effective Polycrystalline-Based Semiconductor (PBS) Radiation Detector Development: Identify and develop high-performance and low-cost polycrystalline-based semiconductor radiation detection solutions which overcome the limitations and disadvantages of current technologies, by exploring new or existing materials using new methods of operation, readout, and signal processing.
- ii.** Topic 2: Untangling Markers of Host/Pathogen Interaction: Investigate and advance the use of biomarkers for disease or syndromic diagnosis in absence of identification of an etiological agent.
- iii.** Topic 3: Rapid, Sensitive Indicators for Chemical Threat Sensing: Develop and demonstrate novel indicator materials to detect airborne toxic chemical threats at low concentrations, to enable monitoring of public spaces and enhance field end user safety.
- iv.** Topic 4: Theoretical Classification Methodologies to Enable Detection with Predicted Signatures: Investigation into classification capabilities using

theoretical deduction for chemicals and biological materials, rather than previously acquired spectra.

11. Performance Measures

The ARI Program adheres to program measurement and evaluation standards in accordance with CWMD and other Government policies and guidance. ARI Program objectives and individual topic goals (see Appendix A) support advancement in state-of-the-art research in performance, cost effectiveness, and/or operational risk reduction in CBRN material detection, identification, and threat tracking.

Government program managers and staff will evaluate progress toward goal achievement through periodic program reviews/evaluations and review of required reports (template provided post-award). Proposal submissions must clearly define intermediate project targets and year end/project end milestones against which project performance can be qualitatively and quantitatively measured. Progress toward project milestones, costs, and schedule will be considered during project reviews and evaluations in determining project continuation.

B. Federal Award Information

1. Available Funding for the NOFO

Up to \$7M for the first year of the program. This Notice of Funding Opportunity (NOFO) is for incrementally funded multi-year projects with a total duration of up to 5 years (60 months). Each award agreement will be funded in 12-month increments called budget periods. Individual award annual funding limits are stated for each topic in Appendix A.

2. Projected number of Awards

11 to 14

3. Period of Performance

Up to 60 months

DHS anticipates each program year will be 12 months. Each year, annual funding is subject to the availability of funds, DHS research priorities, and project performance evaluation.

a. Projected Budget Period of Performance Start Date. 09/01/2022

b. Projected Budget Period of Performance End Date. 08/31/2023

An extension to the period of performance may be permitted. Please refer to Extensions in Section H, for the steps award recipients must follow and what information must be included in the justification for consideration of such a request.

4. Projected Period of Performance Start Date(s)

09/01/2022

5. Projected Period of Performance End Date(s)

Up to 60 months following the start date

6. Funding Instrument Type

Cooperative Agreement

The Program Office will have substantial involvement in the administration of the award(s) associated with this NOFO, as the Program Office maintains regular coordination and engagement with DHS operational components and other federal, state, local, tribal, and territorial stakeholders, in order to inform the strategic direction and capability needs that drive the research conducted in the ARI program. This ongoing engagement with the ultimate end users of technical advances to improve detection and awareness of CBRN threats is key to ensuring that the research undertaken by the awardees is aligned with the Program Office direction and the research topics in this NOFO, and such engagement with expertise in the CWMD mission space would be otherwise unavailable to the awardees. Therefore, the Program Office will have regular involvement with the ongoing management of the projects awarded under this NOFO, to include: close monitoring of research progress toward defined milestones; review and approval of initiation and modification of project phases, sub-tasks, and work plans; approval of funding levels and modifications thereto; and tracking of project publications, intellectual property, and personnel/student participation. Award recipients will be required to maintain close and regular interaction with the Program Office. This will include periodic meetings and program reviews, monthly reports on progress (including financial status), and an annual report that details the work completed each year.

C. Eligibility Information

1. Eligible Applicants

Public and state-controlled institutions of higher education and private institutions of higher education are eligible to apply for this NOFO.

2. Applicant Eligibility Criteria

- c. Organization Limit.** The list below are organizations that are eligible and encouraged to submit a proposal:
 - i.** Universities and Colleges. Universities and 2- and 4-year colleges (including community colleges) accredited by a U.S. Department of Education-recognized accrediting agency, and having a campus located in the United States or its territories.
 - ii.** Organizations are referred to as academic institutions for the purposes of this solicitation.

- iii. Non-academic institutions regardless of profit or non-profit status are ineligible to participate as prime offerors. Subawards with non-academic institutions are allowed. All sub-awardees must accept DHS grants terms and conditions as flowed down from the prime offeror. Prime offerors may contract with for-profit entities if the contract follows 2 CFR Part 200 requirements for contracting by grant recipients.

3. Other Eligibility Criteria

DHS will not consider applications that do not adhere to one or more of the following requirements:

- a. **Deadlines.** DHS will not accept late applications. Without exception, applications posted to Grants.gov after the deadline in this announcement will not be considered.
- b. **Application Relevance.** Applications that do not address the purpose of this announcement will not be considered.
- c. **Compliance and Completeness.** Applications that do not substantially comply with the application submission instructions and requirements in this announcement will not be considered. Proposals that do not meet eligibility, page length, line spacing, font size, or other administrative requirements, as listed in the NOFO may be returned without review. Proposals containing unsolicited appendices/attachments may be returned without review.
- d. **Funding Limits.** Applications exceeding the funding limits for a given topic will not be considered.
- e. **Project Period.** Applications exceeding the project period of performance will not be considered.
- f. **Principal Investigator (PI) Limit.** None specified
- g. **Limit on Number of Proposals per Organization.** None specified
- h. **Limit on Number of Proposals per PI.** One (1). Furthermore, an individual researcher may not be named as a participant on more than one proposal submitted to this solicitation. This limitation includes participation as a PI, co-PI, senior researcher, student, consultant, or any other role for which financial remuneration is requested.

Applications who do not meet the eligibility criteria will be considered ineligible.

4. Maintenance of Effort

Not applicable

5. Cost Share or Match

Cost share or match is prohibited in this NOFO.

D. Application and Submission Information

1. Key Dates and Times

a. Application Start Date. 05/03/2022

b. Application Submission Deadlines.

i. Phase I – Preapplication White Paper. Required preliminary submission in advance of potential invitation for full proposal. Submit via Grants.gov. See Section 10 of this NOFO for further information.

- Deadline to submit questions to CWMD Inbox (cwmd.tsi@hq.dhs.gov): 05/17/2022 at 5:59:59PM [UDT]
- White Paper Submission Deadline (required): 06/02/2022 at 5:59:59PM [UDT]

Note. Late submissions will not be reviewed.

ii. Phase II – Invited Full Proposal. Per invitation after Government review of white papers. Submit via Grants.gov. See Section 10 of this NOFO for further information.

- Invitations to Submit a Full Proposal: Anticipated invitation release date 6/29/2022 at 5:59:59PM [UDT]
- Deadline to submit questions to CWMD Inbox (cwmd.tsi@hq.dhs.gov): 7/6/2022 at 5:59:59PM [UDT]
- Invited Full Proposal Submission Deadline: 07/19/2022 at 5:59:59PM [UDT]

Note. Late submissions will not be reviewed.

Proof of timely submission is automatically recorded by Grants.gov. An electronic date/time stamp when an application is successfully received by Grants.gov. Please see **Section D7**, “Timely Receipt Requirements and Proof of Timely Submission” for additional details on acknowledgement of receipt of white paper and invited full proposal submissions.

c. Anticipated Award Date. No later than 08/31/2022

d. Other Key Dates

Event	Suggested Deadline for Completion
Obtaining DUNS number	NLT 4 weeks before full proposal deadline
Obtaining a valid EIN	NLT 4 weeks before full proposal deadline
Updating SAM registration	NLT 4 weeks before full proposal deadline
Starting white paper application process in Grants.gov	NLT 1 week before white paper submission deadline

Starting invited full proposal application in Grants.gov	NLT 1 week before proposal submission deadline
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e. Agreeing to Terms and Conditions of the Award

When applying, applicants agree to comply with the requirements of this NOFO and the terms and conditions of the award, should they receive an award

f. Address to Request Application Package

Application forms and instructions are available at <http://www.grants.gov>. For a hardcopy of the full NOFO, please write or fax a request to:

Janet Bailey
 Grants Officer
 Grants and Financial Assistance Division
 Department of Homeland Security
 Email: janet.bailey@hq.dhs.gov
 Office: 202-505-8897

2. Steps Required to Submit an Application, Unique Entity Identified, and System for Award Management (SAM)

To apply for an award under this program, all applicants must:

- a. Apply for, update, or verify their Data Universal Numbering System (DUNS) number from Dun & Bradstreet (D&B) and Employer ID Number (EIN).
- b. In the application, provide a valid DUNS number, which is currently the unique entity identifier, or SAM UEI after April 4, 2022.
- c. Have an account with <https://login.gov/>.
- d. Register for, update, or verify their SAM account and ensure the account is active before submitting the application.
- e. Create a Grants.gov account.
- f. Add a profile to a Grants.gov account.
- g. Establish an authorized organizational representative (AOR) in Grants.gov.
- h. Submit white paper application in Grants.gov.
- i. Submit full proposal in Grants.gov.
- j. Continue to maintain an active SAM registration with current information, including information on a recipient’s immediate and highest-level owner and subsidiaries. Also all predecessors that have been awarded a federal contract or grant within the

last 3 years, if applicable, at all times during which it has an active federal award or an application or plan under consideration by a federal awarding agency.

Applicants are advised that DHS may not make a federal award until the applicant has complied with all applicable DUNS and SAM requirements. Therefore, an applicant's SAM registration must be active not only at the time of application, but also during the application review period and when DHS is ready to make a federal award. Further, as noted above, an applicant's or recipient's SAM registration must remain active for the duration of an active federal award. If an applicant's SAM registration is expired at the time of application, expires during application review, or expires any other time before the award, DHS may determine that the applicant is not qualified to receive a federal award and use that determination as a basis for making a federal award to another applicant.

3. Electronic Delivery

DHS is participating in the Grants.gov initiative to provide the grant community with a single site to find and apply for grant funding opportunities. DHS requires applicants to submit their applications online through Grants.gov, depending on the funding opportunity. For this funding opportunity, the CWMD Office requires applicants to submit applications through Grants.gov.

4. How to Register to Apply through Grants.gov

- a. Instruction:** Registering in Grants.gov is a multi-step process. Read the instructions below about registering to apply for DHS funds. Applicants should read the registration instructions carefully and prepare the information requested before the registration process. Reviewing and assembling the required information before the registration process will alleviate last-minute searches for required information.

The registration process can take **up to 4 weeks to complete**. Therefore, registration should be done in sufficient time to ensure it does not impact your ability to meet required application submission deadlines.

Organizations must have a DUNS number, active SAM registration, and Grants.gov account to apply for grants. If individual applicants are eligible to apply for this grant funding opportunity, then you may begin step 3, Create a Grants.gov account, listed below.

Creating a Grants.gov account can be completed online in minutes, but DUNS and SAM registrations may take several weeks. Therefore, an organization's registration should be done in sufficient time to ensure it does not impact the entity's ability to meet required application submission deadlines. Complete organization instructions can be found on Grants.gov here:

<https://www.grants.gov/web/grants/applicants/organization-registration.html>.

- b. Obtain a DUNS Number.** All entities applying for funding, including renewal funding, must have a DUNS number from D&B. Applicants must enter the DUNS number in the data entry field labeled “Organizational DUNS” on the SF-424.

For more detailed instructions for obtaining a DUNS number, refer to:

<https://www.grants.gov/web/grants/applicants/organization-registration/step-1-obtain-duns-number.html>.

- c. Register with SAM.** All organizations applying online through Grants.gov must register with SAM. Failure to register with SAM will prevent your organization from applying through Grants.gov. SAM registration must be renewed annually.

For more detailed instructions for registering with SAM, refer to:

<https://www.grants.gov/web/grants/applicants/organization-registration/step-2-register-with-sam.html>.

- d. Create a Grants.gov Account.** The next step is to register an account with Grants.gov. Follow the on-screen instructions or refer to the detailed instructions here: <https://www.grants.gov/web/grants/applicants/registration.html>.

- e. Add a Profile to a Grants.gov Account.** A profile in Grants.gov corresponds to a single applicant organization the user represents (i.e., an applicant) or an individual applicant. If you work for or consult with multiple organizations and have a profile for each, you may log into one Grants.gov account to access all your grant applications. To add an organizational profile to your Grants.gov account, enter the DUNS number for the organization in the DUNS field while adding a profile.

For more detailed instructions about creating a profile on Grants.gov, refer to:

<https://www.grants.gov/web/grants/applicants/registration/add-profile.html>.

- f. EBiz Point of Contact (POC) Authorized Profile Roles.** After you register with Grants.gov and create an Organization Applicant Profile, the organization applicant’s request for Grants.gov roles and access are sent to the EBiz POC. The EBiz POC will then log into Grants.gov and authorize the appropriate roles, which may include the AOR role, thereby giving you permission to complete and submit applications on behalf of the organization. You will be able to submit your application online any time after you have been assigned the AOR role.

For more detailed instructions about creating a profile on Grants.gov, refer to:

<https://www.grants.gov/web/grants/applicants/registration/authorize-roles.html>.

- g. Track Role Status.** To track your role request, refer to:

<https://www.grants.gov/web/grants/applicants/registration/track-role-status.html>.

- h. Electronic Signature.** When applications are submitted through Grants.gov, the name of the organization applicant with the AOR role that submitted the application is inserted into the signature line of the application, serving as the electronic signature. The EBiz POC **must** authorize people who are able to make legally

binding commitments on behalf of the organization as a user with the AOR role; **this step is often missed, and it is crucial for valid and timely submissions.**

5. How to Submit an Application to DHS via Grant.gov

Grants.gov applicants can apply online using Workspace. Workspace is a shared, online environment where members of a grant team may simultaneously access and edit different webforms within an application. For each NOFO, you can create individual instances of a workspace.

Below is an overview of applying on Grants.gov. For access to complete instructions on how to apply for opportunities using Workspace, refer to:

<https://www.grants.gov/web/grants/applicants/workspace-overview.html>.

- a. **Create a Workspace.** Creating a workspace allows you to complete it online and route it through your organization for review before submitting.
- b. **Complete a Workspace.** Add participants to the workspace to work on the application together, complete all the required forms online or by downloading PDF versions, and check for errors before submission. The Workspace progress bar will display the state of your application process as you apply. As you apply using Workspace, you may click the blue question mark icon near the upper-right corner of each page to access context-sensitive help.
- c. **Adobe Reader.** If you decide not to apply by filling out webforms you can download individual PDF forms in Workspace. The individual PDF forms can be downloaded and saved to your local device storage, network drive(s), or external drives, then accessed through Adobe Reader.

Note. Visit the Adobe Software Compatibility page on Grants.gov to download the appropriate version of the software at:

<https://www.grants.gov/web/grants/applicants/adobe-software-compatibility.html>.

- d. **Mandatory Fields in Forms.** In the forms, you will note fields marked with an asterisk and a different background color. These fields are mandatory fields that **must be completed to successfully submit your application.**
- e. **Complete SF-424 Fields First.** The forms are designed to fill in common required fields across other forms, such as the applicant's name, address, and DUNS number. To trigger this feature, an applicant must complete the SF-424 information first. Once it is completed, the information will transfer to the other forms.
- f. **Submit a Workspace.** An application may be submitted through Workspace by clicking the Sign and Submit button on the Manage Workspace page, under the Forms tab. Grants.gov recommends submitting your application package *at least 24-48 hours prior to the close date* to provide you with time to correct any potential technical issues that may disrupt the application submission.

- g. Track a Workspace Submission.** After successfully submitting a Workspace application, a Grants.gov tracking number (GRANTXXXXXXXX) is automatically assigned to the application. The number will be listed on the Confirmation page that is generated after submission. Using the tracking number, access the Track My Application page under the Applicants tab or the Details tab in the submitted workspace.

For additional training resources, including video tutorials, refer to:
<https://www.grants.gov/web/grants/applicants/applicant-training.html>.

Applicant Support: Grants.gov provides applicants 24/7 support via the toll-free number 1-800-518-4726 and email support@grants.gov. For questions related to the specific grant opportunity, contact the number listed in the application package of the grant to which you are applying.

If you are experiencing difficulties with your submission, it is best to call the Grants.gov Support Center and obtain a ticket number. The Support Center ticket number will assist DHS with tracking your issue and understanding background information on the issue.

6. Submitting the Final Application in [Another Grant System] (if applicable)

N/A

7. Timely Receipt Requirements and Proof of Timely Submission

Online Submission. All applications must be received by 5:59:59PM [UTC] on the due dates established for the preapplication white paper submissions and for invited full proposal submissions. Proof of timely submission is automatically recorded by Grants.gov. An electronic date/time stamp is generated within the system when the application is successfully received by Grants.gov. The applicant with the AOR role who submitted the application will receive an acknowledgement of receipt and a tracking number (GRANTXXXXXXXX) from Grants.gov with the successful transmission of their application. This applicant with the AOR role will also receive the official date/time stamp and Grants.gov tracking number in an email serving as proof of their timely submission.

When DHS successfully retrieves the application from Grants.gov, and acknowledges the download of submissions, Grants.gov will provide an electronic acknowledgment of receipt of the application to the email address of the applicant with the AOR role who submitted the application. Again, proof of timely submission shall be the official date and time that Grants.gov receives your application. Applications received by Grants.gov after the established due date for the program will be considered late and will not be considered for funding by DHS.

Applicants using slow internet, such as dial-up connections, should be aware that transmission can take some time before Grants.gov receives your application. Again, Grants.gov will provide either an error or a successfully received transmission in the form of an email sent to the applicant with the AOR role attempting to submit the

application. The Grants.gov Support Center reports that some applicants end the transmission because they think that nothing is occurring during the transmission process. Please be patient and give the system time to process the application.

8. Content and Form of Application Submission

Submissions for this NOFO will be conducted in two distinct phases: Phase I, which requires submission of a white paper; and Phase II, based on invitation for submission of full proposal. Phase requirements are described more fully below. Separately submitted collaborative proposals will not be accepted. Funding to partner organizations must be through subawards. When preparing a full proposal for this competition, proposers are advised to review the program description and the proposal review information found in this NOFO.

All submissions (white papers and invited full proposals) must be made in accordance with the submission instructions in this NOFO and submitted through www.grants.gov using the application packages on www.grants.gov. Applicants are responsible for ensuring submission compliance for both white paper and full proposal.

Upon completion of review of the white papers, CWMD will determine those respondents eligible to compete in the full proposal submission phase. The CWMD Office's decisions regarding full proposal eligibility are final. Only those respondents invited may submit full proposals. The PI and the organization's Sponsored Projects Office will be electronically notified of CWMD's decision to invite or decline the invitation to submit a full proposal.

i. Phase I Preapplication White Paper Submission and Content

This NOFO has a two-phase application process. The preapplication white papers are required as the initial response to this solicitation and must be submitted via Grants.gov. **All applicants must submit a white paper to be eligible for invitation for a full proposal.** White papers are to be submitted electronically to Grants.gov, must be single spaced, should not exceed 4 pages, and should be in 12-point Times New Roman font. **DHS will not accept white papers that are not compliant with the guidelines of this NOFO**, thus making the proposing team automatically ineligible for submitting a full ARI proposal. The submitting organization is responsible for ensuring that the white paper is compliant with all applicable guidelines.

DHS reserves the right to reject incomplete application packages and required attachments or to request any missing information via email. Should the applicant fail to provide all the requested information either as part of the Grants.gov submission or in response to email requests from DHS, at their discretion, DHS may not consider the proposal further.

To be considered complete, each Phase I application package must address only one topic and should contain the following forms and attachments:

Form	Attachment	Action
SF-424 (R&R) Application for Federal Assistance (SF-424-V2.0)	N/A	Enter the appropriate information in data fields
Attachments Form	Attachment 1 – White paper Cover Sheet	Use template posted on Grants.gov NOFO announcement, or request from cwmd.tsi@hq.dhs.gov Upload as Attachment 1
	Attachment 2 – White paper (up to 4 pages)	Upload as Attachment 2
	Attachment 3 – Quad Chart	Use template posted on Grants.gov NOFO announcement, or request from cwmd.tsi@hq.dhs.gov Upload as Attachment 3

• **White Paper Package Preparation Instructions**

- SF-424 (R&R) Application for Federal Assistance (SF-424-V2.0)
Please complete this form first and in its entirety. This will allow other required forms to automatically populate with basic metadata such as name, address, etc. Signature and date will auto-fill when you submit the application package through Grants.gov. Please pay special attention to the following when completing the form:
 - Block 1, Type of Submission – Please check “Application”
 - Block 8, Type of Application – Please check “New”
 - Block 12, Proposed Project – Enter Dates of Entire Project Period
 - Block 15a, Estimated Project Funding – This amount should correspond to your R&R Budget form’s total and budget justification total for the requested budget period
 - Block 16, E.O. 12372 review question – Please check “No”
 - Block 17, By submitting this application, your organization is providing certifications and assurances regarding:
 - Drug-Free Workplace Requirements
 - Debarment, Suspension, and Other Responsibility Matters— Primary Covered Transactions
 - Assurance that your organization is not delinquent on any federal debt
- **Attachments Form**
Use the attachments form to attach/upload the following three items with the white paper application (SF-424):

Attachment 1 – White Paper Cover Sheet

The white paper cover sheet information is shown below. The cover sheet is not included in the 4-page white paper limit. The cover sheet should be uploaded as “Attachment 1” of the attachments form. Note. For a proposal ID, please follow the following naming convention:

ARINOF022-XXXX-YYYY-1-T#-0##

XXXX = four letters (maximum 4 letters) character shortcut for organization name

YYYY = four letters (maximum 4 letters) character shortcut for department/division name

= Topic number (see Appendix A)

= number of proposal submission

Example: Organization A, Dept. B’s submission for its first white paper to Topic 1 would have the ID listed: ARINOF022-ORGA-DEPB-1-T1-001

The cover sheet should describe:

- Overall project information (Requested budget for this period, project duration, project title).
- Primary Organization Information (Name and address, DUNS+4, TIN/EIN).
- Principal Investigator information (Name and address, phone, email, co-PI information if applicable).
- Contact information for any organization involved in a collaborative effort, if applicable.

A white paper cover sheet template will be posted with the NOFO on Grants.gov. A template may also be requested by emailing cwmd.tsi@hq.dhs.gov.

Attachment 2 – White Paper

The white paper should be no more than 4 pages in length and provide sufficient information on the research being proposed (e.g., the hypothesis, theories, concepts, approaches, data measurements and analysis) to allow for an assessment by a technical expert. The white paper should be uploaded as “Attachment 2” of the attachments form.

Any pages submitted for the white paper that exceed the limit of 4 pages will not be read or evaluated. A “page” is defined as 8 ½ x 11 inches, 1-inch margins, single spaced, and 12-point Times New Roman font. The white paper must be provided in portrait layout.

At minimum, the white paper should address the following:

- A project abstract, which should be concise (less than 250 words), provide a summary of the proposed work, and demonstrate relevance to the ARI topic being addressed. The abstract should not contain any proprietary data or markings.
- Project overview addressing the scientific context, intellectual merit, relevance to the topic, and potential long-term impact including how the research contributes to the CWMD science needs outlined in the ARI topic. The overview must present a clear and compelling explanation of the cutting-edge nature of the proposed research.
- Estimate of cost, by year and total dollars, required to accomplish the research as presented in the white paper (no detailed breakout of costs is required).
- Potential team and management plan, including details on student involvement. Multidisciplinary white papers should detail each of the institutions/departments involved and the contribution that will be made by each of the institutions.
- DO NOT include institution or personnel qualifications, experience, or any supplemental information with the white paper. References may be included within the 4-page limit at the discretion of the applicant; however, extensive references are not required.
- The ARI topic (see Appendix A) should be included as a header on the white paper attachment and referenced in the text of the white paper.

No other items or appendices are to be included. Information pertaining to “Current and Pending Support,” and “Facilities, Equipment and Other Resources” are not required for white papers and should not be included. White papers containing items other than those required above may be returned without review.

Attachment 3 – Quad Chart

The quad chart is not included in the 4-page white paper limit. The quad chart provides a single page summary of the effort and should include a picture, graphic or artist’s conception of the effort in the top left, a summary of scientific and technical merit in the bottom left, a summary of broader impact on the top right, and a summary of schedule and proposed budget in the bottom right. The quad chart must be provided in landscape layout. The quad chart should be uploaded as “Attachment 3” of the attachments form.

A quad chart template will be posted with the NOFO on Grants.gov. A template may also be requested by emailing cwmd.tsi@hq.dhs.gov

DO NOT SEND other separate documents, including letters of commitment from partner organizations; current and pending support

statements; facilities, equipment and other resources; budget and budget justification; data management plan; postdoctoral and/or graduate mentoring plan, with white papers.

White papers submitted in response to this solicitation will be reviewed in accordance with Section D.10 of this NOFO. Once the review is complete, applicants will either receive an invitation to submit a full proposal or notified that they will not.

ii. Phase II – Full Proposal Submission and Content

The full proposal will be formally requested after review of the Phase I white papers. Proposals must be submitted via Grants.gov. **Only invited applicants may submit a full proposal.** Proposals are to be submitted electronically to Grants.gov, must be single spaced, and should be in 12-point Times New Roman font. Specific page limit is discussed later in this section.

DHS reserves the right to reject incomplete application packages and required attachments or to request any missing information via email. Should the applicant fail to provide all the requested information either as part of the Grants.gov submission or in response to email requests from DHS, at their discretion, DHS may not consider the proposal further.

The submitting organization is responsible for ensuring that the proposal is compliant with all applicable guidelines. Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the Grants.gov Application Instruction.

To be considered complete, each Phase II application package must address only one topic and should contain the following forms and attachments:

FORM	ATTACHMENT	ACTION
SF-424 (R&R) Application for Federal Assistance Form (SF-424-V2.0)	N/A	Enter the appropriate information in data fields
Research & Related (R&R) Budget Form	Budget Justification for the entire performance period	Attach to Section K in budget period one
R&R Subaward Budget Attachment(s) Form (if applicable)	Individual subaward budgets	Attach a separate budget with justification for each subaward
R&R Project/Performance Site Location(s)	N/A	Enter the appropriate information in data fields
Assurances for Non-Construction Programs Form	N/A	Enter the appropriate information in data fields
Certification Regarding Lobbying (GG_Lobbying Form-V1.1)	N/A	Enter the appropriate information in data fields

Research & Related Senior/Key Personnel Profile Form	PI Biographical Sketch	Attach to Biographical Sketch field
	PI Current/Pending Support	Attach to Current & Pending Support field
	Key Personnel Biographical Sketches	Attach to Biographical Sketch field for each senior/key person
	Key Personnel Current/Pending Support	Attach to Current & Pending Support field for each senior/key person
Research & Related Other Project Information Form	Publicly Releasable Proposal Summary/Abstract	Attach to Block 7 Project Summary/ Abstract
	Project Narrative/Technical Proposal (up to 16 pages)	Attach to Block 8 Project Narrative
Attachments Form	Attachment 1 – Full Proposal Cover Sheet	Use template posted on Grants.gov NOFO announcement, or request from cwmd.tsi@hq.dhs.gov Upload as Attachment 1
	Attachment 2 – Quad Chart	Use template posted on Grants.gov NOFO announcement, or request from cwmd.tsi@hq.dhs.gov Upload as Attachment 2

- **Full Proposal Package Preparation Instructions**

Each Phase II full proposal must address only the topic for which it was invited. Those applicants recommended to submit a full proposal must submit the package via Grants.gov no later than 7/19/2022 at 5:59:59PM [UDT].

- **SF-424 (R&R) Application for Federal Assistance (SF-424-V2.0)**
Please complete this form in its entirety. If you fill this form out first, other required forms will populate with basic data such as name, address, etc. Signature and date will auto-fill when you submit the application package through Grants.gov. Please pay special attention to the following when completing this form:
 - Block 1, Type of Submission – Please check “Application”
 - Block 8, Type of Application – Please check “New”
 - Block 12, Proposed Project – Enter Dates of Entire Project Period
 - Block 15a, Estimated Project Funding – This amount should correspond to your R&R Budget form’s total and budget justification total for the requested budget period
 - Block 16, E.O. 12372 review question – Please check “No”
 - Block 17, By submitting this application, your organization is providing certifications and assurances regarding:

- Drug-Free Workplace Requirements
- Debarment, Suspension, and Other Responsibility Matters—
Primary Covered Transactions
- Assurance that your organization is not delinquent on any federal debt

○ **Attachments Form**

The attachments form should be used to include the following two items with the application:

Attachment 1 – Full Proposal Cover Sheet

The full proposal cover sheet information is shown below. The full proposal cover sheet is not included in the 16-page full proposal page limit. The full proposal cover sheet should be uploaded as “Attachment 1” of the Attachments form. Note. For a full proposal ID, please follow the following naming convention:

ARINOF022-XXXX-YYYY-2-T#-0##

XXXX = four letters (maximum 4 letters) character shortcut for organization name

YYYY = four letters (maximum 4 letters) character shortcut for department/division name

= Topic number

= number of proposal submission.

Example: Organization A, Dept. B’s submission for its first full proposal to Topic 1 would have the ID listed: ARINOF022-ORGA-DEPB-2-T1-001

The cover sheet should include:

- Overall project information (Requested budget for this period, project duration, project title).
- Primary Organization Information (Name and address, DUNS+4, TIN/EIN).
- Principal Investigator information (Name and address, phone, email, Co-PI information if applicable).
- Contact information for any organization involved in a collaborative effort, if applicable.

A Full Proposal Cover Sheet template will be posted with the NOFO on Grants.gov. A template may also be requested by emailing cwmd.tsi@hq.dhs.gov

Attachment 2 – Quad Chart

The quad chart is not included in the 16 page full proposal page limit. The quad chart provides a single page summary of the effort and

should include a picture, graphic or artist's conception of the effort in the top left, a summary of scientific and technical merit in the bottom left, a summary of broader impact on the top right, and a summary of schedule and proposed budget in the bottom right. The quad chart must be provided in landscape layout. The quad chart should be uploaded as "Attachment 2" of the Attachments form.

A quad chart template will be posted with the NOFO on Grants.gov. A template may also be requested by emailing cwmd.tsi@hq.dhs.gov.

e. Research & Related (R&R) Budget Form

An R&R budget is required for ALL Phase II full proposal applications. Please ensure that the total amount requested corresponds to Block 15a on the SF-424 R&R. Include up to 3 to 5 annual budgets, one for each year of the duration of the project; a cumulative budget will be automatically generated by Grants.gov. A detailed budget justification (up to 3 pages) should document proposed expenses. Multi-institutional proposals should use the award/sub-award proposal mechanisms.

f. Budget Justification

A budget justification is required for ALL applications. Please ensure that items listed in the budget justification correspond to the funds requested on the R&R Budget form. Attach the Budget Justification to the R&R Budget form. If you need to attach more than one file to fully capture your budget justification, you may use the optional "Attachments" form.

Please use the following cost categories to group items of cost in your budget justification:

- i.** Personnel
- ii.** Fringe benefits
- iii.** Travel
- iv.** Equipment
- v.** Supplies
- vi.** Contractual
- vii.** Other direct costs
- viii.** Indirect costs

If you wish to display your budget justification by task, please ensure that you supply a total for each of the cost categories listed above for the proposed budget period in your application.

The budget justification should note if any Government-furnished equipment (GFE, e.g., specific radioactive sources to calibrate or test detector systems) is required. Attach an expanded equipment list (see item C on R&R Budget form) if necessary.

An annual grantees review will enable the investigators of grants awarded through this solicitation to review progress, exchange information, and promote

collaborations. The PI, all co-PIs, and at least one of the students supported from each funded award will be required to participate. Representatives of CWMD, other DHS Components, other federal agencies, and various federal laboratories are also expected to be present at this annual review to provide an expanded opportunity for collaboration and information sharing. Funds must be included in each year of the proposal budget for attendance at this annual workshop, should public health conditions allow for an in-person workshop. For budgetary purposes, the workshop may be assumed to be in the United States during a 3-day duration. This workshop will be a primary mechanism for the CWMD PMs to assess progress and thus to adjust the future funding profiles for individual projects.

g. Research and Related Project/Performance Site Location(s)

Please provide information for every site (including subcontractors and outside vendors, with subawards or subcontracts of \$25,000 or more) in your project.

h. Assurances for Non-Construction Programs Form

Submit this form. It will be electronically signed upon submission to Grants.gov as part of your application.

i. Certification Regarding Lobbying (GG_Lobbying Form-V1.1)

Submit this form. It will be electronically signed upon submission to Grants.gov as part of your application.

j. Research and Related Senior/Key Personnel Profile Form

Applicants must complete a profile for the principal investigator(s) and other senior key personnel identified for the project. Provide a biographical sketch for each senior/key person that includes education and research activities and accomplishments, and each individual's role in the proposed project. Each biographical sketch may not exceed 2 pages. The biographical sketch should be uploaded as an attachment to the corresponding field on the form.

Additionally, a statement of current and pending support must be provided for each of the key personnel (e.g., PI and co-PI(s)) on the project. This statement must include the following items and requires disclosure of all grants and contracts through which each of the key personnel is currently receiving or may potentially receive financial support:

- i.** A list of all current projects the individual is working on, in addition to any future support the individual has applied to receive, regardless of the source.
- ii.** Title and objectives of the other research projects.
- iii.** The percentage per year to be devoted to the other projects.
- iv.** The total amount of support the individual is receiving in connection to each of the other research projects or will receive if other proposals are awarded.
- v.** Name and address of the agencies and/or other parties supporting the other research projects.
- vi.** Period of performance for the other research projects.

k. Research and Related Other Project Information Form

Write for a general audience and avoid use of scientific jargon to the extent possible. Please define any technical terminology that is discipline specific. Be concise and direct in descriptions. The file submission for this section shall have a Project Summary/Abstract, followed by the Project Narrative/Technical Proposal.

i. Block 7 – Project Summary/Abstract

The project summary/abstract is limited to one single spaced page with 1-inch margins and 12-point Times New Roman font. The project summary must address the intellectual merit and broader impacts of the proposal, and how the proposed works is relevant to the topic being addressed. The abstract must be written such that the public may understand the potential scientific contribution and impact of the research.

The abstract must not contain any proprietary or confidential information, as it may be disseminated to the public.

ii. Block 8 – Project Narrative/Technical Proposal

The uploaded Project Narrative/Technical Proposal must not exceed 16 pages (including references). If the proposal exceeds 16 pages, only the first 16 pages will be reviewed. A “page” is defined as 8.5 x 11 inches, 1-inch margins, single spaced, and font cannot be smaller than 12-point Times New Roman. The technical proposal must be provided in portrait layout. Fonts for figures, tables, and diagrams should use at least 10 point for caption descriptions. Video and sound file attachments will not be accepted.

The Project Narrative/Technical Proposal must include the following components:

- **Proposed Research:** Narrative consisting of the following items:
 - *Objective:* A clear and concise statement of the objectives for the proposed project.
 - *Background:* Provide the necessary technical and scientific background to support the scientific and intellectual merit of the proposed project.
 - *Relevance:* Describe the relevance to the topic and the technical capability or knowledge gap the project will address, particularly in terms of advancing fundamental knowledge in CBRN sciences applicable to CWMD. Indicate how the work builds upon prior work and the state-of-the-art of the respective theories, technologies, and applications of the proposed areas of study, and how this research differs from prior research.
 - *Work to be Performed:* Provide details of the work to be performed by task and sub-task. Tasks should be laid out to provide a clear experimental and theoretical plan over the years of the proposed effort, including goals, objectives, milestones, go/no-go criteria, and a listing of substantive risks and risk mitigation strategies. The hypothesis to be tested, methods for data collection and analysis, and discussion of the broader impacts of the proposed work, should also be included.

- *Performance Schedule*: Provide a table of tasks and sub-tasks, and the duration of performance of each, in a Gantt or other suitably formatted chart.
- **Modes of Dissemination and Education**: Narrative describing:
 - Proposed approaches to training undergraduate students, graduate students, and postdoctoral researchers, including co-mentorship or other collaborative training.
 - Plans for dissemination and education/outreach/publications including any pilot activities. Where possible, results from the research should be made publicly available to enable dissemination of results to broadly enhance scientific and technological understanding that may be beneficial to the homeland security enterprise and operators, academic community, and society such as through publications, conference presentations, and intellectual property resulting from the project.
- **Programmatic**: Narrative describing:
 - A description of the qualifications and contributions to be made by each senior investigator.
 - How the group effort will be coordinated, including the role of sub awardee partners.
 - How decisions will be made regarding the conduct of the project.
 - If appropriate, a justification for why an effort involving at least two investigators is necessary to carry out the proposed project.
 - A description of the organization's qualifications to support the proposed work and supporting institutions as appropriate. Include specific examples of equipment and/or facilities available to perform the proposed work, with a focus on information directly relevant to the proposed work. Mention if any GFE (e.g., specific radioactive sources to calibrate or test detector systems) is required.
- **Cited References**: References should include full titles of articles and book chapters cited. This section should only include bibliographic citations and must not be used to provide parenthetical information outside of the project description. Indicate with an asterisk (*) references co-authored by two or more proposal investigators.

A quad chart template will be posted with the NOFO on Grants.gov. A template may also be requested by emailing cwmd.tsi@hq.dhs.gov.

9. Other Submission Requirements

Phase I white papers and invited Phase II full proposals may only be submitted via Grants.gov. All files submitted in the preapplication white paper and full proposal shall be in .pdf format. Limit filenames to 50 characters. Do not password-protect files.

10. Intergovernmental Review

An intergovernmental review may be required. Applicants must contact their state's single point of contact to comply with the state's process under Executive Order 12372.

See <https://www.archives.gov/federal-register/codification/executive-order/12372.html>; <https://www.whitehouse.gov/wp-content/uploads/2019/02/SPOC-February-2019.pdf>.

11. Funding Restrictions

- a. **Award Size.** DHS intends to make 11-14 awards in FY22. For the purposes of this announcement, applicants should account for time to ramp up research including finding students to work on the project. Budgets for the first year will likely be lower than for future years when the team is fully formed, and the project is at a more mature stage of development.
- b. **Personnel:** Personnel supported (funded) under this project must be citizens or permanent residents of the U.S., its territories or its possessions. Personnel who are foreign nationals, i.e., not citizens or permanent residents of the U.S., its territories, or its possessions, may be involved in the project, but not funded. Award recipient institutions will receive instructions post-award for reporting of any foreign nationals to be involved in the project (e.g., professors, postdoctoral associates, students) to DHS prior to their involvement in the project.
- c. **Kick-Off Meeting.** This meeting will be held remotely or on site to discuss in detail the technical and programmatic aspects of the proposed research.
- d. **Project Reviews and Updates.** The ARI Program requires three meetings each year, which can take place at the awardee site, CWMD Office, virtually, and/or partner site. These meetings will go over project progress to date and allow for in depth discussions of the project and opportunities for students to participate. Each month there will also be a teleconference to go over project updates.
- e. **Foreign Travel.** Foreign travel required in the performance of the duties approved in this award must be approved by DHS in advance and in writing and comply with the applicable OMB Cost Principles Circular. Requests for foreign travel identifying the traveler, the purpose, the destination, and the estimated travel costs must be submitted to the DHS Grants Officer 60 days prior to the commencement of travel.
- f. Funding beyond the first year will be dependent upon satisfactory performance and the continued availability of funds.

12. Allowable Costs

- a. **Pre-Award Costs.** Not allowed

- b. **Management and Administration (M&A) Costs.** M&A are not operational costs but are necessary costs incurred in direct support of the grant or cooperative agreement or as a consequence of it, such as travel, meeting-related expenses, and salaries of full-/part-time staff in direct support of the program. As such these can be itemized in financial reports.
- c. **Indirect Facilities and Administrative Costs.** Indirect Costs (IDC) are allowable by the recipient and sub-recipients. IDC are based on a federally approved and negotiated rate. Please provide a copy of the negotiated rate approved by the applicant's cognizant agency at the time of application. Indirect costs on subawards are limited to the first \$25,000 of direct costs.

E. Application Review Information

1. Application Evaluation Criteria

a. Programmatic Criteria

The evaluation of white papers (Phase I) and full proposals (Phase II) submitted in response to this NOFO will be accomplished through independent technical reviews using the following criteria, which are of equal importance:

i. Criterion I: Scientific Merit and Technical Approach

The following elements will be considered and evaluated:

- The proposal describes a comprehensive, testable, hypothesis-driven approach for achieving the technical objectives based on sound scientific principles.
- The proposal conveys a clear and complete technical plan with tasks and milestones in a logical sequence, which also addresses cost, schedule, resources, and key technical risks and its associated mitigation strategies.
- The proposed research activity will serve to advance knowledge and understanding within the related technical field and/or across multiple related disciplines.
- The proposed team has the qualifications (credentials, expertise, and prior technical experience) and suitable facilities to conduct the proposed research.
- The appropriateness and reasonableness of the proposed costs.

ii. Criterion II: Transformational Impact

The following elements will be considered and evaluated:

- The extent to which the applicant demonstrates an understanding of the CWMD research or mission challenges.
- The relevance of the proposed research toward the topic requirements/objectives and the CWMD mission.

- The benefit of the proposed research on enabling knowledge, technology, or capabilities over current approaches to address end-user needs in the CWMD mission space.
- Whether the proposed research is original (i.e., non-duplicative; challenges current research or paradigms by using novel theoretical concepts, approaches, or methodologies), innovative (i.e., a novel refinement, improvement, or new application of theoretical concepts, approaches, or methodologies proposed), and/or potentially transformative.

iii. Criterion III: Broader Impact

The following elements will be considered and evaluated:

- The research activity will advance knowledge and understanding in CWMD-related fields while promoting teaching, training, and learning to support fostering the next generation scientists and engineers.
- The degree of graduate and/or undergraduate student participation in the proposed research.
- The proposed activity will broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, and geographic).
- The dissemination of the results will broadly enhance scientific and technological understanding that may be beneficial to the academic community and society.

b. Financial Integrity Criteria

Prior to making a federal award, the DHS Grants and Financial Assistance Division (GFAD) is required by 31 U.S.C. § 3321 note, 41 U.S.C. § 2313, and 2 C.F.R. § 200.205 to review information available through any OMB-designated repositories of Government wide eligibility qualification or financial integrity information. Therefore, application evaluation criteria may include the following risk-based considerations of the applicant:

- i. Financial stability.
- ii. Quality of management systems and ability to meet management standards.
- iii. History of performance in managing federal award.
- iv. Reports and findings from audits.
- v. Ability to effectively implement statutory, regulatory, or other requirements.

c. Supplemental Financial Integrity Criteria and Review

Prior to making a federal award where the anticipated total federal share will be greater than the simplified acquisition threshold, currently \$250,000 (see Section 805 of the National Defense Authorization Act for Fiscal Year 2018, Pub. L. No. 115-91, OMB Memorandum M-18-18 at: <https://www.whitehouse.gov/wp-content/uploads/2018/06/M-18-18.pdf>):

- i. DHS GFAD is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible

through SAM, which is currently the [Federal Awardee Performance and Integrity Information System](#) (FAPIIS) and is accessible through [Sam.gov](#).

- ii. An applicant, at its option, may review information in FAPIIS and comment on any information about itself that a federal awarding agency previously entered.
- iii. DHS GFAD will consider any comments by the applicant, in addition to the other information in FAPIIS, in making a judgment about the applicant's integrity, business ethics, and record of performance under federal awards when completing the review of risk posed by applicants as described in 2 CFR § 200.206.

2. Review and Selection Process

a. Application Receipt

All completed white papers and invited full proposals (“applications”) submitted through Grants.gov in response to this NOFO will be subjected to a technical evaluation by a panel review. This NOFO contains four topics. An application that is determined non-compliant to the topic under which it was submitted will not be considered for technical evaluation.

b. Application Handling

Completed applications will be handled following DHS safeguarding procedures. All application materials will be treated as confidential.

c. Panel Review and Reviewers

Each application will be reviewed by at least three panelists. Panelists are subject matter experts assigned to the appropriate topics based on their technical expertise. The panelists and review will be established and conducted by the Program Office.

d. Section Process

- i. **Evaluation.** Reviewers will conduct their individual evaluation for each assigned application. Following the individual evaluation, a consensus review will be held to formulate a recommendation for each application. The rating of recommendations for each application will follow:

- **Recommended (R)** – Proposals have met and/or exceed the topic requirements/objectives, and have a high likelihood of successful research. Proposals under this rating are recommended for funding.
- **Selectable (S)** – Proposals will likely satisfy the topic requirements/objectives, and have a moderate likelihood of successful research. Proposals under this rating are recommended for funding, if available.
- **Not Recommended (NR)** – Proposals that are non-responsive to the topic requirements/objectives and/or do not satisfy the evaluation criteria, and will not likely conduct a successful research. Proposals under this rating are not recommended for funding.

- ii. **Recommendation.** A summary of the recommendation and accompanying narrative will be completed by each reviewer. The Program Office will make the selection based on the consensus evaluation. Please note that decisions to fund all the recommended for funding proposals are subjected to available funding.

When the anticipated federal award amount will be greater than the simplified acquisition threshold, currently \$250,000 (see 2 CFR §200.88), the following applies:

- Prior to making a federal award with a total amount of federal share greater than the simplified acquisition threshold, DHS is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS).
- An applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.
- DHS will consider any comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under federal awards when completing the review of risk posed by applicants as described in 2 CFR §200.205.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the DHS GFAD for review of business, financial, and policy implications. After an administrative review has occurred, grants officers will perform the processing and issuance of an award. Proposers are cautioned that only a grants officer may make commitments, obligations, or awards on behalf of DHS or authorize the expenditure of funds. No commitment on the part of CWMD should be inferred from technical or budgetary discussions with a CWMD program officer. A principal investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the DHS grants officer does so at their own risk.

F. **Federal Award Administration Information**

1. **Notice of Award**

Notification of the award is made to the submitting organization via email by a grants officer in the DHS GFAD. Notification may be made prior to the award being completed. The notification of award is not an authorization to begin performance. Award documentation, signed by the grants officer, is the authorizing document. The award documentation will also have period of performance dates.

Before accepting the award, the AOR and recipient should carefully read the award package. The award package includes instructions on administering the grant award and the terms and conditions associated with responsibilities under federal awards.

Recipients must accept all conditions in this NOFO and any special terms and conditions in the Notice of Award to receive an award under this program.

Applications that were not selected for an award will be notified by a grants officer via email in the DHS GFAD in a timely manner. The applicant will receive feedback comments from the consensus reviews. The feedback comments will not include the identities of the panelists and reviewers.

2. Pass-Through Requirements

Not applicable

3. Administrative and National Policy Requirements

All successful applicants for DHS grant and cooperative agreements are required to comply with DHS Standard Terms and Conditions, which are available online at: [DHS Standard Terms and Conditions](#).

The applicable DHS Standard Terms and Conditions will be those in effect at the time the award was made, unless the application is for a continuation award. In that event, the terms and conditions in effect at the time the original award was made will generally apply. What terms and conditions will apply for the award will be clearly stated in the award package at the time of award.

4. Reporting

a. Federal Financial Reporting Requirements

The Federal Financial Report (FFR) form SF-425 is available online at: <https://www.grants.gov/web/grants/forms/post-award-reporting-forms.html#sortby=1>

All recipients are required to submit Federal Financial Reports (SF-425) in accordance with the terms and conditions of the grant award into the GrantSolutions system using the Grant submission guidance entitled, “Grantee Reporting Process: Federal Financial Report” found here:

<https://www.grantsolutions.gov/support/granteeUsers.html>

b. Quarterly Federal Financial Reports (Cash Transaction)

The recipient shall submit the FFR (SF-425) Federal Cash Transaction Report to the Department of Health and Human Services, Payment Management System, Smartlink. Quarterly Cash Transaction reports shall be submitted no later than 1/30, 4/30, 7/30, and 10/30.

c. Annual Federal Financial Report

The recipient shall submit an annual FFR (SF-425) to the DHS grants officer no later than 90 days after the budget period end date into the GrantSolutions system per the instructions given in section F4a above.

d. Final Federal Financial Report

The recipient shall submit the final FFR (SF-425) to the DHS grants officer no later than 90 days after the end of the project period end date. The report must be submitted in the GrantSolutions system per the instructions given in section F4a above.

e. Programmatic Performance Reporting Requirements

Deliverables will include the following:

All recipients are required to submit Programmatic Performance Reports in accordance with the terms and conditions of the grant award into the GrantSolutions system using the Grant submission guidance entitled, “Grantee Reporting Process: Programmatic Performance Reports” found here:

<https://www.grantsolutions.gov/support/granteeUsers.html>

- **Monthly Project Reporting:** A monthly report will be submitted each month to provide project updates. The due date is no later than the 15th of the month following the month being reported. For example, a monthly report for June will be due no later than July 15. A monthly report template will be provided by the Program Office. The report must be submitted via email to the DHS CWMD program manager, and to cwmd.tsi@hq.dhs.gov. The report must also be submitted in the GrantSolutions system per the instructions above.
- **Annual Performance Progress Report and Accomplishments:** A detailed Annual Performance Progress Report (PPR) shall be submitted no later than 30 days after the budget period end date. The Annual PPR shall include an updated project quad chart and summary of accomplishments during the reporting period. The Annual PPR must be submitted via email to the DHS CWMD program manager, and to cwmd.tsi@hq.dhs.gov. The report must also be submitted in the GrantSolutions system per the instructions above. Please see section H.2.g in “Additional Information” below for a description of the recommended content for the Annual PPR.
- **Final (End of Program) Performance Progress Report:** The recipient shall submit the Final Performance Progress Report (PPR) no later than 90 days after the project’s completion date. The Final PPR takes the place of the Annual PPR at the end of the final year of the project. The Final PPR shall include an updated project quad chart and summary of accomplishments during the reporting period. The Final PPR must be submitted via email to the DHS CWMD program manager, and to cwmd.tsi@hq.dhs.gov. The report must also be submitted in the GrantSolutions system per the instructions above. Please see section H.2.g in “Additional Information” below for a description of the recommended content for the Final PPR.

f. Additional Performance Reporting Requirements

The Program Office will have substantial involvement in the administration of the award(s) including tracking research progress toward defined objectives and goals,

funding levels and expenditures, and tracking of project publications, patents, and student participants. The recipient will be required to maintain close and regular interaction with the Program Office, including a kick-off meeting to discuss in detail the technical and programmatic aspects of the proposed research program review meetings.

g. Closeout Reporting Requirements

Within 90 days after the end of the period of performance, or after an amendment has been issued to close out a grant, recipients must submit the following in the GrantSolutions system per the instructions given in section F4a above:

- i. The final request for payment, if applicable
- ii. The final FFR (SF-425)
- iii. The final Performance Progress Report detailing all accomplishments
- iv. A qualitative narrative summary of the impact of those accomplishments throughout the period of performance
- v. Other documents required by this NOFO, terms and conditions of the award, or other DHS GFAD guidance

If applicable, an inventory of all construction projects that used funds from this program must be reported with the final progress report.

After these reports have been reviewed and approved by DHS GFAD, a closeout notice will be completed to close out the grant. The notice will indicate the period of performance as closed, list any remaining funds that will be de-obligated, and address the requirement of maintaining the grant records for 3 years from the date of the final FFR, unless a longer period applies, such as due to an audit or litigation, for equipment or real property used beyond the period of performance, or due to other circumstances outlined in 2 CFR § 200.334.

In addition, any recipient that issues subawards to any subrecipient is responsible for closing out those subawards as described in 2 CFR § 200.344. Recipients acting as pass-through entities must ensure that they complete the closeout of their subawards in time to submit all necessary documentation and information to DHS GFAD during the closeout of their prime grant award.

The recipient is responsible for returning any funds that have been drawn down but remain as unliquidated on recipient financial records.

h. Disclosing Information per 2 CFR § 180.335

This reporting requirement pertains to disclosing information related to Government-wide suspension and debarment requirements. Before a recipient enters a grant award with DHS GFAD, the recipient must notify DHS GFAD if it knows if it or any of the recipient's principals under the award fall under one or

more of the four criteria listed at 2 CFR § 180.335:

- i. Are presently excluded or disqualified.
- ii. Have been convicted within the preceding 3 years of any of the offenses listed in 2 CFR § 180.800(a) or had a civil judgment rendered against it or any of the recipient's principals for one of those offenses within that time.
- iii. Are presently indicted for or otherwise criminally or civilly charged by a Governmental entity (federal, state, or local) with commission of any of the offenses listed in 2 CFR § 180.800(a).
- iv. Have had one or more public transactions (federal, state, or local) terminated within the preceding 3 years for cause or default.

At any time after accepting the award, if the recipient learns that it or any of its principals falls under one or more of the criteria listed at 2 CFR § 180.335, the recipient must provide immediate written notice to DHS GFAD in accordance with 2 CFR § 180.350.

Reporting of Matters Related to Recipient Integrity and Performance

Per 2 CFR Part 200, Appendix I § F.3, the additional post-award reporting requirements in 2 CFR Part 200, Appendix XII may apply to applicants who, if upon becoming recipients, have a total value of currently active grants, cooperative agreements, and procurement contracts from all federal awarding agencies that exceeds \$10,000,000 for any time during the period of performance of an award under this funding opportunity. Recipients that meet these criteria must maintain current information reported in FAPIIS about civil, criminal, or administrative proceedings described in paragraph 2 of Appendix XII at the reporting frequency described in paragraph 4 of Appendix XII.

5. Monitoring and Oversight

Per 2 CFR § 200.329, DHS GFAD, through its authorized representatives, has the right, at all reasonable times, to conduct desk reviews, make site visits to review project accomplishments and management control systems to review project accomplishments and to provide any required technical assistance. During site visits, DHS GFAD will review grant recipients' files related to the grant award. As part of any monitoring and program evaluation activities, grant recipients must permit DHS GFAD, upon reasonable notice, to review grant-related records and to interview the organization's staff and contractors regarding the program. Recipients must respond in a timely and accurate manner to DHS GFAD requests for information relating to the grant program.

G. DHS Awarding Agency Contact Information

1. Contact and Resource Information

The Program Officer shall be the DHS official responsible for monitoring the completion of work and technical performance of the projects or activities described in the Program Narrative Statement:

Anthony Esposito
DHS Countering Weapons of Mass Destruction Office
CWMD Stop 0315
245 Murray Lane SW
Washington, DC 20528-0550
Office: (202) 934-1763
Email: anthony.esposito@hq.dhs.gov
Program inbox: cwmd.tsi@hq.dhs.gov

The grants officer shall be the DHS official that has the full authority to negotiate, administer and execute all terms and conditions of this award in concurrence with the Program Officer.

Janet Bailey
Office of Procurement Operations (MGMT I OPO)
245 Murray Lane SW, Mail Stop 0115
Washington, D.C. 20528-0115
Office: (202) 505-8897
Email: janet.bailey@hq.dhs.gov

2. Systems Information

Not applicable

H. Additional Information

1. Period of Performance Extensions

Extensions to the period of performance under this program are allowed. Note. Extensions are only allowed during the last year of the award. Please follow the instructions below to apply for an extension.

- a. Send a request for the form to the Program Office, grants officer, and the program inbox – cwmd.tsi@hq.dhs.gov. Upon completion of the Extension Request form, send your completed forms to the Program Office, grants officer, and the program inbox.
- b. Requests shall be submitted no later than 1 month prior to the end of period of performance.

2. Other

a. Related Programs

This is a new program. There are no related programs or other upcoming or ongoing DHS FAO funding opportunities or similar activities.

b. Proposal Invitation and Award Notification

Full Proposals may only be submitted if invited by CWMD, following the outcome of the assessment of the white papers. DHS will notify full proposal invitees through email. If an application is selected for funding, award recipients will be notified through email.

c. Carry-Forward/Carry-Over

Budget periods are funded annually. Any unobligated funds remaining at the end of an initial budget period will automatically transfer to the next budget period, a process commonly known as carry-forward or carry-over, subsequent budget period amounts may be reduced in proportion to the carry-forward/carryover amounts. DHS may request estimated FFRs be submitted prior to the budget period end date to determine potential unobligated amounts. Large unobligated amounts may result in reduction in new funds for future budget years.

d. Risk Assessment Evaluation

DHS staff will evaluate the risks to the program posed by each applicant, including conducting due diligence to ensure an applicant's ability to manage federal funds. This evaluation is in addition to the evaluation of the applicant's eligibility and the quality of its application on the basis of the Selection Criteria, and results from this evaluation may assist funding decisions. If an award is made, DHS may apply special conditions that correspond to the degree of risk of the award.

In evaluating risks, DHS may consider the following:

- i. Financial stability.
- ii. Quality of management systems and ability to meet the management standards prescribed in applicable OMB guidance.
- iii. Applicant's record in managing previous DHS awards, cooperative agreements, or procurement awards, including:
 - Timeliness of compliance with applicable reporting requirements.
 - Accuracy of data reported.
 - Conformance to the terms and conditions of previous federal awards.
 - If applicable, the extent to which any previously awarded amounts will be expended prior to future awards.

- Information available through OMB-designated repositories of Government-wide eligibility qualification or financial integrity information, such as: FAPIIS, DUNS, and SAM.
- Reports and findings from single audits performed under Subpart F – Audit Requirements, 2 CFR Part 200 and findings and reports of any other available audits.
- Applicant organization’s annual report.
- Publicly available information, including information from the applicant organization’s website.
- Applicant’s ability to effectively implement statutory, regulatory, or other requirements imposed on award recipients.

In addition, organizations who have not received prior DHS GFAD awards may be required to complete a risk assessment questionnaire as part of the pre-award financial and administrative review.

e. Applicant Disclosure of High-Risk Status

Applicants are to disclose if they are currently designated as high risk by a federal awarding agency. This includes, but is not limited to, any status requiring additional oversight by a federal awarding agency due to past programmatic, administrative, or financial concerns. If an applicant is designated as high risk by a federal awarding agency, it should provide an explanation with the application package and include the following information:

- i. The federal awarding agency that assigned the high-risk status.
- ii. The federal awarding agency’s POC for the risk status including name, phone number, and email address.
- iii. Date of the risk status designation.
- iv. Reason(s) for the risk status.

DHS seeks this information to ensure appropriate federal oversight of all cooperative agreement awards. The disclosure of an organization’s risk status does not disqualify it from receiving an award; however additional grant oversight may be required. If necessary, this information will be provided in the award documentation. Failure to disclose high-risk status may result in award termination or other remedies.

f. Obligation by DHS/GFAD

Publication of this NOFO does not obligate the DHS, GFAD to award any specific number of grants and/or cooperative agreements or to obligate any particular amount of funding.

g. Performance Progress Reports (PPRs)

The Performance Progress Report is used by awardees to submit progress reports to ARI on their cooperative awards. Progress reports document recipient accomplishments and compliance with terms of award.

Annual PPR – Use to describe a cooperative agreement’s scientific progress, identify significant changes, report on personnel, and describe plans for the subsequent budget period or year.

Final PPR – Use as part of the cooperative agreement closeout process to submit project outcomes in addition to the information submitted on the Annual PPR, except budget and plans for the upcoming year.

Submitting the PPR

Annual PPRs are due 30 days after each 12-month reporting period. Final PPRs are due within 90 days of the project’s completion date. The Final PPR takes the place of the Annual PPR at the end of the final year of the project. For example, a project funded for one year will have one Final PPR, while a project funded for three years will have two (2) Annual PPRs and one Final PPR.

Performance Progress Report Format and Content

There is no PPR form available for download. Awardees are required to submit all PPRs directly into their GrantSolutions electronic file. Each Annual and Final PPR must also be submitted via email to the DHS CWMD program manager, and to cwmd.tsi@hq.dhs.gov.

Performance Progress Reports should be written for all audiences. The author’s intent should be simplicity in approach and language, with professional jargon kept to a minimum. Technical terms should be defined.

The length of a Performance Report will be determined by the reporting period and subject matter. Final Reports, for example, will be longer since they cover the entire project period rather than a twelve-month reporting period. Performance Reports should:

- Use a font size of 12, preferably in Times New Roman
- Include one (1) inch margins
- Include footnotes/references on a separate page in single line spacing

The PPR requests various types of information, including:

- Major goals and milestones for a given project year
- Accomplishments, including those measured against the goals and planned milestones
- Plans for the next reporting period to accomplish the goals and milestones
- Publications, conference papers, and presentations
- Inventions, patent applications, and/or licenses

- Participants and Other Collaborating Organizations
- Changes/Issues (not required for Final PPR)
- Changes in approach and reasons for change
- Actual or anticipated problems or delays and actions or plans to resolve them
- Changes that have a significant impact on expenditures
- Changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents (if applicable)
- Updated quad chart
- Budgetary Information (not required for Final PPR)
- Project Outcomes (only required on Final PPR)
- Concise summary of the outcomes or findings of the award, written for the public in clear and comprehensible language, without including any proprietary/confidential information or trade secrets

Performance Progress Report Format Organization

Below is a description of the content for each section required for Annual and Final Reports listed in the order they should appear in the report. Awardees should direct any questions they may have about report content to their assigned Program Manager. Awardees (Project Directors/Principal Investigators) should ensure that submitted reports follow internal organizational policies and procedures.

Performance Report Organization Summary

Annual Reports

- Title Page
- Introduction/Project Overview
- Activities and Outcomes During Reporting Period
- Plans for Next Reporting Period
- Project Schedule Status/Progress Against Milestones/Changes/Issues
- Budgetary Information
- Personnel Overview (e.g., Faculty; Students; Staff Scientists)
- Accomplishments/Impacts (e.g., Publications; Presentations; Intellectual Property; Transitions; Degrees Awarded)
- Appendices (e.g., Quad Chart; List of Abbreviations and Acronyms)
- Footnotes/References

Final Reports

- Title Page
- Table of Contents
- Executive Summary
- Introduction/Project Overview
- Activities and Outcomes Over Entire Project
- Project Schedule Status/Progress Against Milestones
- Personnel Overview (e.g., Faculty; Students; Staff Scientists)
- Accomplishments/Impacts (e.g., Publications; Presentations; Intellectual Property; Transitions; Degrees Awarded)

- Conclusions
- Appendices (e.g., Quad Chart; List of Abbreviations and Acronyms)
- Footnotes/References

I. Appendix A: Topic Areas Being Solicited

Topic 1: High-Performance and Cost-Effective Polycrystalline-Based Semiconductor (PBS) Radiation Detector Development

Objective: Identify and develop high-performance and low-cost polycrystalline-based semiconductor radiation detection solutions which overcome the limitations and disadvantages of current technologies by exploring new or existing materials using new methods of operation, readout, and signal processing.

Technology Readiness Level at Beginning: TRL 2

Technology Readiness Level at Conclusion: TRL 4

Note. TRL definitions can be found in Appendix B.

Background

Larger band gap, covalently bonded, heavy metal semiconductors [1] are of great interest as the basis of X-ray, gamma ray and neutron radiation detectors, given its high resistivities ($\geq G\Omega\text{-cm}$), high radiation attenuation (sensitivity) and high mobility-lifetime products (good charge transport and collection). Options are limited, however, given that heavy metal semiconductors tend to possess narrower band gaps. Materials like CdZnTe (CZT) exhibit attractive properties but are challenging to grow in large dimensions and free of defects and dislocations. Other larger band gaps, but ionically bonded materials, like CsPbBr₃, have also shown good radiation detector figures of merit, and have been grown more readily as high-quality crystals, but its ionic character can result in field and irradiation dependent ion transport, leading to time dependent performance and degradation over time. While polycrystalline materials are much more readily fabricated, and generally exhibit increased dark resistivities (lower dark currents), they suffer from enhanced electron-hole recombination. Means for overcoming the inherent limitations of polycrystalline-based semiconductor detectors would enable production of lower cost, larger scale, and more easily fabricated devices.

Description

- This topic seeks to accomplish the identification and development of polycrystalline-based, semiconductor radiation detection solutions with potential for high stability over long times and over a large temperature range, radiation hardness, environmental robustness, mechanical robustness, chemical inertness, non-hygroscopicity, ease of fabrication, low cost, high sensitivity/efficiency (high density, high proton number Z), non-toxicity, low noise (large band gap), and fast response, as compared to commercial off-the-shelf (COTS) solutions. Current semiconductor detector performance is temperature sensitive and experiences degradation in performance at elevated temperatures, with increased dark current, reduced sensitivity, and reduced energy resolution. This topic area is seeking exploration of new or existing materials using new methods of operation, readout, and signal processing. Initially, efforts should explore applicability to personal dosimeters and personal dose rate meters. If successful, the effort would investigate extending technology to applications such as personal radiation detectors, spectroscopic personal radiation detectors, radioactive isotope identification devices, and other radiation detector formats.

- The specific research areas of interest that proposals should focus on are demonstration of the ability to prepare large volume, low cost, solid-state radiation detectors optimized for high sensitivity and selective response to X-ray and gamma ray radiation up to several MeV energy, and neutron radiation, in open and potentially harsh environments. This call is aimed at the identification of existing materials and/or the discovery of new materials, the synthesis of such materials, and the validation of its applicability as high sensitivity solid-state radiation detectors. The topic area is looking for advancements in large band gaps ($>3\text{eV}$) and high-Z materials (including polycrystalline microstructures) that can be manufactured at low cost and operated without need for active temperature control. Such materials should demonstrate high radiation sensitivity and be able to sustain high irradiation intensities/doses as well as maintain nominal room temperature operation performance even at elevated temperature operation ranges (e.g., $100\text{ }^\circ\text{C}$).
- Specific outputs that are expected should include generation of electrical response data to irradiation versus temperature (e.g., $-50\text{ }^\circ\text{C}$ to $100\text{ }^\circ\text{C}$), irradiation intensity, and operating environment with experimental demonstration of proof of concept of devices that can respond with high sensitivity ($\Delta\text{Response} >1,000$) to both high ($>10\text{Gy/min}$) and low (0.1Gy/min) radiation intensity exposures. Especially, demonstration of radiation resistance (hardness) to high doses ($>500\text{KGy}$) and stable elevated-temperature operation ($100\text{ }^\circ\text{C}$) are of interest for the detector material. Studies investigating role of composition and microstructure in impacting performance and stability, and development of models capable of predicting performance, are strongly desired.
- Areas of research that are **not** of interest for this topic include solutions which are already widely used in commercial radiation detection instrumentation or COTS equipment. Also, research areas that are **not** of interest are scintillation technologies, detector materials that require active heating or cooling, or single-crystal detector materials.
- A university team working in collaboration with an industry partner or national laboratory that can test the material in accordance with Technical Capability Standards for Radiological Detection [2,3] is of interest to this call. Relevant preliminary data and order of magnitude estimates of predicted capability improvements are of interest in these proposals. Ultimately, it is of interest to include and/or identify an industrial partner early in the effort by which the developed material can ultimately be commercialized.
- Anticipated length of effort is up to 5 years, with an annual funding limit of \$450,000 per year.

Impact

The anticipated impact of successful research is development of new materials that can lead to compact and low-cost solid state detector devices with high selectivity and sensitivity response in open and/or harsh environments to X-ray, gamma ray radiation, and neutron radiation. The materials and device designs should provide unprecedented savings in size, weight, and power for fielded detector systems and be versatile enough to be operated as next generation low-cost portable radiation detectors or as long duration monitoring capabilities for specialized Governmental facilities that could experience harsh and challenging environmental conditions. This will support long-term Department of Homeland Security needs and the Countering Weapons of Mass Destruction mission space for the development of detection technologies to help prevent nuclear threats both domestically and abroad. This project will also support the training of the next generation workforce in chemical, biological, radiological, and nuclear-

related science and engineering fields in the design, fabrication and testing of next generation solid state radiation detectors.

References

1. Johns, P. M., & Nino, J. C. (2019). *Room Temperature Semiconductor Detectors for Nuclear Security*. *Journal of Applied Physics*, *126*, 040902. <https://doi.org/10.1063/1.5091805>.
2. Department of Homeland Security. (2021). *Technical Capability Standards for Radiological Detection*. <https://www.dhs.gov/publication/technical-capability-standards-radiological-detection>.
3. American National Standards Institute, N42.33-2006, American National Standard for Portable Radiation Detection.

Topic 2: Untangling Markers of Host/Pathogen Interaction

Objective: To investigate and advance the use of biomarkers for disease or syndromic diagnosis in absence of identification of an etiological agent.

Technology Readiness Level at Beginning: TRL 1-2

Technology Readiness Level at Conclusion: TRL 3-4

Note. TRL definitions can be found in Appendix B.

Background

A variety of pro- and anti-inflammatory host markers have been identified in response to viral, bacterial, or fungal infections. Studies have shown gene and/or protein expression may be altered in specific and potentially identifiable patterns in response to different biological agents. The alteration of multiple non-specific markers may yield a “fingerprint” for identifying an etiological agent or provide a preliminary presumptive identification when these markers are aggregated together. These pattern shifts may provide important information depending on the type of infection or the stage of the infection, and the genotype of an individual. Of equal importance may be the identification of which markers are rarely or never seen in a particular disease state. Due to the large number of genes and gene products that may be influenced by pathogen infection of a host, extremely sophisticated data analytics are required to analyze and understand the complexity of the host response. Confounding variables are driven by the specific pathogen with expression of certain genes increasing or decreasing, likewise for protein expression. To further complicate matters, the expression patterns may change with disease progression. A more accurate prognosis may be possible through an improved understanding of these patterns. One study identified differences in the status of signaling pathways based on responses to different strains of the same virus, i.e., Ebola.

For this topic, the offeror is asked to analyze human tissue and/or blood samples of known provenance and identify biomarkers beyond discriminators of simply viral or bacterial infection. The intent is to ultimately develop a capability to identify, or dramatically narrow down, possible etiological causes for a given disease state, prior to overt symptom development (pre-symptomatic) or in individuals that are infected but will not develop signs or symptoms (asymptomatic) for a given disease state.

Description

- Specific area of research should focus on human response to biological agent exposure, how this response is impacted by disease etiology, the genetic constitution of the individual, and the route of exposure (e.g., bubonic versus pneumonic versus septicemic plague) among other variables. The expectation is a broad and deep survey of the host response to infection, and identification of markers for temporal changes, and prognosis. Serial samples of known provenance would likely be of significant value.
- Examples of variables include, but are not limited to age, gender, genetics of person, disease state, disease outcome, pathogen or toxin, more specifically pathogen strain or toxin serotype, underlying conditions, patient temperature and temperature duration, treatments, metabolic panel, vaccination status, patient’s geographical home, patient travel history, patient disease history.

- Sophisticated statistical analysis methods may be required to manage missing information or data points in a given data field.
- Data analytics, and complex pattern recognition will be required to unravel the sophisticated data stream.
- This topic is not intended to fund repeating previous work for host pathogen interaction that is not broad in scope.
- This topic is intended to take initial steps to move beyond the proof of concept stages and advance the field of understanding how host response mechanisms may be leveraged to improve disease understanding, improve identification of etiological agents, and improve disease prognoses. To accomplish this, teams should consider including, but not be limited to, data collection from human case studies. While Department of Homeland Security mission of is to defend against biological threats of high consequence (US select agent and toxin list, emerging and re-emerging infectious diseases), initial phases of the research may include samples infected with more common pathogens. The expectation is an eventual expansion of the study to include pathogens and threats of all types, which would include RNA and DNA viruses, bacterial infections, fungal infections, and toxins.
- Collaborating with national and international partners where more exotic pathogens, or those rarely found in the US, are endemic, may lead to results that are of greater importance to the US Biodefense sector. Selecting appropriate controls will be critical to high resolution (fine) discrimination of potential markers. **Note:** international partners may **not** receive DHS funding through this program.
- This topic **is not** intended for animal model development as an end state. Instead, it seeks to fund research using de-personalized human samples of known provenance, i.e., confirmed disease state as a comparator for unknown (unconfirmed) disease state samples.
- Award amounts are anticipated to be up to \$700,000 per year, for up to 5 years, contingent on demonstration of progress and meeting of milestones.

Impact

This effort is expected to be an initial step into an improved understanding of host response to infectious diseases. We expect this work to eventually lead to a comprehensive understanding of host pathogen interaction that could provide new insights into the identification of novel targets for both host effectors and microbial factors and may eventually lead to new therapeutic treatments for infections and other human diseases. Curation of interactions to capture experimental details and biological context of the interaction enables comprehensive insights into pathogenesis at a molecular level. Integration of the more detailed data into network analysis will assist researchers in understanding how best to navigate and apply this information to ensure that approaches for controlling pathogens are more effective.

References

1. Ammari, M., McCarthy, F., & and Nanduri, B. (2018). *Leveraging Experimental Details for an Improved Understanding of Host-Pathogen Interactome*, *Curr Protoc Bioinformatics*. *Curr Protoc Bioinformatics*. 61(1), 8.26.1–8.26.12, <https://doi.org/10.1002/cpbi.44>.
2. Ashkenazi-Hoffnung, L., Oved, K., Navon, R., Friedman, T., Boico, O., Paz, M., Kronenfeld, G., Etshtein, L., Cohen, A., Gottlieb, T. M., Eden, E., Chistyakov, I., Srugo, I., Klein, A., Ashkenazi, S., & Scheuerman, O. (2018). *A Host-Protein Signature is Superior to Other Biomarkers for Differentiating Between Bacterial and Viral Disease in Patients with*

- Respiratory Infection and Fever without Source: A Prospective Observational Study*. Eur J Clin Microbiol Infect Dis., 37(7), 1361–1371. <https://doi.org/10.1007/s10096-018-3261-3>.
3. Bosworth. A., Dowall. S. D., Garcia-Dorival. I., Rickett. N. Y., Bruce. C. B., Matthews. D. A., Fang. Y., Aljabr. W., Kenny. J., Nelson. C., Laws. T. R., Williamson. E. D., Stewart. S. P., Carroll. M .W., Hewson. R., & Hiscox. J. A. (2017). *A Comparison of Host Gene Expression Signatures Associated with Infection in Vitro by the Makona and Ecran (Mayinga) Variants of Ebola Virus*. Sci Rep. 7, 43144. <https://doi.org/10.1038/srep43144>.
 4. T. S. Fung. T. S., & Liu. D X. (2017). *Human Coronavirus: Host-Pathogen Interaction*. Ann Rev Microbiol, 73, 529-557. doi.org/10.1146/annurev-micro-020518-115759.
 5. Jo. E-K. (2019). *Interplay Between Host and Pathogen: Immune Defense and Beyond*. Exp Mol Med, 51, 1–3. doi.org/10.1038/s12276-019-0281-8.
 6. Juan. C., Peña. C., & Oliver. A. (2017). *Host and Pathogen Biomarkers for Severe Pseudomonas aeruginosa Infections*. J Infect Dis, 215, S44–S51. <https://doi.org/10.1093/infdis/jiw299>.

Topic 3: Rapid, Sensitive Indicators for Chemical Threat Sensing

Objective: Develop and demonstrate novel indicator materials to detect airborne toxic chemical threats at low concentrations, to enhance field end user safety and enable monitoring of public spaces.

Technology Readiness Level at Beginning: 2

Technology Readiness Level at Conclusion: 3-5

Note. TRL definitions can be found in Appendix B.

Background

Rapid detection of low concentrations of airborne chemical threat compounds in cluttered backgrounds are ongoing challenges to the Department of Homeland Security (DHS). Typical methods for field detection of toxic industrial chemicals (TIC) and chemical warfare agents (CWA) rely on instruments that, while sensitive, also have various drawbacks including high cost, limited portability, low selectivity, or slow analysis times. Commercial colorimetric chemical detection kits provide some low-cost capability, but these products are not intended for continuous monitoring or early warning of chemical threats. Low-cost, portable approaches that provide field personnel with a visual indicator of the presence of airborne toxic chemicals, via a simple color change on a disposable medium, would provide additional capability that could be expanded into ubiquitous monitoring for chemical threats.

Advances in materials design and synthesis have improved the promise of toxic chemical detection without sophisticated instrumentation. Researchers have shown sensing of nerve agent simulants by amplifying color change detection chemistry using self-propagating chemical reaction cascades [1,2]. Other approaches use colorimetric dye-impregnated filter paper [3,4] or modified mesoporous silicon [5] with optical properties that change upon contact with TICs and CWAs, enabling sensitive detection via optical reporting. However, some approaches have limited selectivity, or require multi-step reactions or analysis of complex indicator arrays. New materials approaches are needed to enable rapid, low-cost presumptive sensing of airborne chemical threats.

Description

This topic seeks development and demonstration of novel indicators that provide rapid, unique spectral or optical responses to airborne TICs and CWAs. Materials of interest should provide a varying spectral or optical response upon interaction with target chemicals and include indicator or amplification chemistries embedded in sensing media; photonic media with high surface area; and functionalized porous crystal structures.

- Chemicals of highest interest for detection are:
 - TICs: AsH₃, Cl₂, CNCl, COCl₂, HCN, H₂S, H₂Se, NH₃, NO₂, PH₃, SO₂
 - CWAs: nerve (G-series; V-series, A-series) and blister (H-series; L) agent classes
- Proposals should outline approaches to detect at least five of the TICs and/or CWA classes listed above. Priority will be given to proposals with a sound technical path toward detection of six or more TICs and two or more CWA classes listed above.

- Approaches are sought for rapid preliminary threat indication (<1 minute) and identification/classification (<5 minutes).
- Desired approaches should detect analyte concentrations at, or below, the EPA 10-minute Acute Exposure Guideline Level 2 (AEGL-2) [6] or NIOSH Recommended Exposure Limit [7].
- Indicators should detect target chemicals in the presence of common interferents, such as vehicle exhaust, smoke, cleaners (e.g., bleach), or common organic compounds (e.g., solvents; fuels). Indicators that are robust to wide ranges in humidity and temperature are also preferred.
- Sensing approaches should ultimately not require sample preparation, input power on the sensing material (e.g., electrical current), or the addition of complex reagents following sampling.
- Proposals should include a clear phase-based technical path with milestones, including development and testing of the proposed solution against both analytes and interferents, concluding with proof of concept/early prototype demonstration. Relevant data from related experiments and publications should be included and explained. Proposals should include order of magnitude estimates of the predicted detection capabilities (e.g., response times; sensitivities).
- Proof of concept experimentation and demonstration are expected; however, this topic is **not** intended for advanced/commercial off-the-shelf instrument development or system integration activities.
- It is recommended that the offerors team with an industry or federal laboratory partner if required to access appropriate facilities for toxic material testing. Simulant chemicals are allowable for initial proof of concept studies for CWAs.
- Award amounts are anticipated to be up to \$500,000 per year, for up to 5 years. In all cases, the proposed award value should be clearly substantiated by the scope of the effort.

Impact

New approaches to detect multiple airborne toxic chemicals in a sensitive, rapid, low cost, low burden manner would find many applications in Government and private sector use. This includes decreased logistical load for DHS operational personnel and other first responders using disposable sensing materials that require no power or complex instrumentation. Such approaches can also enable distributed sensing for persistent monitoring and early warning in public spaces and industrial settings. Advances in synthetic chemistry and materials science could support applications for chemical sensing in environmental (e.g., pesticide indicators) and medical settings (e.g., breath analysis for rapid diagnostics). This topic will also support the training of the next generation workforce in science and engineering fields relevant to chemical, biological, radiological, and nuclear threat detection.

References

1. Sun. X., Boulgakov. A. A., Smith, L. N., Metola. P., Marcotte. E. M., & Anslyn. E. V. (2018). *Photography Coupled with Self-Propagating Chemical Cascades: Differentiation and Quantitation of G- and V-Nerve Agent Mimics via Chromaticity*. ACS Central Science, 4(7), 854–861. <https://doi.org/10.1021/acscentsci.8b00193>.
2. Lee. D-H., Valenzuela. S. A., Dominguez. M. N., Otsuka. M., Milliron. D. J., & Anslyn. E. V. (2021). *A Self-Degradable Hydrogel Sensor for a Nerve Agent Tabun Surrogate through*

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Topic 4: Theoretical Classification Methodologies to Enable Detection with Predicted Signatures

Objective: Investigation into classification capabilities using theoretical deduction for chemicals and biological materials, rather than previously acquired spectra.

Technology Readiness Level at Beginning: 1

Technology Readiness Level at Conclusion: 3-4

Note. TRL definitions can be found in Appendix B.

Background

Using a priori knowledge and data analytic techniques, the cost and time associated with library development using live agents or hazardous chemicals could be greatly reduced. New approaches are needed to classify new chemical derivatives and novel/mutated biological strains, without the logistical burden of library updates through experimental characterization. A key outcome of this project would be theoretically based algorithms that can be integrated into next generation or current operational detector technologies to enable detection of currently unknown threats.

Description

- This effort will focus on investigation into derivative signatures and classification of threats without experimental characterization. This topic should expand upon basic research to determine limitations and capabilities for detection of mutated biological and/or derivative chemical threats. This would include using a priori information for the detection of emerging variations, such as different R-group attachment to a base chemical threat.
- The first phase of the project shall involve research into the methodologies and concepts that will prove most advantageous to the detection effort. This can include downselection to the most promising technologies for future phases of the effort.
- Phase I should include a feasibility evaluation of using predicted signatures, rather than experimentally obtained results, for classification of new materials using current detection technologies (e.g., IR [1][2], MS [3], NMR [4], and PCR [5]).
- Phase II shall involve modeling and simulation to generate simulated spectral data that will enable the classification of new and emerging chemical or biological threats. This can be done through separate biological and chemical development tracks or a single detector-based methodology with the overall operational capability for both unknown chemical and biological materials.
- Phase II shall involve algorithm development and implementation of detection and classification in a performer-developed virtual simulated environment.
- Phase III of the project shall involve experimental proof of concept testing and validation using test simulants that have not been previously observed by the system. This could involve derivative chemical simulant materials or related biological strains to that of training data used in Phase II.
- Phase III implements the simulated data analytics efforts into a proof of concept demonstration to display the algorithm functionality in a lab environment.

- Areas of research that are **not** of interest for this topic include hardware development or detector component development. This effort should focus on non-proprietary software enhancements that can be made to commercial off-the-shelf or Government off-the-shelf (if partnering with federal laboratories) technologies.
- Relevant preliminary data, such as spectral library information for targets of interest, may be provided to assist in algorithm development efforts.
- As part of the effort, performers may work with the Government and industry partners in the development of standard exportable formatting to enable development of voluntary consensus standards which will ensure applicability of the developmental effort to the broader community.
- Anticipated length of effort may be up to 5 years, with individual award amounts of up to \$250,000 per year. Award allocation for future years will be considered based on the downselect of the best performing universities and progress in meeting incremental milestones.

Impact

Discovery of novel classification methods will provide unprecedented savings in cost and timelines for fielding new detector systems. Standard exportable data formatting will enable improved efficiencies for data processing techniques and reach back analysis. By preemptively addressing gaps in detection and identification capabilities for rapidly emerging threats, this program could provide critical improvements in the reliability and performance of future systems. Further benefits would include increased safety for the public and Department of Homeland Security operational units when encountering novel agents either naturally occurring and deliberately or accidentally released.

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J. Appendix B: Technology Readiness Level Definitions

Research and Development						
Basic Research		Applied Research		Technology Development	Technology Demonstration	System Development
Technology Readiness Level-1	Technology Readiness Level-2	Technology Readiness Level-3	Technology Readiness Level-4	Technology Readiness Level-5	Technology Readiness Level-6	Technology Readiness Level-7
Basic Principles Observed/ Reported	Technology Concept/ application formulated	Critical Function or Characteristic proof of concept	Validation in lab Environment	Validation in Relevant Environment	System Prototypes in relevant environment	System Prototypes in operational environment