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DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

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Announcement of Requirements and Registration for a Prize Competition Titled: *Arsenic Sensor Challenge – Stage 1*.

AGENCY: Bureau of Reclamation, Interior.

ACTION: Notice.

SUMMARY: This Challenge seeks to identify new or improved sensors, devices, or test kits to test for arsenic in water within natural and engineered systems. Solutions must improve on the current arsenic measurement methods. Areas of needed improvement include: performance, ease of use, reduction in hazardous waste production, data interpretation, and cost. This is Stage 1 of a planned two-stage Challenge, with the second stage consisting of a prototype demonstration and a larger prize purse. The Bureau of Reclamation is the Seeker for this Challenge.

DATES: Listed below are the specific dates pertaining to this prize competition:

1. Submission period begins on [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].
2. Submission period ends on [INSERT DATE 90 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].
3. Judging period ends on [INSERT DATE 150 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].
4. Winners announced by [INSERT DATE 170 DAYS AFTER DATE OF

PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: The *Arsenic Sensor Challenge – Stage 1* Prize Competition will be posted on the following crowd-sourcing platforms where Solvers can register for this prize competition:

1. The Water Pavilion located at the InnoCentive Challenge Center:

<https://www.innocentive.com/ar/challenge/browse>.

2. U.S. Federal Government Challenge Platform: www.Challenge.gov.

InnoCentive, Inc. is administering this challenge under a challenge support services contract with the Bureau of Reclamation. Challenge.gov will re-direct the Solver community to the InnoCentive Challenge Center as the administrator for this prize competition. Additional details for this prize competition, including background information, figures, and the Challenge Agreement specific for this prize competition, can be accessed through either of these prize competition web addresses. The Challenge Agreement contains more details of the prize competition rules and terms that Solvers must agree with to be eligible to compete.

FOR FURTHER INFORMATION CONTACT: Challenge Manager: Dr. David Raff, Science Advisor, Bureau of Reclamation, (202) 513-0516, draff@usbr.gov; Andrew Tiffenbach, (303) 445-2393, atiffenbach@usbr.gov.

SUPPLEMENTARY INFORMATION: The Bureau of Reclamation (Reclamation) is announcing the following prize competition in compliance with 15 U.S.C. 3719, Prize Competitions.

PRIZE COMPETITION SUMMARY: Measuring arsenic in the environment and in drinking water is important for protecting human health. Drinking water and wastewater

treatment facilities are subject to arsenic regulations in order to limit human exposure and environmental contamination. Privately-owned drinking water wells are tested for arsenic in order to prevent exposure. Contaminated site cleanup requires screening to know where arsenic contamination occurs. Regulatory compliance includes collecting and analyzing samples using approved methods with results available days to weeks later. While current analytical methods are suitable for ensuring regulatory compliance, there is a need for rapid, low-cost monitoring of arsenic that would benefit water treatment plant operations, wastewater monitoring, contaminated site remediation, private well owners, scientific research, and other interested parties.

Routine arsenic monitoring can identify changes in process performance and improve operations. Rapid, on-site monitoring of arsenic in the field can help identify hot spots for more targeted sampling and remediation. Potential barriers to the widespread implementation of on-site arsenic monitoring include the generation of hazardous waste, the unreliability of analytical methods that rely on color charts, the high level of operator effort required to conduct monitoring, and the cost of online analyzers. Collectively, Reclamation and our collaborators hope to stimulate innovation in water sensing technologies that can lead to more effective, affordable, and reliable methods to monitor water quality. We are launching the Arsenic Sensor Challenge to accelerate the development of new arsenic monitoring methods.

This Challenge consists of two stages:

- **Stage 1** is a Theoretical Challenge. Participants will be asked to submit an idea, along with detailed descriptions, specifications, supporting data or literature, and requirements necessary to bring the idea closer to becoming a product.

- **If Stage 1 produces winning concepts, Stage 2** is planned as a subsequent Reduction to Practice Challenge. Participants will be asked to present their technology and submit a working prototype that puts their idea into practice.

Stage 1 may award up to 5 prizes from a total prize award pool of \$50,000.

Stage 2 envisions a total prize pool of \$250,000 and awarding up to 2 prizes.

In addition to the direct monetary award for Stage 2, Reclamation will invite industry, non-profit organizations, and venture capital representatives to be present at the Stage 2 presentations and testing. Participating industry and venture capital representatives will also have the ability to seek and secure potential business deals with Solvers.

This posting only launches the Stage 1 competition. However, information on the envisioned framework and prizes for Stage 2 are available here:

<http://www.usbr.gov/research/challenges/current/index.html>. Stage 2 will be officially launched and announced with a separate Challenge.gov posting and a separate Federal Register Notice.

Stage 1 is a Theoretical Challenge that requires only a written proposal to be submitted. The Challenge award will be contingent upon evaluation by the Seeker (Reclamation) and the judging panel appointed by the Seeker. The Seeker has a total prize pool budget of \$50,000 to pay the top five submission(s) that meet or exceed the criteria below an award of at least \$10,000 each. No awards are guaranteed unless they meet or exceed the criteria, and more than one award is not guaranteed. Full or partial awards will be considered for solutions that meet all or some of the criteria, respectively. If only a single submission meets or exceeds the criteria, a single prize award may be as

high as \$20,000.

To receive an award, the Solvers will not have to transfer their intellectual property rights to the Seeker and will not have to grant the Seekers a non-exclusive license to practice their solutions. Please note that any proposal submitted will not be treated as confidential information. Accordingly, Solvers should take whatever steps they deem necessary to protect their proprietary rights in their solutions prior to submitting their written proposal for consideration in the Challenge (e.g. filing provisional or full patent applications on the solution described in the written proposal submitted prior to submission).

Technical Requirements. Describe an approach to substantially improve upon currently available field test kits or online analyzers for arsenic monitoring. Solutions must improve upon technology in either the field test kits or online analyzers. Solvers must provide a well-supported, science-based justification about how the proposed technology improves upon currently available products.

A successful solution will overcome or lower barriers to monitoring *as compared to current technologies*. Solvers must compare their proposed solution to currently available products to justify how their solution improves upon current methods (e.g., field test kits or online analyzers). A successful solution will meet the following criteria (full or partial awards will be considered for solutions that meet all or some of the criteria, respectively):

1. Proposed solution does not require subjective data interpretation (i.e., color comparison) to reduce bias between users and environments.
2. Solution does not use or produce a hazardous material (including mercury) that requires frequent handling or disposal.

3. Solvers must explain the anticipated cost of the proposed solution and justify that cost relative to an appropriate technology upon which the proposed solution improves.

Targets costs for each technology are:

- a. Online Analyzer.
 - i. Target capital cost < \$5000.
 - ii. Target operating cost < \$1000 per year.
- b. Field Test Kit/Handheld device.
 - i. Target capital cost < \$500.
 - ii. Target sample cost < \$5/test.

4. Solvers must describe the anticipated performance of the proposed solution based on performance criteria defined below. Criteria follow the nomenclature as defined in Standard Methods for the Examination of Water and Wastewater. Target performance criteria include:

- a. Bias < 1.5 parts per billion (ppb) at 10 ppb as Arsenic (As).
 - i. Bias is defined as the consistent deviation of measured values from the true value, caused by systematic errors in procedure.
 - ii. Bias is calculated for three replicates using the following equation for a 10 ppb (as As). $Bias = Measured_{avg} - True_{avg}$
- b. Precision < 10%.
 - i. Precision is defined as a measure of the degree of agreement among replicate analyses of a sample.
 - ii. Precision is calculated as the relative standard deviation (RSD) of five (5) replicates of a 10 ppb (as As) standard using the following equation:

$$RSD = \frac{\textit{Standard Deviation}}{\textit{Average}}$$

- c. Detection range: 1-100 ppb total arsenic.
- d. Minimal interferences with an arsenic recovery between 80%-120% in the presence of other constituents.
 - i. Recovery is defined as the ratio of the measured value relative to the true value.
 - ii. Recovery is calculated using the following equation for a laboratory-fortified matrix with 50 ppb (as As)):

$$\textit{Recovery} = \frac{\textit{Measured Concentration}}{\textit{True Concentration}} \times 100\%$$

- iii. Recovery will be assessed in a matrix containing:
 - A. pH 6.0-8.5.
 - B. Iron at 10 parts per million (ppm).
 - C. Manganese at 1 ppm.
 - D. Sulfide at 1 ppm.
 - E. Phosphate at 1 ppm.
 - e. Ability to perform quality control on-site using arsenic standards of known concentrations.
 - f. Ability to quantitatively measure arsenite (As(III)), arsenate (As(V)), or total arsenic (As(III) + As(V)).
5. Solution reduces level of effort for the analyst. Solvers must justify how the proposed solution improves upon currently available methods (e.g., field test kits or online analyzers). Aspects to consider for each method include:
- a. Online analyzers.

- i. Reagent use, waste production and handling.
 - ii. Frequency of calibration.
 - iii. Maintenance requirements.
- b. Field test kits.
 - i. Reagent use, waste production and handling.
 - ii. Number of steps.
 - iii. Analysis time.

The Solvers must provide a well-supported justification for how the proposed solution improves upon currently available methods to overcome barriers. The Seekers recognize that the implementation barriers are different between field test kits and online analyzers. Solvers must quantitatively compare their proposed solution to the most relevant commercially available product.

PROJECT DELIVERABLES: This Theoretical Challenge requires a written proposed solution which describes novel technologies or improvements to existing technologies that meet the Solution Requirements described above. Each submission should include:

1. An executive summary (no longer than 1-page) of proposed solution. All Solvers agree to allow the executive summaries of their solutions to be posted on Reclamation's web-page and used in other publications reporting the results of this Challenge.
2. Detailed description of the proposed solution relative to existing technologies that address the Challenge criteria.
3. Rationale as to why the Solver believes that the proposed method will work. This rationale should address each of the Solution Requirements, quantitatively where possible. The Solver should expect that their submittal will be reviewed by experts in the

field of arsenic measurement and multiple fields of engineering.

4. Drawings/sketches of the proposed solution, if applicable.

5. Optional (will not impact judging): Description of resources, materials, budget, and proposed timeframe needed to develop a prototype capable of producing data sufficient for evaluations.

The proposal should not include any personal identifying information (name, username, company, address, phone, email, personal website, resume, *etc.*)

JUDGING: After the Challenge submission deadline, a Judging Panel will evaluate the submissions and make a decision with regards to the winning solution(s). The Judging Panel may be composed of Federal and/or Non Federal scientists, engineers, and other technical experts, including subject matter experts from the listed collaborators for this Challenge. All Solvers that submit a proposal will be notified on the status of their submissions. Decisions by the Seeker cannot be contested.

ELIGIBILITY RULES: To be able to win a prize under this competition, an individual or entity must:

1. Agree to the rules of the competition (15 U.S.C. 3719(g)(1));
2. Be an entity that is incorporated in and maintains a primary place of business in the United States, or (b) in the case of an individual, a citizen or permanent resident of the United States (15 U.S.C. § 3719(g)(3)).

However, submissions can be entertained from all Solvers regardless of whether they are U.S. citizens/entities. Meritorious submissions from non-eligible persons and entities, if any, will be recognized in publications issued by the Seeker announcing the results of the competition, such as press releases. Non-U.S citizens/permanent residents or non-U.S

entities can also be included on U.S. teams. However, prizes — whether monetary or otherwise — will only be awarded to eligible persons and entities under the authority of the America COMPETES Reauthorization Act of 2010 (15 U.S.C. § 3719).

3. Not be a Federal entity or Federal employee acting within the scope of their employment (15 U.S.C. § 3719(g)(4)). A Federal entity is defined by 5 U.S.C. Appendix 8G with a list of current Federal entities periodically posted on the Federal Register.

4. Assume risks and waive claims against the Federal Government and its related entities (15 U.S.C. § 3719(i)(1)(B)); and,

5. Not use Federal facilities, or consult with Federal employees during the competition unless the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis.

The following individuals or entities are not eligible regardless of whether they meet the criteria set forth above:

1. Any individual or organization who employs an evaluator on the Judging Panel or otherwise has a material business relationship or affiliation with any Judge.

2. Any individual who is a member of any Judge's immediate family or household.

3. The Seeker, participating organizations, and any advertising agency, contractor or other individual or organization involved with the design, production, promotion, execution, or distribution of the prize competition; and all employees, and all members of the immediate family or household of any such individual or organization.

4. Any individual or entity that uses Federal funds to develop the proposed solution now or any time in the past, unless such use is consistent with the grant award, or other applicable Federal funds awarding document. NOTE: Individuals or entities that have

been funded by the Federal Government in the past to work within the technical domain of the competition are eligible provided their specific submission was not developed by them with Federal funds. Submissions that propose to improve or adapt existing federally funded technologies for the solution sought in this prize competition are also eligible. Individuals are also encouraged to consult with their employer Ethics Officer for additional guidance and considerations.

CONSULTATION: Reclamation and collaborator scientists, engineers, and technical specialists were consulted in identifying and selecting the topic of this prize competition. Direct and indirect input from various stakeholders and partners were also considered. The U.S. Environmental Protection Agency, Xylem, Inc, the Indian Health Service, the National Institute of Standards and Technology, the U.S. Agency for International Development, the Agricultural Research Service, and the U.S. Geological Survey collaborated with Reclamation on various aspects of this Challenge.

PUBLIC DISCLOSURE: InnoCentive, Inc. is administering this challenge under a challenge support services contract with Reclamation. Participation is conditioned on providing the data required on InnoCentive's online registration form. Personal data will be processed in accordance with InnoCentive's Privacy Policy which can be located at <http://www.innocentive.com/privacy.php>. Before including your address, phone number, e-mail address, or other personal identifying information in your proposal, you should be aware that the Seeker is under no obligation to withhold such information from public disclosure, and it may be made publicly available at any time. Neither InnoCentive nor the Seeker is responsible for human error, theft, destruction, or damage to proposed solutions, or other factors beyond its reasonable control.

LIABILITY AND INDEMNIFICATION: By participating in this Challenge, each Solver agrees to assume any and all risks and waive claims against the federal government and its related entities, except in the case of willful misconduct, for any injury, death, damage, or loss of property, revenue, or profits, whether direct, indirect, or consequential, arising from participation in this Challenge, whether the injury, death, damage, or loss arises through negligence or otherwise. By participating in this Challenge, each Solver agrees to indemnify the federal government against third party claims for damages arising from or related to Challenge activities

NO INSURANCE REQUIRED: Based on the subject matter of the Challenge, the type of work that it will possibly require, as well as an analysis of the likelihood of any claims for death, bodily injury, or property damage, or loss potentially resulting from competition participation, Solvers are not required to obtain liability insurance or demonstrate financial responsibility in order to participate in this Challenge.

Dated: November 18, 2016.

David Raff,
Science Advisor

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