

United States Geological Survey

Earthquake Hazards Program
External Research Support
<http://earthquake.usgs.gov/research/external>



Proposals for Grants – Fiscal Year 2017
Program Announcement/Funding Opportunity G16AS000XX

Closing Date: **May 25, 2016**

PAPERWORK REDUCTION ACT STATEMENT: The Paperwork Reduction Act says that the agency must tell you why we are collecting this information, how we will use it, and whether you have to give it to us. This information is being collected to determine the eligibility of the applicant and as a basis for approval or disapproval of the proposed research. The purpose of the program is to support research in earthquake hazards and earthquake prediction to provide earth science data and information essential to mitigate earthquake losses. Response to this request is required to obtain and retain a grant, under the Earthquake Hazards Reduction Act of 1977, Public Law 95-124. Public report burden for this collection is estimated to average 45 hours per grant application and 12 hours to prepare a final technical report. The OMB Control Number is 1028-0051 for this information collection; the expiration date is April 30, 2016. Direct comments regarding this collection of information may be sent to the Bureau Clearance Officer, U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston VA 20192 (gs-info_collections@usgs.gov)

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Highlights and Warnings

USGS Earthquake Hazards Program External Research Support Announcement for Fiscal Year 2017

Grants.gov Subscription

PIs are urged to sign up for Grants.gov's subscription service to receive notices about the Earthquake Hazards Program grant funding opportunities and possible updates during the application period. Sign up is through the Grants.gov website; our CFDA number is 15.807.

Research Priorities for Fiscal Year 2017 (see Attachment A)

Each submitted proposals must address applicable priority topic(s).

Letters of Commitment and Letters of Support

Read Sections 6 and 11 carefully as requirements have changed.

Application Preparation Instructions

The order and requirements for application components **have changed**; please read Section 11 carefully.
The budget template has changed
The Proposal Information Summary has changed

Award Terms and Conditions

A data management plan is required for each proposal. See Section 4.

It is the expectation of the USGS that Principal Investigators **will publish the results** of funded research in peer-reviewed scientific or technical journals. In addition, all source data and data products and computer codes **must be made readily available** within the public domain.

Questions?

For Grants.gov issues, see: http://www.grants.gov/applicants/app_help_reso.jsp or <http://www.usgs.gov/contracts/grants/grantsgov.html>, contact Laura Mahoney, (703) 648-7344, lmahoney@usgs.gov

For Contracting Officer issues, contact Maggie Eastman, (703) 648-7366, mrussell@usgs.gov

For External Research Support Manager issues, contact Thomas L. Pratt, (703) 648-6709, gd-erp-coordinator@usgs.gov

Announcement G16AS000XX

The USGS Earthquake Hazards Program (EHP) issues this annual Announcement for assistance to support research in earthquake hazards, the physics of earthquakes, earthquake occurrence, and earthquake safety policy. This activity is authorized by the Earthquake Hazards Reduction Act of 1977 (Public Law 95-124, 42 U.S.C. 7701 et. seq.), as amended by Public Laws 101-614, 105-47, 106-503, and 108-360.

1. Application Submission Closing Date: May 25, 2016, 6 pm Eastern Daylight Time

2. Electronic Application Requirement

For the FY 2017 funding cycle all proposals shall be submitted electronically via Grants.gov (<http://www.grants.gov>). Hard/paper submissions will NOT be accepted. Electronic copies submitted via e-mail will NOT be accepted under any circumstances. All proposals must be submitted electronically through Grants.gov on or before:

May 25, 2016, at 6 pm, Eastern Daylight Time

Please be aware that the electronic submission process requires first time users to register using an e-Authentication process. This registration process can be somewhat complex and can take up to 3 weeks to complete. Be advised that it is virtually impossible to begin the process of electronic submission for the first time if you start just a few days before the due date. If you are from a university, contact your Office of Sponsored Programs. They may already have completed the registration process and should work with you to submit the application.

Once at the website, click “Get Registered” under the “For Applications” heading and follow the instructions provided. In order to complete the SF 424 forms, **everyone** must use the Adobe Reader version which is available for download from the grants.gov site at: http://www.grants.gov/help/download_software.jsp#adobe811. To ensure that you have the correct version of Adobe Reader, you can use the versioning test located at:

<http://www.grants.gov/applicants/AdobeVersioningTestOnly.jsp>. Any and all edits made to the application package must be made with the Adobe Reader version specified on Grants.gov. Grants.gov does not guarantee to support other versions of Adobe Reader released prior to version 8.1.1. For more information on Adobe Reader, please see: http://www.grants.gov/applicants/applicant_faqs.jsp#adobe-reader-error. Please note that there is an underscore between “applicant” and “faqs” in the URL. If you have any questions regarding the registration process, please contact the Grants.gov help desk at 1-800-518-4726.

In the Grants.gov forms, floating your mouse over a field will provide instructions for completing that field. You can also click on the Check Package for Errors button to check the entire application for validation errors (incomplete fields, etc.)

There are several steps of the submission process that require careful attention by applicants in order to assure that the application has been fully accepted. It is suggested that applicants read the document available at <http://www.grants.gov/assets/TrackingYourApplicationPackage.pdf>.

Briefly, when you submit a grant application package to Grants.gov, you will receive a confirmation screen as well as three additional emails over two business days from Grants.gov informing you of your application processing status:

1. Confirmation screen
2. Submission Receipt (with “Track My Application” link)
3. Submission Validation (or Rejection with Errors)
4. Agency Retrieval

CONFIRMATION: Submission Confirmation Screen.

After you submit your grant application package, a confirmation screen will appear on your computer screen. This screen confirms that you have submitted an application to Grants.gov.

NOTIFICATION 1: Submission Receipt Email

Within two business days after your application package has been received by the Grants.gov system, you will receive a submission receipt email which indicates that your submission has entered the Grants.gov system and is ready for validation. This email also contains a tracking number for use while tracking the status of the submission as well as a “Track My Application” link, to use to see the progress of your submission.

NOTIFICATION 2: Submission Validation Receipt Email – This is the important one!

After you receive the submission receipt email, the next email you will receive will be a message validating or rejecting your submitted application package with errors. The Grants.gov system is designed to check for technical errors within the submitted application package. Grants.gov does not review application content for award determination. Grants.gov will not post the application if there are errors. Failure to correct errors and submit by the date and time for closing shall not be a reason for accepting a late application.

NOTIFICATION 3: Grantor Agency Retrieval Email

Once your application package has passed validation it is delivered to the grantor for award determination and further approval. After the grantor has confirmed receipt of your application, you will be sent a **third and final email** from Grants.gov. The grantor may also assign your application package an agency specific tracking number for use within their internal system. **IF YOU HAVE NOT RECEIVED THIS E-MAIL WITHIN FOUR DAYS OF THE CLOSING DATE, PLEASE CONTACT THE CONTRACTING OFFICER.**

If you need help entering your proposal, you can reach the **Grants.gov Contact Center at: 1-800-518-4726**. Their hours of operation are Monday-Friday, 7:00 a.m. to 9:00 p.m., Eastern Time, and they are closed on Federal Holidays.

For more information on the Grants.gov registration and submission process, please see <http://www.usgs.gov/contracts/grants/grantsgov.html>

During the application period an applicant may submit a revised or corrected proposal through grants.gov. Include a cover letter as the first page of the proposal stating that the proposal is revised and indicating that the previous submittal is to be withdrawn from consideration. Such submissions must be completed by **May 25, 2016 at 6:00 pm Eastern Daylight Time**.

See Section 11, Application Preparation Instructions, which describes requirements for the proposal and other application components.

Please allow sufficient time for the proposal to be submitted electronically through Grants.gov and allow time for possible computer delays. Applicants are strongly advised not to wait until the last minute for submission. A proposal received after the closing date and time will NOT be considered for award. If the USGS determines that a proposal will not be considered for award due to lateness, the applicant will be notified immediately.

3. Funds and Start Dates

A maximum of \$7 million will be available for support of research grants and cooperative agreements in FY2017. Based on awards in recent years, 70 to 100 new awards are funded each fiscal year. In general, grants do not exceed \$100,000, with the majority of grants between \$15,000 and \$75,000, and the total for competitive grants of approximately \$4 million. This estimate does not bind the USGS to a specified number of awards or to the amount of any award unless that amount is specified by statute or regulation. All projects must propose **start dates between December 1, 2016 and September 1, 2017**.

4. Application Requirements

- A. Proposals must be for a duration of either one or two years with a clearly stated objective for the requested term.

- B. The majority, greater than 50 percent, of research activities must be conducted by the Applicant. The Applicant must retain administrative and technical control of project activities.
- C. Proposals for geologic investigations shall be clearly oriented toward earthquake hazard research and assessment. Research Priorities are described in Attachment A.
- D. USGS personnel are prohibited from assisting any organization in preparing its proposal for competitive funding under this Program Announcement.
- E. Proposals to fund research in foreign countries will be considered only if the research is clearly oriented toward providing new knowledge or new techniques transferable to a U.S. seismogenic zone.
- F. Proposals to fund research in foreign countries must be based on cooperation with scientific groups in the host countries, with host country personnel being used for operational functions, and host countries providing financial support for such personnel. Proposals involving foreign governments or foreign individuals may require additional coordination and approval by the U.S. Department of State.
- G. Applications submitted by foreign organizations must be submitted in English and in U.S. dollars.

5. Research Priorities

The Research Priorities presented in Attachment A reflect the mission of the USGS Earthquake Hazards Program (EHP). Applicants must review the high-priority targets listed in Attachment A for each region and topic in addition to the four major program elements described in Attachment A to determine if application is appropriate under this Program Announcement. Proposals **must** address both applicable program element(s) and priority topic(s).

The USGS EHP operates as an element of the four-agency National Earthquake Hazards Reduction Program, a partnership with the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology (NIST), and the National Science Foundation (NSF) and authorized by the Earthquake Hazards Reduction Act of 1977 (Public Law 95-124, 42 U.S.C. 7701 et. seq.), as amended by Public Laws 101-614, 105-47, 106-503, and 108-360. Each of these agencies has established focus areas as defined by the cited Public Law and by past assistance and procurement activities; grant applications to the EHP must be for research or hazard assessment within the EHP's focus areas as described in Attachment A.

6. Collaborative Proposals

Two types of collaborative proposals are acceptable: Collaboration between two or more external organizations that are seeking funding from the USGS/EHP External Research Support and collaboration between an external organization seeking such funding and a USGS/EHP internal project. Collaborative proposals are **not** instances where persons from a second organization are hired as consultants or other contractual agreements to conduct work on behalf of the grant or cooperative agreement recipient.

Please note that collaborative research between a USGS internal project and external investigator(s) must be structured such that neither project could succeed without the other being funded. While many external research projects either directly or indirectly support or cooperate with ongoing internal USGS projects, these projects are **not** considered collaborative projects because their research objectives can be pursued with or without the existence of the internal USGS research.

- A. For collaborative proposals that propose work by two or more separate institutions or organizations, each individual organization must accept responsibility for specific parts of the work proposed. A separate proposal must be submitted from each external organization involved in collaborative studies. Major sections of each proposal shall be **identical** and each proposal must clearly define the tasks to be performed by each organization, and each institution shall submit a **separate** budget, which clearly reflects their tasks and responsibilities.
- B. Each Principal Investigator and his/her institution that is recommended for funding will receive a separate grant or cooperative agreement and shall accept financial responsibility for administering the grant and technical responsibility for submitted required technical reports.

- C. Collaborative proposals must be clearly identified in the proposal title. The application title shall read “Proposal Title: Collaborative Research with First Institution name, and Second Institution name.”
- D. Recipient of collaborative awards must submit one Progress Report (for 2-year awards) and one Final Technical Report, incorporating the efforts of all collaborators.
- E. USGS reserves the right to fund only some of the Applicants involved in a collaborative study.
- F. In the case of collaborative proposals involving external organizations and USGS-EHP scientists, the external proposal must include a letter of commitment from the relevant internal USGS-EHP scientist(s) stating that the scientist(s) has included specific efforts in his/her agreed-upon internal work plan for the period of time of the proposal to EHP. The proposal to EHP and letter of commitment must fully describe the degree of collaboration and the relationship between the internal and external planned/proposed efforts. The letter(s) of commitment will be the last page(s) of the submitted proposal and do not count toward the 25-page limit.

7. Two-year Proposals

Most proposals are funded for one year; all work that can be completed in one year should be proposed as a one-year project. However, if the proposed work is such that two years are required to complete the research, then a two-year proposal is appropriate and should be submitted. Applicants should carefully consider their time commitments and request the required grant duration and funding to accomplish the project goals. The peer review panel may recommend funding only the first year of a two-year proposal when the proposed research is easily divided into two, one-year projects or when they feel that results from the first year’s proposed work will need to be evaluated before a second year of research can be considered. Applicants should be sure to address the stipulations for two-year proposals in item 11, section F2.

The second year of funding of a two-year grant is contingent upon the availability of funds and satisfactory progress by the Recipient. Progress will be determined through technical review of a Progress Report by the External Research Support Manager and his or her agent. The Progress Report shall be submitted by the Recipient, in accordance with grant award Special Terms and Conditions (see Attachment D).

8. Out-of-Cycle Awards

The USGS may accept proposals outside of the normal competitive cycle under very limited circumstances:

- A. Research proposals may be accepted and approved out-of-cycle (after the closing date) only in cases where there is compelling circumstance or emergency (*e.g.*, seismic event), which must be acted on before the next competitive review cycle. Proposers should contact the appropriate Regional or Topical Coordinator prior to submitting out-of-cycle proposals.
- B. Congress mandates directed awards to support activities that evaluate earthquake hazards and losses. In this case, the USGS will solicit applications.

9. Unsuitable Proposals

The following proposals are ineligible for consideration under this Announcement:

- A. Proposals for regional seismic monitoring or establishing Data Centers.
- B. Proposals for long-term operation of geodetic networks or instruments.
 - C. Proposals from U.S. Government agencies or U.S. Government employees.
 - D. Proposals from Federally Funded Research and Development Centers (FFRDC).
 - E. Proposals in which there is a real or apparent conflict of interest.
 - F. Proposals principally involving the direct procurement of a product, equipment, or service.
 - G. Proposals having subcontracts for 50 percent or greater of total direct costs. This requirement is based on the importance of the Principal Investigator (PI) as an evaluation factor; applicants may request a waiver (within their application) based on any unique circumstances within their proposal.

10. External Research Projects Previously Supported by the USGS EHP

Lists of current and past supported projects may be obtained from the External Research Support web site:
<http://earthquake.usgs.gov/research/external>

11. Application Preparation Instructions

Your electronic submission shall consist of forms SF-424, SF-424a, and SF-424b, plus the items described below. No additional documents or materials may be submitted. Failure to comply with the required application components listed below may result in the proposal being rejected. The USGS cannot request or receive supplemental or replacement application components after the closing date/time under this Program Announcement.

To view complete forms instructions, please visit the Grants.gov Forms Repository at
http://www.grants.gov/agencies/aapproved_standard_forms.jsp#1

Items A through F as described below **shall be combined together into one document, in the order noted below**, and submitted through Grants.gov in either MS Word or PDF format. The application **shall not exceed 25 single-spaced pages** (including figures, tables, references, appendices, curriculum vitae, etc.), and the **type size shall not be smaller than 11 point**. All pages of the application shall be numbered. All text, figures, and tables shall be sized to fit on 8½" by 11" paper. The SF forms and letters of support do **not** count toward the 25-page limit. The application shall be in color as needed for review by peer review panel members.

In the Grants.gov forms, floating your mouse over a field will provide instructions for completing that field. You can also click on the Check Package for Errors button to check the entire application for validation errors (incomplete fields, etc.)

The application submitted through grants.gov as the Project Narrative Attachment Form (in MS Word or PDF format) shall be **assembled in the following order**:

- A. Proposal Information Summary. This summary is mandatory for the Grants.gov submittal for each proposal. The same format, with ALL information as shown in Attachment B shall be included in each applicant's Grants.gov submittal. The two- or three-letter panel designation shall be indicated in Item 1. **If you do not submit this page, your proposal will be rejected.**
- B. Abstract. The abstract shall be no longer than one single-spaced page. It shall include identification of the problem, a summary of the approach, project objectives, anticipated results, and the implications of the project results.
- C. Table of Contents.
- D. Budget Summary. The proposed budget shall be presented in two parts: a one-page summary, which shall be in the format shown in Attachment C. The detailed budget is described item E below.
- E. Detailed Budget. The detailed proposed budget shall be keyed to the Budget Summary. Non-federal funds available to support the project may be reflected in the detailed budget or the SF 424, as appropriate. For **two-year projects**: The Applicant shall provide summary information (see Attachment C) as well as a detailed budget for the second year. The SF 424, however, shall reflect year one only.

The detailed budget **must** include the amount proposed for each of the following items in this order:

- 1) Salaries and wages. Identify individuals by name and position, estimated hours or percent of time, and the rate of compensation proposed. Include an explanation of the amounts included for projected increases if the rate of pay shown is higher than the current rate of pay. Identify each person with a task in the project. Principal Investigator time should be limited with majority of salary for students. **Tuition** remission and other forms of compensation paid as, or in lieu of, wages to students performing necessary work are allowable provided that the tuition or other payments are reasonable compensation for the work performed and are conditioned explicitly upon the performance of the work. Tuition and/or tuition remission should be identified in this section of the budget.
- 2) Fringe benefits/labor overhead. Indicate the rates/amounts in conformance with normal accounting procedures. Explain what costs are covered in this category and the basis of the rate computations. Indicate whether rates are used for proposal purposes only or whether they are also fixed or provisional rates for billing purposes.
- 3) Equipment. Show the cost of all special-purpose equipment necessary for achieving the objectives of the project. "Special-purpose equipment" means scientific equipment having a useful life of more than 1 year and having an acquisition cost of \$5,000 or more per item. Each item should be itemized and include a full justification and a dealer or manufacturer quote, if available. General-purpose equipment must be purchased from the applicant's operating funds. Title to non-expendable personal property shall be vested solely with the Recipient. Under **no** circumstances shall property title be vested in a sub-tier recipient.
- 4) Supplies. Enter the cost for all tangible property. Include the cost of office, laboratory, computing, and field supplies separately. Provide detail on any specific item, which represents a significant portion of the proposed amount. If fabrication of equipment is proposed, list parts and materials required for each and show costs separately from the other items.
- 5) Services or consultants. Identify the tasks or problems for which such services would be used. List the contemplated sub-recipients by name (including consultants), the estimated amount of time required, and the quoted rate per day or hour. If known, state whether the consultant's rate is the same as she/he has received for similar services or under Government contracts or assistance awards. Note the restriction on sub-recipients efforts indicated in section 4. Application Requirements.
- 6) Radiocarbon or other dating. Include the **type of analyses, number of samples, cost per sample, and facility** likely to perform the analyses. If the dating is to be done at a national lab, include the full contact information for the contact at the lab.; a separate award will be made to the national lab, however, include the costs within the grant application budget.
- 7) Travel. State the purpose of the trip and **itemize** the estimated travel costs to show the number of trips required, the destinations, the number of people traveling, the per diem rates, the cost of transportation, and any miscellaneous expenses for each trip. **For travel requested to meetings or conferences, include a description of the benefit to the proposed project. Failure to provide this information may result in a determination of the cost as unallowable.** Calculations of other special transportation costs (such as charges for use of applicant-owned vehicles or vehicle rental costs) should also be shown.
- 8) Publication costs. Show the estimated cost of publishing the results of the research. Include costs of drafting or graphics, reproduction, page or illustration charges
- 9) Other direct costs. Itemize the different types of costs not included elsewhere; such as, shipping, telemetry, computing, and equipment-use charges, not specifically identified for other budget sections, above. Provide breakdowns showing how the cost was estimated; for example, computer time should show the type of computer, estimated time of use, and the established rates.
- 10) Total direct costs. Total items 1 through 9.
- 11) Indirect cost/general and administrative (G&A) cost. Show the proposed rate, cost base, and proposed amount for allowable indirect costs based on the cost principles applicable to the Applicant's organization. G&A should not be calculated for any tuition remission. If the Applicant has separate rates for recovery of labor overhead and G&A costs, each charge should be shown. Explain the distinction between items included in the two cost pools. The Applicant should propose rates for evaluation purposes, which they are also willing to establish as fixed or ceiling rates in any resulting award.

NOTE: A copy of the indirect negotiated cost agreement with the Federal Government will be requested from all applicants recommended for an award. This request will be made at the time of recommendation notification. **In the absence of a negotiated cost agreement or CPA certification, the applicant will be required to provide financial documentation to support the calculation of the proposed rates. If no documentation to support the calculation of indirect cost rates is provided, no award will be made.**

- 12) Amount proposed. Total items 10 and 11.
- 13) Applicant's contribution to Project Cost Total project cost.
- 14) Total Federal and non-Federal amounts, if any.

F. Proposal: The description of the proposed research shall consist of the following parts:

- 1) Significance of the project. In a separate paragraph of the proposal, discuss the specific problem addressed and its importance. Describe **the significant contribution the project will make to one or more of the Priority Topics under the 8 Research Areas in Attachment A. This description must be included.**
- 2) Project plan. Discuss the specific hypotheses or research questions, the conceptual framework or model to be used, as well as the data collection and analysis plans, and relationship with past studies. Plans should also include procedures to be used to insure objectivity and balance in the project. Include project milestones and related due dates for the proposed work and required reports (See Attachment D, Sections 3 and 4). Time allocations, responsibilities for the project staff members, and level of effort for personnel **must** also be described separately for each year of the proposal; this is critical for two-year proposals.
- 3) Final report and dissemination. The USGS considers dissemination of research data and results to potential users of those results to be an integral and crucial aspect of projects it funds. Beyond the requirements for a final technical report, describe your plan for dissemination of project data and results and the planned users of those results that will result in the greatest possible benefit to earthquake hazards reduction.
- 4) Related efforts. Describe significant, related studies conducted by members of the research team and discuss any planned coordination with other workers in the field. Include descriptions of current and recent USGS/EHP External Research Support grants or cooperative agreements, the relationship of those to this proposal (if any), and relevant results from previous grants or cooperative agreements.
- 5) Project personnel and bibliography of directly related work. Provide curriculum vitae for all professional staff, summarizing education, experience, and the last five years' bibliographic information related to the proposed work; a length of one-page is recommended. Curriculum vitae for non-PI researchers who contribute significantly to the project **must** also be included.
- 6) Institutional qualifications. State the resources available at, and the relevant experience of, the institution. Resources include personnel, computer and library facilities, and ties to both sources of data and potential users of the results.
- 7) Current support and pending applications. List all sources of support (in addition to the proposed effort) to which the senior research members have committed a portion of their time for the period covered by the proposal. The information should account for 100 percent of the work time of each investigator and include titles, annual budget levels, period of the awards, and the person-months committed in each case. This section must also list research being considered by, or that will be submitted to, other possible sponsors. This information will not affect the evaluation of the proposal; however, if identical or similar work is also proposed to another institution (e.g., National Science Foundation), an explanation of the relationship of such work to this proposal should be provided.
- 8) Past USGS-supported projects. List the total amount of funding per year for which support was provided by the USGS for previous work related to the proposed research effort, as well as the duration of each award (including no-cost extensions) and the total number of person-months committed by each Principal Investigator each year.
- 9) References.
- 10) Letters of Support. Such letters are **not** acceptable from EHP scientists. See Section 6, Collaborative Proposals for requirements for letters of commitment. Letters of support are useful for all proposals

that include coordination with or participation by researchers at institutions other than those submitting the proposal. These letters do not count toward the 25-page limit.

12. Evaluation of Applications and Funding Decisions

- A. Proposals pertinent to one of the eight research areas will be evaluated by multi-disciplinary peer review panels. The panel members read all the proposals assigned to their panel prior to their meeting and at the panel meeting discuss each proposal according to the evaluation criteria. The four to seven panel members are scientists and engineers drawn from academia, Federal, State, local, and regional agencies, non-profit organizations, and private industry. In addition, one USGS member is often chosen for each panel. The panels will evaluate the technical merit of the proposals especially in the context of development of an integrated program of investigations for that region with attention to the research priorities (see Attachment A). The peer review panel votes on each proposal based on the criteria in section C below; panel rankings are the principal determination of proposal success pending available funds. The panels include five regional panels, and panels for earthquake effects, earthquake physics, and the National panel focused on Research activities specific to the National Seismic Hazards Maps and to the National Earthquake Information Center (NEIC). Applicants **shall indicate in the Proposal Information Summary (Attachment B)** the panel that is most appropriate for their proposal. The USGS will reassign proposals to a more appropriate panel as necessary.

The panels and their designations are as follows:

Designation	Panel Name
CEUS	Central and Eastern United States
EE	Earthquake Effects Research
EP	Earthquake Physics Research
IMW	Intermountain West
NAT	National
NC	Northern California
PNA	Pacific Northwest and Alaska
SC	Southern California

Applications can be directed to only one panel. If unsure of which panel is most appropriate, contact the applicable Regional or Topical coordinator (see Attachment A).

- B. Following the peer panel reviews, the USGS will make funding decisions and will notify applicants of one of three possible decisions: the proposal has been recommended for funding, subject to appropriations; the proposal is being declined and will not be funded; or the proposal is on hold, and may be funded if sufficient funds become available during the fiscal year in question. The USGS intends to provide these notifications to the institution and PI by the end of October. For proposals that are placed on hold, secondary notification regarding funding will be provided in or before the following February.
- C. All proposals are considered in accordance with the criteria set forth below:
- 1) **Relevance and timeliness.** This factor considers the relevance and timeliness of the proposed research activities as they relate to the USGS Earthquake Hazards Program goals, including regional emphasis where appropriate (see Attachment A).
 - 2) **Technical quality of the proposal.** This factor considers the scientific merit of the proposed approach and the probability of achieving positive results within the designated period.
 - 3) **Competence and recent research performance of Principal Investigator (PI) and research team.** This factor considers the scientific and technical competence and recent research of the PI and team and the promptness with which the research results were disseminated to the scientific community from previous funding. This factor includes performance records and capability to provide the necessary facilities and support that will ensure satisfactory completion of the proposed work. This factor includes the timely publication of project results and data in peer-reviewed scientific and technical journals, the impact of the results, and whether

reporting requirements from previous USGS awards have been satisfied.

- 4) Appropriateness and reasonableness of the budget. This factor considers whether the proposed budget is commensurate with the level of effort needed to accomplish the project objectives and whether the cost of the project is reasonable relative to the value of the anticipated results.
- D. The peer review panels make recommendations and provide advice by ranking proposals into priority groupings based on the scores related to the criteria described above. The results of the peer review will assist the USGS in making final award determinations under this Announcement.

13. Rejection of Applications after Initial Review

If an application does not meet all requirements specified in the Announcement, as determined by the Contracting Officer in consultation with the External Research Support Manager, the institution and principal investigator will be promptly notified that the proposal will not be reviewed indicating the reason for its rejection.

14. Involvement of Federal Employees

Federal employees, including USGS employees, are prohibited from serving in any capacity (paid or unpaid) on any application submitted under this Announcement; federal employees may not assist in the development of proposals. Proposals that have a real or apparent conflict of interest related to Federal employees will not be processed for evaluation. This does not prohibit cooperation or collaboration between USGS and non-USGS scientists once a grant or cooperative agreement is in place. Section 6 describes collaborative proposals.

15. Award Terms and Conditions

Award Recipients must comply with grant award Special Terms and Conditions (Attachment D) and Cost Principles, Audit, and Administrative Requirements (Attachment E). Submittal of an application constitutes the applicant's acceptance of these terms and conditions for inclusion in any award resulting from their application. Any concerns with the requirements of the Special Terms and Conditions shall be presented to the Contracting Officer at least three (3) days prior to the closing date of the Announcement. Following are additional conditions applicants should be aware of.

- A. No pre-award costs are authorized.
- B. No-Cost Extensions to the Project Period: No-cost extensions are discouraged. The USGS/EHP awards grants and cooperative agreements for research that extends or supplements the ongoing research within the USGS. The timely conduct of funded projects is of great importance to the achievement of the goals of the program. Applicants should consider their time commitments at the time of applying for a grant. Requests for no-cost extensions will be considered on a case-by-case basis. Applicants should supply documentation supporting their request for an extension, as described in Attachment D, Section 5.
- C. Supplemental Funds: Increases in funds beyond the amount awarded are also discouraged. The peer review panels recommend funding at a rate commensurate with their judgment of the scientific merit of a proposal and their expert knowledge of the expenses likely to be incurred in the conduct of the research. The USGS is aware that the course of any research cannot always be predicted. However, the bulk of the funds available for grants and cooperative agreements are expended early in the fiscal year and little is retained for expenses beyond emergencies or special opportunities for the program. Requests for increased funding will be considered on a case-by-case basis. Applicants should supply documentation supporting their request for increased funding.
- D. Dissemination of Results: When award recipients have completed their studies, a Final Technical Report must be submitted within 90 days; these reports will be posted at <http://earthquake.usgs.gov/research/external>. It is the expectation of the USGS that Principal Investigators will publish the results of funded research in peer-reviewed scientific or technical journals. In addition, all data products and computer codes must be made readily available within the public domain.

16. Payment to Foreign Recipients

The Department of the Interior requires all payments under financial assistance awards be made using the Department of the Treasury Automated Standard Application for Payments (ASAP) system. HOWEVER, ASAP cannot make payments to foreign recipients. As such, payment to foreign recipients will be made by Treasury Check in U.S. funds upon receipt of properly prepared SF-270, "Request for Advance or Reimbursement". Requests should be submitted on quarterly basis. Payments may be drawn in advance only as needed to meet immediate cash disbursement needs.

Foreign recipients are further advised that, although ASAP cannot handle foreign recipients, a waiver from use of ASAP **is** required. This waiver is processed by the USGS and no award may be issued until such time as the waiver is approved.

USGS Earthquake Hazards Program Research Priorities: FY2017

The Research Priorities presented here reflect the mission of the USGS Earthquake Hazards Program (EHP). Applicants are encouraged to review the high-priority research targets listed below for each region and topic in addition to the four major program elements described below as each is applicable for research support through external grants. Proposed work should advance the science that underlies EHP products by posing and testing new hypotheses and/or developing novel data acquisition tools, analysis methods, and products. While proposed projects may involve collection of new data and/or application of existing analysis methods, such activities should be in support of clearly stated research goals. Proposals for projects focused on development of new products must demonstrate strong collaboration with intended users.

Element I. National and regional earthquake hazards assessments. The EHP prepares national and regional assessments of the expected degree of ground shaking over various exposure times. These studies, developed from research on earthquake locations, magnitudes, recurrence, and ground motions, are the basis of the seismic safety elements of the model building codes upon which most local codes are based. The EHP also prepares long-term forecasts/probabilities of future earthquake occurrences, and the shaking and ground deformation they may cause as scenario ground-motion maps. These products are essential for development of cost-effective mitigation measures and practices in structure design, construction, and planning. The USGS is particularly interested in supporting research that contributes to improvements in the national seismic hazards maps and to assessing earthquake hazards and reducing losses in urban areas. Seismic source and ground-motion models that may be directly incorporated into the National Seismic Hazard Maps are most useful; examples include models of earthquake locations, focal mechanisms, and magnitudes and their frequencies.

Element II. Earthquake information, monitoring, and notification. The EHP supports efforts to improve the accuracy of algorithms and processes that provide information about earthquakes in near-real-time, including early warning, estimation of finite fault rupture extent, and refined seismic moment determinations. However, note that all other monitoring and notification activities are evaluated and funded under a separate solicitation for seismic and geodetic network operations.

Element III. Research on earthquake occurrence, physics, effects, impacts, and risks. Earthquake impact and risk assessments help emergency managers, planners, and the public prepare for future earthquakes. With the goal of improving hazard assessments, earthquake forecasts, and earthquake monitoring products, the EHP supports research on earthquake processes and effects. This work is focused on observations, theory, experiments, and developing testable models of earthquake and tectonic processes and of earthquake effects. Because large earthquakes occur infrequently, coordination between disciplines plays a central role in allowing lessons from one area to be applied in other areas and time frames, particularly in the development of a comprehensive understanding of tectonic and earthquake processes and of the effects of earthquakes, e.g., ground shaking, ground failure, and structural response.

Element IV. Earthquake safety policy. The EHP produces a significant quantity of data and information on earthquakes and related hazards. Experience has shown that production of data and reports alone is not sufficient to reduce earthquake risk, and that the Program must take an active role with the user community in the application and interpretation of Program results. Additionally, active engagement with our user community provides opportunities for dialogue on modifications to our existing products and new products that make our work and results more relevant and applicable. Opportunities for engaging the user community take place at both the national and regional levels.

These Elements are cast in eight areas: five regional and two topical areas as well as a National category, as noted below. The EHP places high priority on investigations in the five geographic areas where large populations are exposed to significant seismic risk: Southern California, Northern California, the Pacific Northwest and Alaska, the Central and Eastern United States, and the Intermountain West.

The eight Research Areas are:

1. Central and Eastern United States (CEUS): The United States east of the Rocky Mountains, including Puerto Rico and the U.S. Virgin Islands
2. Earthquake Effects (EE): Basic and applied geographically broad research on the effects of earthquakes
3. Earthquake Physics (EP): Basic and applied geographically broad research on the physics of earthquakes
4. Intermountain West (IMW): Seismically active regions of the Intermountain West
5. National (NAT): Research applicable nationally, especially activities related to the National Seismic Hazards Maps and to the National Earthquake Information Center (NEIC)
6. Northern California (NC): From Cape Mendocino to the central creeping section of the San Andreas fault and the adjacent Coast Ranges, with particular emphasis on the greater San Francisco Bay Area
7. Pacific Northwest and Alaska (PNA): Washington, Oregon, Idaho, California north of Cape Mendocino (Cascadia), and Alaska
8. Southern California (SC): From the Carrizo Plain south to the international border with Mexico.

Proposals for research on earthquake occurrence and effects applicable to a specific region should be directed to the relevant regional panel. Proposals for research on generic earthquake occurrence and for research related to the experiments at Parkfield, California should generally be directed to the EP panel, however, PIs are encouraged to contact the NC, SC, and EP coordinators regarding the most appropriate panel. Proposals for short-term geodetic research or for research using the data from long-term studies should be submitted to the appropriate regional or topical panel. Proposals addressing earthquake research that is national in scope or in support of the National Seismic Hazard Maps should be directed to the National (NAT) panel. Proposals for research to improve algorithms and processes to provide information about earthquakes in near real time should be directed to the National (NAT) panel. Proposals for research on foreign earthquakes should be directed to the regional panel for the U.S. seismogenic zone that will most benefit from the study's knowledge or where new techniques would be most transferable.

Proposals submitted in response to this Program Announcement must indicate the regional or topical area that the proposed research addresses; if the proposal addresses a specific priority noted in this attachment, that too must be indicated. Regional and topical coordinators are available to assist applicants by describing related work being done internally within the USGS, identifying existing relevant data sets, and helping applicants establish contacts with USGS researchers working in similar areas. Coordinators are listed below.

Descriptions of USGS internal projects can be found at: <http://earthquake.usgs.gov/research>. It is strongly recommended that the applicant contact the appropriate regional or topical coordinator and other USGS points of contact noted below to ascertain how their proposed work can complement and help support the goals and objectives of these projects and efforts.

Applicants are encouraged to use seismic monitoring data, including structural monitoring data, from the Advanced National Seismic System (ANSS). Specific ANSS coordination priorities are included in several of the regional or topical priority areas, below. For example, within the area of earthquake effects research, the mission of earthquake response monitoring within the ANSS is to provide data and information products that will contribute to earthquake safety through improved understanding and predictive modeling of the earthquake response of engineered civil systems, or to aid in post-earthquake response and recovery.

The EHP strongly encourages proposals for collaborative research making use of the National Science Foundation's (NSF) EarthScope facilities and George E. Brown Network for Earthquake Engineering Simulation (NEES and NEES-2), as long as these proposals address EHP goals and objectives. Such proposals would most likely address structural

engineering topics. Proposals for EarthScope- or NEES-related projects that are not directly related to EHP goals and objectives should be directed to NSF. In particular, EHP does not tend to fund proposals related to ground remediation, structural mitigation strategies, or elaborate structural modeling,

Following are priority tasks for the EHP Program Elements for each geographical and topical area. We emphasize that this listing of Priority Topics is not intended to discourage submission of proposals to accomplish other important tasks.

1. Priority Topics for Research in the Central and Eastern U.S. (CEUS)

Coordinator: Robert Williams, rawilliams@usgs.gov

Except in a few areas seismic hazard in the CEUS is largely based on the historical catalog, so finding and characterizing active faults outside of these areas is a high priority. The Central Virginia seismic zone is an example area with hazard characterized by historical seismicity. Thus, locating and characterizing potentially seismogenic faults, like the one responsible for the 2011, M5.8 Mineral, Virginia, earthquake, elsewhere in the Central Virginia Seismic Zone is of particular interest. Another priority is an improved understanding of seismic wave propagation at local and regional distances using a combination of field observations, analysis of monitoring data and modeling approaches. Research activities that utilize monitoring data from the regional seismic and geodetic networks are strongly encouraged. Please contact the Regional Coordinator to learn more about the status of internally supported projects or to discuss potential proposals.

Many earthquakes over the last few years in the CEUS may be related to wastewater injection. Studies aimed at understanding the triggering mechanisms, probabilities, stress drops and maximum earthquake magnitudes in the areas of recent earthquake swarms in Arkansas, Colorado, Oklahoma, Ohio, Texas, and other CEUS regions where fluid injection into the subsurface is occurring should be directed to the EP panel (see the EP section, below).

CEUS Element I. Regional earthquake hazards assessments.

- Use geological, paleoseismological, paleotsunami, seismological, and geophysical studies, and studies of historical accounts to identify and assess the seismotectonics and seismic potential of source zones throughout the CEUS. Studies that seek to identify potentially seismogenic faults and discover the late Pleistocene and Holocene chronology of earthquakes in Oklahoma, Texas, and the New Madrid—Wabash Valley seismic zones are of particular interest. New LiDAR data acquired in the New Madrid region and the Virginia epicentral area by the earthquake hazards program in 2012-2014 is publicly available to assist in these studies at OpenTopography.org (New Madrid) and for Virginia at the USGS National Elevation Dataset site (<http://viewer.nationalmap.gov/viewer/>).
- Improve assessments of the earthquake and tsunami potential of the Puerto Rico trench and Antilles subduction zone, and associated hazards in U.S. Caribbean territories and along the U.S. Atlantic seaboard.
- For the Central Virginia Seismic Zone (CVSZ) and the epicentral region of the 1886 earthquake near Charleston, SC, priorities include:
 - Identifying and characterizing the Quaternary activity of the faults, and determining if they are new or reactivated faults;
 - Finding evidence of Quaternary-age M5.5 and larger earthquakes and associating the evidence with causative faults in the geologic record; and
 - Determining and describing the tectonic process that govern earthquakes in these areas and demonstrate how and why these areas are different from adjacent less seismically active areas.
- Systematically and comprehensively search for paleoliquefaction and other signs of strong shaking to define the occurrence of M5 and greater prehistoric earthquakes. The paleoseismic studies should also seek to address whether the clusters of historical seismicity represent areas that have produced M>6.0 earthquakes in the past.

- Infer earthquake source characteristics (including stress drop), calibrate seismic magnitudes, and characterize wave propagation and attenuation in the CEUS (including constraints on geometrical spreading and kappa).
- Improve estimates of site response and liquefaction using laboratory and field experiments and instrumental recordings of local earthquakes in the CEUS and large intraplate earthquakes in analog regions. Assess the liquefaction hazard in the New Madrid region, given the influence of agricultural pumping on ground water depth. Constrain ground motions at seismograph stations through site characterization studies of existing ANSS and Transportable Array (TA) stations. Use of seismic data from ANSS and EarthScope TA or flexible array stations is encouraged.
- Reduce uncertainties in the use of continuous GPS data in regions with low rates of seismic strain accumulation. Continue to examine whether the very small strain rates now known to exist in the CEUS are significantly different from zero. Incorporate geodetic data in targeted geodynamic modeling for assessment of earthquake-generation processes, and develop technical approaches to improve the quality and breadth of geodetic measurements from midcontinent geodetic networks.

CEUS Element III. **Research on earthquake occurrence, physics, and effects.**

- Develop physical models of long-term deformation in intraplate areas including both onshore and offshore areas of the CEUS. Proposals may seek to address topics such as the cause of large earthquakes, regional migration of seismicity and earthquake clustering as suggested by paleoseismological results, and interaction of known geological structures within the tectonic stress field.
- Systematically evaluate the temporal and spatial distributions of foreshocks and aftershocks of intraplate earthquakes to improve, for example, declustering of seismic catalogs, estimates of short-term earthquake probabilities, and understanding of earthquake processes. Proposals may seek to understand whether areas that have been seismically active historically represent aftershocks of larger prehistoric earthquakes.
- Build on the development of earthquake scenario impacts and risk, which may include earthquake time histories and earthquake ground motion simulations using regional velocity models, such as the velocity model developed at the USGS in Golden, Colorado.

CEUS Element IV. **Earthquake safety policy.**

- Improve the quality and extend the usefulness of the Memphis, TN, and Evansville, IN, urban hazard maps. Studies utilizing recently completed urban hazard maps in Memphis and Evansville may involve, but are not limited to, assessing social and structural vulnerability, cost-benefit analysis of adopting various levels of seismic provisions within building codes, earthquake scenarios, and loss estimation.
- Incorporate education and outreach to better inform and enable the public, decision makers, developers, and engineers. Studies could include, for example, an assessment and development of strategies to better disseminate information, promote earthquake hazards mitigation and broad awareness. Projects could include, for example, the development and presentation of media (e.g. pamphlets, videos, web content) outlining earthquake hazards in local regions. The proposal should also describe how past activities affected change in business or government preparedness plans and should include a plan for measuring the impact and “buy-in” of the outreach effort.

2. Priority Topics for Research on Earthquake Effects (EE)

Coordinator: David Wald, wald@usgs.gov

The EHP supports basic and applied, geographically broad research into the effects of earthquakes including better descriptions and characterization of shaking hazards, related ground deformation (liquefaction, landslides, lateral

spread), and related impacts on the natural and built environments.

EE Element III. Research on earthquake occurrence, physics, ground motions, and effects.

- Develop and improve methods for producing broadband (0.1-20 Hz) synthetic seismograms for large earthquakes, including near-source directivity pulses, fault fling, 3D basin effects, nonlinear soil response, scattering, topographic effects, and frequency-dependent radiation pattern. Develop and apply methods of combining dynamic simulations of complex rupture with wave propagation in 3D heterogeneous crustal models. Use recordings in urban areas of small earthquakes as empirical Green's functions for making synthetics for large earthquakes, also considering nonlinear site response. These methods should be developed for crustal and subduction zone earthquakes. These methods should be validated in the time and frequency (spectral response) domains by comparison with observed strong-motion records. We encourage proposals that use strong-motion and high-rate GPS data from recent large crustal and great subduction zone earthquakes.
- As a focus topic for the priority above, improve the estimation of long-period (2-6 sec period) ground motions for large crustal earthquakes and great subduction-zone earthquakes. Develop long-period synthetic seismograms that accurately model the effects of sedimentary basins, rupture incoherence, realistic fault geometry, and propagation through a realistically complex crustal structure.
- Improve observations relevant to predicting the shaking behavior of near-surface materials in high-risk urban areas. Characterize relevant soil parameters, conduct observational experiments to provide ground motion data, and study non-linear processes relevant to the behavior of thick sediments.
- Improve site characterization for building code and other applications. In particular, develop recommendations for improving soil classification methods and code site amplification factors; revise ground-motion prediction equations for use in engineering design and probabilistic seismic hazard analysis; and develop regional ground motion attenuation models and investigate the causes of regional variations. Develop sedimentary basin amplification terms and regional amplification factors for deep soil sites that could be included in future building codes.
- Improve predictive relationships between strong ground shaking and damage in buildings and other structures for implementation in probabilistic hazard maps, including the effects of basin surface waves, soil nonlinearity, soil-structure interaction, forward directivity, near-field and impulsive ground motions, long duration shaking, and surface rupture. Develop tools to use data from instrumented structures to predict earthquake response, monitor structural health, and assess the level of damage. Develop probabilistic methods to describe building performance in response to strong shaking. We encourage the use of data from ANSS instrumented structures (<http://nsmmp.wr.usgs.gov>).
- Improve predictive models of earthquake-triggered ground failures including landslides and liquefaction, to quantify ground failure susceptibility for hazard assessment; validate by comparison with macroseismic observations and field recordings. Develop and apply methods for probabilistic mapping of liquefaction and other types of failure, using the results of probabilistic ground-motion mapping.
- Develop and test computer programs for calculating nonlinear response of soils, by comparing predicted seismograms with recorded data. Develop and test computer programs for three-dimensional nonlinear wave propagation. Apply such codes to study basin surface waves, S-wave propagation in soft-soil deposits (fill and young alluvium) and deep sediments; and topographic amplification. Evaluate the variability and upper-bound limit of ground-motion distributions used in probabilistic seismic hazard assessment.
- Investigate the coherence and variability of earthquake ground motions using observations from seismic arrays. Analysis of data from various geologic conditions is encouraged, including sites on hard rock in the eastern U.S., soft-rock in the western U.S., and soil sites. Use this information to develop models of the spatial variation of seismic velocity.

3. Priority Topics for Research on Earthquake Physics and Occurrence (EP)

Coordinator: Nicholas Beeler, nbeeler@usgs.gov

Understanding earthquake phenomena and evaluating earthquake hazards requires research on the controlling processes. The EHP supports field, lab, theoretical and numerical studies to address these needs and to contribute to improved hazard assessment and risk-mitigation throughout the US. Of particular interest are studies that make use of data collected by USGS and its partner organizations, including the ANSS, geodetic networks, surface and borehole instruments in the San Andreas Fault system, and the USArray, the Plate Boundary Observatory (PBO) and the San Andreas Fault Observatory at Depth (SAFOD) components of EarthScope (www.earthscope.org).

EP Element III. Research on earthquake occurrence, physics, and effects.

- Refine and evaluate existing models, compile observational data to test models, or develop and test new predictive models for earthquake occurrence, failure, time to failure, and clustering. Goals of such efforts could be developing and vigorously testing methods for Operational Earthquake Forecasting of aftershock probabilities in near-real-time or developing models for the elastic rebound cycle, fault segmentation, cascading rupture, multi-segment rupture, the characteristic earthquake hypothesis, fault to fault jumps, and recurrence probability density. These may be probabilistic or deterministic, including earthquake simulators. Where possible, validate and test such models in coordination with the Collaboratory for the Study of Earthquake Predictability (CSEP) (<http://scecddata.usc.edu/csep>). Such efforts might include the development of new methods for the testing and validation of these models and understanding the effects of the changing catalogs and data uncertainties on the forecasts.
- Develop and test methods for evaluating the likelihood that subduction zones produce interplate thrust earthquakes that have the potential for launching trans-oceanic tsunamis. Emphasis is placed on using physics-based criteria for evaluating such hazard.
- Develop strategies for estimating time-dependent earthquake probabilities and the likelihood of strong shaking, to include the time of the last earthquake on a fault, and reflecting complex phenomena such as non-uniform earthquake slip, earthquake clustering fault interactions, transient deformation, cascading ruptures, and changeable or non-existent fault segment boundaries. Develop physical models and theory of multi-fault or multi-segment interactions, in particular addressing what factors control the location, occurrence time, and final extent of large earthquake ruptures.
- Quantify processes controlling fault stress and strain accumulation, transfer, and release in both interplate and intraplate settings. Apply findings to reconcile deformation rates inferred from geodetic, geologic, and seismic observations. Reconcile or develop improvements in understanding differences between depth of seismic rupture versus interseismic "locking" depth, in particular whether large earthquakes rupture into areas that are apparently slipping interseismically. Better determine the origin, mechanisms and duration of post-earthquake deformation, including the relation of deformation in and below the seismogenic zone to aftershocks.
- Refine and test fault constitutive laws, both at quasi-static and rapid fault slip rates, through laboratory, field, and seismic observations, heat flow studies, and numerical modeling. Use samples, core cutting analyses, downhole measurements and monitoring results from SAFOD and other fault-zone drilling projects, where relevant.
- Develop improved data sets on past earthquakes and test frequency-magnitude relationships with respect to empirical models and data. Improve methods for combining instrumental, historical and paleoseismic catalog data, and for assessing the quality, completeness, accuracy, and magnitude completeness of earthquake catalogs throughout the U.S.

- Assess the predictability of large earthquakes by focusing on the underlying physical processes and continue fault-monitoring experiments in search of possible earthquake precursors. Develop stochastic and deterministic models, including earthquake simulators that encapsulate the physical processes. Develop reliable time-dependent, intermediate-term earthquake forecasting techniques; where possible, validate and test such techniques in coordination with CSEP.
- Develop theory, models, and make field and laboratory measurements of fault zone structure, including damage, permeability, dilatancy, shear localization, alteration, mineralogy, roughness, shear zone width, and evolution of fault structure with accumulated offset and shear strain. Address and quantitatively determine differences in the physical properties between plate boundary faults such as the San Andreas and smaller scale fault zones, and further establish the implications of fault zone 'maturity' for seismicity, and fault and earthquake mechanics. Studies of post-seismic changes in properties, and earthquake occurrence using monitoring data, laboratory measurements on recovered core samples, active source studies, fault zone guided waves, borehole seismic networks, and other geophysical techniques are encouraged.
- Conduct field and laboratory studies to ascertain the mechanisms (e.g., fluid flow or fault rheology) responsible for episodic tremor and slip (ETS) as observed in subduction zones, on the San Andreas Fault or in other tectonic settings. Determine whether such phenomena are related to the occurrence of earthquake or acts as a trigger for large earthquakes or provide information that could otherwise help estimate time-dependent earthquake probabilities.
- Develop and test theory, methods and hypothesis relating properties of faults and the dynamics of the earthquake source to the intensity of ground motion in both the near-field and far-field regions. Assess methodologies for modeling earthquake kinematics from geophysical data including local, regional, and teleseismic waves, coseismic displacements and transient deformation. Combine field observations, laboratory data, and theoretical models, including earthquake simulators to develop physically consistent models of the earthquake cycle, including strain accumulation, earthquake nucleation, dynamic rupture, and post-seismic adjustment.
- Using field, theoretical, or laboratory studies, develop and test methods for evaluating the degree to which the injection of fluids at depth induces earthquakes. Of particular interest are analyses of data from designed, active field experiments or analyses of existing monitoring data that yield methods of anticipating, on the basis of injection parameters (injection rate, pressure, total volume), presence of nearby seismogenic faults, stress state and formation properties, the magnitude distribution of induced earthquakes and their contribution to seismic hazard. Use geophysical surveys and other means to detect and characterize potentially seismogenic faults in areas of Oklahoma and Texas undergoing fluid injection. Develop methods to determine whether earthquakes located in the vicinity of an injection activity are natural or induced. Test the feasibility of controlling earthquakes induced by an ongoing fluid injection activity so as to limit the seismic hazards posed by that operation. Estimate the effects of tectonic setting, by assessing, for instance, the likelihood that injection of wastewater near an active major fault triggers a large-magnitude earthquake. Develop forecasting models for induced seismicity and, as possible, test these models in conjunction with CSEP. Apply results from studies of earthquakes induced by fluid injection to improve our understanding of the processes leading to natural earthquakes.

4. Priority Topics for Intermountain West (IMW) Research
Coordinator: Rich Briggs, rbriggs@usgs.gov

Priorities for research in the IMW focus on the collection of data that directly contributes to updates of the U.S. National Seismic Hazard maps. High priority issues to be addressed in proposed work are listed below for each EHP

program element, although other proposal topics will be considered.

IMW Element I. **Regional earthquake hazards assessments.**

- Conduct Quaternary geologic, geomorphic, and paleoseismic investigations to estimate the recurrence, locations, and magnitudes of large prehistoric earthquakes on significant hazardous Quaternary faults in the IMW. Hazardous faults generally include those near urban areas that have slip rates of at least 0.1 mm/yr or those outside of urban areas that have slip rates of more than 0.2 mm/yr. Results of studies should address the needs of the National Seismic Hazard Map by supplying fault-related parameters such as the time of the last earthquake, slip rate, recurrence times, and slip per event, including uncertainties.

- Improve source models for IMW faults deemed priorities by each State (below). These studies could include investigations that determine late Quaternary slip rates, paleoseismic chronologies, earthquake recurrence, and segmentation of fault sources.
 - Arizona: Lake Mary, Big/Little Chino, Mead Slope, Hurricane, and Needles faults.
 - Colorado: Golden, Rampart Range, Ute Pass, Williams Fork Mountains, and Frontal faults.
 - Idaho: Lost River, Squaw Creek, Sawtooth, Beaverhead, and Lemhi faults.
 - Montana: Swan, Centennial/Madison, Continental, Bitterroot, and Brockton-Froid fault zones. For more information see <http://mbmgquake.mtech.edu/faultpriorities.html>
 - Nevada: A list of fault studies recommended by the Nevada Bureau of Mines and Geology is available at:
http://www.nbmg.unr.edu/Geohazards/Earthquakes/docs/NBMG_priorities_NEHRP_studies_March_2015.pdf
 - New Mexico: Rincon Ridge, Northern Alamogordo, Mesilla Basin, Albuquerque Basin, and Southern San Andres Mountains faults.
 - Utah: Priority faults deemed to need further study have been identified by the Utah Quaternary Fault Parameters Working Group (UQFPWG). An updated list of these priorities as defined by the UQFPWG is available at: http://geology.utah.gov/ghp/workgroups/pdf/NEHRP-2017_Priorities.pdf. To learn more about activities of the Utah Earthquake Working Groups, go to <http://geology.utah.gov/ghp/workgroups/index.htm>.
 - Wyoming: Teton, Grand Valley, Rock Creek, Greys River, and East Gros Ventre faults.

- Utilize new and existing LiDAR topographic data sets to conduct Quaternary geologic, geomorphic, and paleoseismic investigations for characterization of significant hazardous Quaternary faults in the IMW.

IMW Element III. **Research on earthquake occurrence, physics, effects, impacts and risks.**

- Conduct studies that address scientific issues that are particularly important for understanding the potential hazard posed by IMW faults, including
 - Empirical relations for M_{max}
 - Fault dips and the intersection of antithetic fault pairs
 - Fault structural segmentation versus rupture segmentation
 - Fault creep and afterslip
 - Long paleoseismic and slip histories (these may best be obtained at undisturbed sites away from urban settings)
 - Apparent odd scaling relations (e.g., short faults with large displacements)

- Collect geotechnical data that contribute to the development and refinement of community velocity models in urban areas of the IMW region. Specific areas of interest include but are not limited to parts of the Wasatch Front, Utah outside of Salt Lake Valley, and the Reno-Carson City urban corridor and Las Vegas urban area of

Nevada. Appropriate data sets could include, but are not restricted to, shear-wave velocities, density of near-surface units, attenuation measurements, basin geometry and structure, and mapping of subsurface faults and folds.

- Development of geological, geophysical, and geotechnical information is needed to characterize the effects of basin geometry, near-surface geology, and structure on strong ground motions and site amplification.
- Conduct studies to develop or improve broad deformational models in the IMW region, including, but not limited to, the Walker Lane and Wasatch front.
- The possible relationship between injection of fluids in the subsurface and swarms of earthquake is a topic of considerable recent scientific interest. PIs interested in proposing work on this subject should consult the Earthquake Physics (EP) priority list; proposals should be directed to the EP panel.

IMW Element IV. **Earthquake safety policy.**

- We invite proposals to foster collaboration (e.g. state or regional working groups) and community outreach on important problems in IMW urban areas, such as community velocity models, defining priority faults for further study, fault setback planning, or similar.

5. Priority Topics for National Research (NAT)

Coordinator: Mark Petersen, mpetersen@usgs.gov

Research activities should provide improvements to the science and data that can be applied to improve the National Seismic Hazards Maps and, with direct interaction with the National Earthquake Information Center (NEIC), develop improvements in the efficiency, operations, and products for the NEIC.

NAT Element I. **Regional earthquake hazards assessments.**

- Develop methods that use geodetic data to improve slip rate estimates along faults or across regions and recurrence of earthquakes that can be applied to seismic-hazard analyses. Construct kinematically self-consistent models of crustal deformation that integrate seismic, geologic, and geodetic data and from which hazard estimates can be derived.
- Develop new source models that incorporate more physics-based approaches into hazard assessments (e.g., ground-motion simulations or physics-based simulators).
- Develop new or improve existing ground-motion prediction equations or other strategies for ground motion and macroseismic intensity estimation (including exploiting macroseismic intensity data) that can be used to improve the U.S. National Seismic Hazard Map and to reduce uncertainty in ShakeMaps. Priority will be given to ground-motion prediction equations and strong-motion analyses that apply to earthquakes in the Central and Eastern U.S. in support of the NGA-East Project, to subduction zone earthquakes (both interface and deep intraslab) in the Pacific NW (see PNA priorities) and Alaska (see PNA priorities), to crustal fault earthquakes in the western U.S., and to earthquake sources in Hawaii and other island territories.
- Develop factors converting ground motions on hard rock site condition to NEHRP B/C boundary firm rock and other NEHRP site conditions, particularly for the eastern U.S. and near subduction zones. Develop an average shear-wave velocity profile for NEHRP B/C boundary and other NEHRP site conditions for these regions. We encourage modeling of observed spectra recorded at sites with V_{s30} around 760 m/s in these regions.

Address several priorities of the National Seismic Hazard Mapping Project, specifically:

- Improve techniques for discriminating earthquakes induced by water injection or other manmade effects from tectonic earthquakes. Develop earthquake catalogs of potentially induced earthquakes for different regions of the country. Develop new models to assess where future induced earthquakes occur, how often they occur, and how strong the ground will shake.
- Define uncertainties of parameters (e.g., slip rate, magnitudes, recurrence) and equations (e.g., magnitude-area relationships, depth to the top of rupture) used in developing the maps.
- Develop procedures for testing the consistency of the hazard models with observations.
- Contribute to extending the NSHMP hazard models to the risk of damage to buildings (and other structures) and associated losses.
- Develop other products that better communicate National Seismic Hazard Model Project products to 1) the general public 2) other professions who interpret USGS science 3) local officials or 4) engineers.
- Develop time-dependent earthquake recurrence models for those U.S. faults with adequate paleoseismic/historic information.
- Perform research on earthquake sources that can be used to better understand earthquake occurrence and ground motions in Hawaii and the U.S. territories. Develop new seismic source models, ground motion models, or other products that will help the National Seismic Hazard Model Project in updating the Hawaii hazard maps.

NAT Element II. Earthquake information, monitoring, and notification.

Address several priorities related to comprehensive global seismic monitoring to ensure collection of seismic source parameters of importance to the EHP.

- Improve the accuracy of automatic and rapid local, regional, and teleseismic event locations, determination of moment magnitude, improved local-magnitude to moment-magnitude scaling and estimates of source depth. Location procedures should significantly improve upon single-event location methods. Methodologies to improve earthquake locations may include use of global 3D travel time modeling, identification and use of well-located clusters (calibrated) of observed earthquakes or reference earthquakes, multi-event techniques, and innovative methods for the identification of depth phases for improved modeling of source depth.
- Develop improved methods for timing and classification/identification of seismic phase arrivals.
- Develop innovative methods to improve event detection and phase association/identification for local, regional and teleseismically recorded earthquakes. Methodologies may involve use of both high-frequency and long-period phase information with likelihood constraints and use of waveform correlation techniques.
- Develop automated or efficient manual techniques for classification and differentiation of mining blasts and tectonic earthquakes.
- Develop efficient methods to assess network capabilities for real-time network capability assessment and design of aftershock or sequence specific deployments.
- Refine and improve practical methods for rapid source mechanism, moment magnitude characterization, and rupture history (finite-fault models) for major earthquakes.

- Develop new products and procedures that will allow the USGS to deliver rapid and/or more accurate post-earthquake loss and risk information. Focus should be on shaking-induced casualties, building vulnerability, and loss estimate for worldwide events, as well as the impacts of secondary effects (including landslides and liquefaction).

6. Priority Topics for Research in Northern California (NC)

Coordinator: Jack Boatwright, boat@usgs.gov

Northern California component of the EHP is charged with determining seismic hazard throughout Northern California. The primary area of concern is the urbanized greater San Francisco Bay region, extending from Monterey to Willits, and from the Central Valley to the Pacific Coast: this extended region bears more than 25% of the nation's annualized seismic risk. Research in Northern California outside this heavily urbanized area is also supported. Note that the Cascadia subduction zone north of Cape Mendocino is assigned to the Pacific Northwest region, and Lake Tahoe and the Walker Lane deformation belt are assigned to the Intermountain West region. Principal Investigators are strongly encouraged to attend the Northern California Earthquake Hazards Workshop. Please contact the Regional Coordinator to learn more about the status of internally supported projects or to discuss potential proposals.

NC Element 1. Regional earthquake hazards assessment.

Conduct paleoseismic and other geological investigations of the behavior and location of active faults in Northern California. Priorities:

- Improve earthquake recurrence and slip history of active faults, especially the main plate boundary faults and subsidiary fault systems in the East Bay (modest proposals for pilot studies of potential paleoseismic trench sites are explicitly encouraged);
- Utilize available LiDAR datasets to improve understanding of active fault processes and to refine estimates of slip in historic and prehistoric earthquakes;
- Estimate Holocene geologic slip rates for the major and subsidiary fault systems in Northern California to improve regional deformation and earthquake recurrence models;
- Evaluate geological evidence for earthquake effects (tsunamis, landslides, liquefaction, ...) with particular concern for the risk to populated areas.

Use crustal deformation measurements to constrain regional deformation rate, fault slip rates, fault creep, fault mechanics, strain transients, and models of stress evolution for Northern California. Priorities:

- Determine bounds on deformation rates across the San Andreas, Hayward-Rodgers Creek, West Napa, and Calaveras-Green Valley-Bartlett Springs fault systems;
- Integrate the range of geodetic observations (e.g., GPS, InSAR, strainmeter, LiDAR, creepmeter) with other available information (e.g., stress orientations, focal mechanisms, seismicity rates, repeating earthquakes, alignment arrays, and fault zone geology) to develop and test detailed models of crustal deformation with particular concern for the eastern Bay Area;
- Integrate real-time GPS data with broadband seismic and accelerometer data for research and earthquake response applications.

The 2014 M6 earthquake near Napa generated extensive sets of geologic, geodetic, seismic, and engineering data.

Priorities:

- Characterize the extent of slip in the earthquake and in paleoseismic earthquakes on the West Napa fault; exploit these datasets to estimate or constrain slip rate;
- Use seismic and geophysical methods to investigate the shallow and deep velocity structure underlying Napa, American Canyon, and Vallejo to evaluate the propagation characteristics in the region and to improve models of the strong ground motion.

Seismic hazard assessment in the San Joaquin-Sacramento Delta region and for the Sacramento River Delta levee system is a critical concern. Priorities:

- Improve estimates of earthquake recurrence of active faults proximal to the San Joaquin-Sacramento Delta, in particular, the Concord-Green Valley-Bartlett Springs fault system, and the Greenville, Midland, and Tracy faults;
- Estimate P and S-wave velocity and attenuation structure of the western Sacramento Valley;
- Determine viable methods for synthesizing ground motions in the Delta from a range of potential earthquake sources;
- Develop and implement methods to assess the earthquake hazard to the levee system.

Validate and improve community regional 3D geologic and seismic velocity models for the Bay Area and Northern California, with particular concern for the East Bay, Napa and Sonoma Valleys, Livermore Valley, and the Sacramento Delta.

- Generate long-period (10 s) simulations for scenario earthquakes in the Bay Area;
- Assess accuracy of synthetic ground motions with the goal of correcting model parameters;
- Develop methods for incorporating very shallow physical properties (e.g., V_{s30} estimates or Quaternary sediments) and fault zone properties into these 3D models. Evolve the regional attenuation model to incorporate the ground motion recordings from the South Napa earthquake.

NC Element 2. **Earthquake information, monitoring, and notification.**

Integrate and improve seismic monitoring efforts in Northern California. Priorities:

- Develop methods to access and present historical seismicity and repeating earthquakes in Northern California to enable recognition of anomalous or precursory behavior;
- Deploy and analyze free-field and borehole seismic instruments recordings of moderate earthquakes to discern source characteristics and regional and 3D propagation effects with the goal of predicting ground motion from scenario earthquakes, particularly along critical lifelines and levees

NC Element 3. **Research on earthquake occurrence, physics, effects, impacts, and risks.**

Develop, evolve, and test probabilistic models for earthquake rupture in Northern California, in coordination with the Uniform California Earthquake Rupture Forecast (UCERF). Proposed investigations should make use of tools and methods provided by the recent UCERF3 Report. Priorities:

- Update the Northern California fault set in Community Fault Model;
- Refine strain rates and deformation models used in assigning slip rates to faults and evaluating off-fault deformation
- Test distributions of UCERF3 estimates of segment recurrence intervals using simulated earthquake fault systems.

NC Element 4. **Earthquake safety policy.**

Develop and disseminate earthquake hazard products for Northern California. Priorities:

- Organize collaborative and educational workshops that bring together a broad range of scientists, engineers, planners, emergency service providers, and local administrators to spur earthquake mitigation, preparedness, and resilience in the Bay Area and Northern California;
- Improve and coordinate earthquake information websites as comprehensive resource, education, and emergency management tools for disseminating earthquake mitigation and preparedness information, earthquake hazard products, and post-earthquake information for Northern California. Explore the use of social media to aid emergency response and spur mitigation efforts.

7. Priority Topics for Research in the Pacific Northwest and Alaska (PNA)

Research priorities for the Pacific Northwest and Alaska are considered by a combined panel, but specific priorities are listed separately below.

Priorities Topics for Research in the Pacific Northwest (PNA)

Pacific Northwest Coordinator: Joan Gomberg, gomberg@usgs.gov

Priority issues are listed below for each EHP program element, although other topics will be considered. Studies proposed should advance understanding of earthquake-related processes and their variability within the Cascadia and other relevant subduction zones, by stating and testing new hypotheses and/or developing and employing novel data sets and analyses. Where appropriate, use of the following data sources is encouraged: 1) Advanced National and Canadian National Seismic Networks and strong motion networks in Cascadia; 2) the NSF-sponsored Cascadia initiative onshore-offshore seismic deployments and high-rate GPS and other geodetic networks; 3) Earthscope Plate Boundary Observatory strainmeters, tiltmeters, and strong motion sensors; 4) high-resolution Lidar, InSAR, potential field, and other remote sensing data; 5) the Pacific Northwest Geodetic Array (PANGA) GPS stations and tiltmeters, and 6) the Ocean Networks Canada and Oceans Observatory Initiative off-shore cabled networks. Studies centered outside the Pacific Northwest of earthquakes, their impacts and other tectonic processes (e.g. Tohoku, Japan; Maule, Chile; Christchurch, New Zealand earthquakes) may also be proposed when clearly linked to understanding processes in Cascadia.

PNW Element I. Regional earthquake hazards assessments

- For Cascadia plate-boundary earthquakes: Clarify down-dip and up-dip limits of the locked zone, conditional probabilities of long and short ruptures, and along-strike trends in these parameters.
- Validate observationally ground motion models applicable to hazard maps at national to urban scales, and as inputs to building codes, ground-failure mapping, and long-term planning.
- Develop approaches and observational inputs for aftershock forecasting that account for potential differences in loading and relaxation processes among crustal, interplate and intraplate faults in the Pacific Northwest and Alaska.
- For faults in the North America plate: Improve estimates of sizes, recurrence intervals, and effects of late Quaternary earthquakes in the Puget Sound region, the Yakima fold and thrust belt and the Columbia Plateau, and Portland and Tualatin basins and vicinity.

PNW Element II. Earthquake information, monitoring, and notification.

- Develop and test new approaches to integrating seismic and geodetic data and a priori information in monitoring operations, applicable to earthquake early warning, routine earthquake monitoring, tsunami warning, and slow slip detection and characterization.
- Develop region-specific relationships for inferring seismic wave velocities and other physical properties from measured data. Provide local and regional information on shallow crustal structure (e.g., sedimentary basins) to improve the existing 3D seismic velocity models for Cascadia, with application to locating earthquakes, simulating ground motions, determining source mechanisms, evaluating sedimentary basin ground motion amplification, and the calculating of probabilistic hazard maps.

PNW Element III. Research on earthquake occurrence, physics, ground motions, and effects.

- Improve estimates of fault-zone properties, such as degree of coupling and failure strength, that may influence rupture area and seismic slip on the Cascadia plate boundary.

- Conduct observational studies, develop models that explain and quantify the relationship between slow slip events (e.g., ETS) and earthquake potential.
- Evaluate the potential interactions between subduction-zone, Benioff-zone, and crustal faults and the impacts of such interactions on seismic hazard.
- Develop physical and statistical models that may be used in earthquake forecasts for the variety of source types and seismicity patterns in Cascadia.
- Use numerical models or data from analog earthquakes elsewhere to test and refine predictions of strong-ground motions from M8-9 earthquakes on the Cascadia subduction zone, including long durations and long period ground motions.

PNW Element IV. Earthquake safety policy.

- Engage user communities to assess the efficacy of existing earthquake products, and to elicit their suggestions for improvements and new products.
- Develop new metrics and tools for conveying seismic hazard to the general public and targeted user groups, such as emergency responders, public utilities, risk managers, and engineers. Collaborative product development, which involves users in the stages from product conception to implementation and evaluation, is particularly encouraged.
- Work with state and local agencies to provide earthquake hazard information needed for risk assessments and mitigation and response planning (e.g. as outlined in the “Resilient Washington State” and “Oregon Resilience Plans” documents; http://www.oregon.gov/OMD/OEM/osspace/docs/Oregon_Resilience_Plan_Final.pdf and http://www.emd.wa.gov/about/documents/haz_FinalRWSReport.pdf).
- Develop approaches for communicating information about earthquake hazard, forecasts, and risk to decision makers, emergency responders, and the public in the Pacific Northwest. Approaches that build on existing relationships and communications channels, particularly those that cross state and national boundaries and various levels of government are encouraged.

Priorities Topics for Research in Alaska (PNA)

Alaska Coordinator: Peter Haeussler, pheuslr@usgs.gov

There is a need for basic information to characterize the active earthquake sources in Alaska for use in updating the seismic hazard maps of Alaska. The EHP encourages proposals for studies that complement existing or planned NSF GeoPRISMS projects that take advantage of the EarthScope’s Transportable Array deployment beginning in 2014.

Alaska Element I. Regional earthquake hazards assessments.

- Improve the paleoseismic and paleogeodetic record of large to great earthquakes and tsunamis on the Alaska-Aleutian megathrust, including assessing the persistence, or non-persistence of rupture boundaries, and whether or not creeping sections of the megathrust have produced past great earthquakes.
- Conduct geodetic field studies and/or modeling of geodetic data to resolve plate coupling and the role of aseismic slip on the potential for, and/or recurrence time of, large earthquakes along the Alaska-Aleutian megathrust.
- Develop methods and utilize geodetic data to estimate slip rates along faults or across regions that can be applied to seismic-hazard analyses. Construct kinematically self-consistent models of crustal deformation that integrate seismic, geologic, and geodetic data from which hazard estimates can be derived.

- Use GPS and/or seismic data to define the location, length, and nature of slow slip events in Alaska, and particularly their relationship to significant earthquakes, or earthquake potential, along the Alaska-Aleutian megathrust.
- Improve the understanding of active faulting, historical seismicity, and the paleoseismic record of large earthquakes on major crustal faults in Alaska, including the Denali, Totschunda, Fairweather, Queen Charlotte, Castle Mountain, Tintina, and Kaltag faults, and on subsidiary and related faults such as the Northern Foothills Fold and Thrust Belt. In particular, increase knowledge of the Queen Charlotte-Fairweather fault system and its geologic structure and tsunami potential. Specifically, determine the relations among the 1949 Queen Charlotte-Fairweather rupture, the 2012 Haida Gwaii earthquake, and 2013 Craig earthquake.
- Conduct onshore or offshore studies to understand the active faults, earthquake history, and seismic potential on and near major crustal faults in Alaska. Studies of offshore, potentially tsunami-generating faults are particularly encouraged.
- Improve ground motion models for subduction interface and deep intraslab earthquakes for use in the Alaska update of the National Seismic Hazard Maps (see NAT priorities).
- Evaluate and map earthquake-induced ground-failure potential (liquefaction, landslides, etc.) in urban areas and along Alaska's principal transportation corridors.

Alaska Element II. **Earthquake information, monitoring, and notification.**

- Develop region-specific relationships for inferring seismic wave velocities from seismic or rock type data. Develop 3D community seismic velocity models for Alaska that are validated against earthquake catalog data to support improving earthquake locations, simulating ground motions, determining source mechanisms, evaluating sedimentary basin ground motion amplification and the calculation of probabilistic hazard maps.

Alaska Element III. **Research on earthquake occurrence, physics, ground motions, and effects.**

- Evaluate the potential interactions among subduction-zone faults, Benioff-zone faults, and crustal faults and the impacts of such interactions on seismic hazard.
- Develop physical and statistical models that may be used in earthquake forecasts for the range of source types and seismicity patterns in Alaska.
- Develop empirical or simulation-based ground motion models that incorporate three-dimensional seismic structure and consider a range of earthquake source scenarios.

Alaska Element IV. **Earthquake safety policy.**

- Engage the user community in assessing the value of existing earthquake products, and elicit their suggestions for improvements and new products.
- Develop new methods, tools, and metrics for conveying seismic hazard to the general public and targeted user groups, such as emergency responders, public utilities, risk managers and engineers. Collaborate with product developers to involve product users in all stages from product conception to implementation and evaluation.

8. Priority Topics for Research in Southern California (SC)

Coordinator: Robert Graves, rwgraves@usgs.gov

Southern California is a region of complex geology containing large mountain ranges, deep sedimentary basins and numerous active faults. To better quantify the hazard from future earthquakes in this region, it is necessary to continue to improve our understanding of fault characterization, earthquake rupture properties and seismic wave propagation at local and regional distances using a combination of field observations, analysis of monitoring data and modeling approaches. Research activities that utilize monitoring data from the regional seismic and geodetic networks are strongly encouraged.

SC Element I. **Regional earthquake hazards assessment.**

- Determine the activity of faults in southern California using paleoseismology, geomorphology, and geologic mapping; integrate field observations with new and complimentary data such as LiDAR and high-resolution aerial photography and imaging.

- Develop and test ground motion simulation models with application to addressing seismic hazards in southern California.

- Develop regional models of active deformation and fault and earthquake interactions.

- Develop new, improved, or alternative models of 3D seismic velocity structures and fault representations. These models may be refinements or extensions of the existing SCEC Community Fault and Velocity Models.

- Develop methods for incorporating very shallow physical properties into these 3D models.

- Develop a regional 3D seismic attenuation model.

- Develop, refine, and test probabilistic models for earthquake rupture using the tools and methods provided by the Uniform California Earthquake Rupture Forecast-3 (UCERF3) Report.
 - Refine strain rates and deformation models used in assigning slip rates to faults and evaluating off-fault deformation.
 - Test distributions and assumptions of segment recurrence intervals.
 - Test sensitivity of earthquake probabilities to variations in model rules for fault rupture.
 - Set up and perform hypothesis testing on models of earthquake recurrence, earthquake nucleation, and earthquake forecasting.
 - Improve statistical quantification of earthquake sequences and regional seismicity, for example analyses of foreshock and aftershock productivity rates.
 - Develop and test models of rupture probabilities including consideration of time dependence and dynamic and static stress transfer.
 - One goal of such efforts could be developing and vigorously testing methods for dynamic earthquake likelihood forecasting aftershock probabilities in near-real-time.

SC Element II. **Earthquake information, monitoring, and notification.**

- Use seismic data to determine earthquake source parameters and crustal structure and the state of stress in the crust, including further development and testing of 2- and 3-D structural models.

- Collaborate with the USGS and university-based seismic and geodetic networks to enhance tools needed for accurate and rapid portrayal of the severity and geographical distribution of strong ground shaking, surface rupture, and ground deformation.

SC Element III. **Research on earthquake occurrence, physics, effects, impacts and risks.**

- Explore, via dynamic rupture modeling or other approaches, the prospect for earthquake ruptures that involve multiple fault segments, stepovers or multiple distinct faults.
- Compile seismic, structural, geotechnical, and geologic data from surface and bore-hole observations necessary to predict regional ground motions; develop models to estimate variations in expected ground motions, accounting for bedrock excitation, local geological structure, topography, and soil-structure interaction.
- Develop methodologies to characterize earthquake ruptures (dynamic, pseudo-dynamic and/or kinematic) for use in ground motion simulations. Approaches including multi-segment ruptures and/or complex fault geometries are encouraged.
- Use ground motion simulations and/or recordings of past earthquakes to quantify the expected level and distribution of shaking over a broad frequency range (e.g. 0-20 Hz) for future large earthquakes in the southern California region. Approaches should include effects of heterogeneous finite-fault rupture, wave propagation through complex geologic media, and response of site-specific geologic conditions.
- Characterize the nature and behavior of fault segmentation and clarify the roles of seismic and aseismic processes; evaluate seismogenic thickness and/or the percentage of aseismic slip.
- Improve the understanding of fault properties and/or earthquake processes by developing models that can be tested with geological or seismological observations.
- Use crustal deformation measurements to constrain the regional deformation rates, fault slip rates, the role of fault creep, fault mechanics, strain transients, and models of stress evolution for southern California.
- Develop methods for improved analysis and modeling of precise geodetic data such as GPS data, InSAR data, and airborne laser swath mapping data.

SC Element IV. **Earthquake safety policy.**

- Compile and provide access to geotechnical, structural, and seismic databases that can be incorporated into EHP products (e.g., ShakeMap, ShakeCast) with the goal of providing useful information for mitigation and emergency response efforts, and with particular emphasis on the southern California region.
- Investigate the applicability of "Drop, Cover, and Hold" as well as other safety advice as recommended responses to felt earthquakes and/or earthquake early warnings through studies designed to survey past research, identify issues, and develop recommendations for further study.

**USGS Earthquake Hazards Program Grant
Proposal Information Summary**

Use the format below for the **required** Proposal Information Summary

1. Panel Designation: Use the short letter code or panel name as listed in Section 12 & in Attachment A
2. Project Title: If a collaborative proposal, the title of the proposal must appear as follows:
"Title of Proposal: Collaborative Research with First Institution Name, and Second Institution Name".
3. Principal Investigator(s): (Name)(s) **List all PIs/Co-Is for the proposal here & all contact information**
(Institute/Organization Name)
(Street Address/P.O. Box)
(City, State, Zip Code)
(Telephone Number), (FAX Number), (E-mail Address)
4. Authorized Institutional Representative: (Name)
(Institute/Organization Name)
(Organizational Unit)
(Street Address/P.O. Box)
(City, State, Zip Code)
(Telephone Number), (E-mail Address)
5. Amount Requested: (List amount requested for Fiscal Year 2017 support)
(Two year projects: list requests for FY 2017 and 2017 separately)
6. Proposed Start Date: (The date you would like to start work; between
December 1, 2016 and September 1, 2017)
7. Proposed Duration: (12 or 24 months, No awards are issued for less than 12 months)
8. New Proposal (If submitting a proposal for a project related to a current or recent USGS award,
indicate the appropriate USGS award number and title)
9. Re-submittal Proposal (Include title of previous proposal to USGS-EHP—the re-submitted proposal
should identify changes made since original submission to USGS-EHP)
10. Has this proposal been submitted to any other organization for funding, if so, which? (Note name(s) of agency, and program or division to which
this proposal was submitted)
11. List any know CRADAs between the USGS and applicant (List title of CRADA, name of USGS representative
and program under which CRADA entered)

BUDGET SUMMARY¹

Project Title: _____

Principal Investigator(s): _____

Proposed Start Date:

Proposed Completion Date:

COST CATEGORY	Federal First Year	Federal Second Year²	TOTAL Both years²
1. Salaries and Wages (list each person separately)	\$	\$	\$
Tuition/Tuition Remission	\$	\$	\$
Total Salaries and Wages	\$	\$	\$
2. Fringe Benefits/Labor Overhead	\$	\$	\$
3. Equipment	\$	\$	\$
4. Supplies	\$	\$	\$
5. Services or Consultants	\$	\$	\$
6. Radiocarbon or other Dating	\$	\$	\$
7. Travel	\$	\$	\$
8. Publication Costs	\$	\$	\$
9. Other Direct Costs	\$	\$	\$
10. Total Direct Costs (items 1 thru 9)	\$	\$	\$
11. Indirect cost/General and Administrative (G&A) cost	\$	\$	\$
12. Amount Proposed (items 10+11)	\$	\$	\$
13. Applicant's contribution to Project Cost	\$	\$	\$
14. Total Project Cost (Total of Federal and non-Federal amounts)	\$	\$	\$

¹ **Use this format** for the required Budget Summary. The detailed budget **must** be keyed directly to the Budget Summary page.

² These Columns only for two-year projects

Special Terms and Conditions

1. Acceptance

Acceptance of a Federal Financial Assistance award from the Department of the Interior (DOI) carries with it the responsibility to be aware of and comply with the terms and conditions of award. Acceptance is defined as the start of work, drawing down funds, or accepting the award by signature or electronic means. Awards are based on the application submitted to and approved by DOI and are subject to the terms and conditions incorporated either directly or by reference below.

2. Method of Payment

Payments under financial assistance awards must be made using the Department of the Treasury Automated Standard Application for Payments (ASAP) system (www.asap.gov).

- a. The Recipient agrees that it has established or will establish an account with ASAP. USGS will initiate enrollment in ASAP. If the Recipient does not currently have an ASAP account, they must designate an individual (name, title, address, phone and e-mail) who will serve as the Point of Contact (POC). All recipients, including foreign entities, must have a DUNS number and a EIN/TIN number in order to receive payment.
- b. With the award of each grant, a sub-account will be set up from which the Recipient can draw down funds. After recipients complete enrollment in ASAP and link their banking information to the USGS ALC (14080001), it may take 7-10 days for sub-accounts to be activated and for funds to be authorized for drawdown in ASAP.
- c. Inquiries regarding payment should be directed to ASAP at 855-868-0151.
- d. Payments may be drawn in advance only as needed to meet immediate cash disbursement needs.

Payment to Foreign Recipients

A waiver has been granted by the Associate Director for Administrative Policy and Services because this award involves payments to a foreign Recipient.

Payment will be made by Treasury Check upon receipt of a properly prepared SF-270, Request for Advance or Reimbursement. Submit the SF-270 form to the Contracting Officer at the following address:

Margaret Eastman, Contracting Officer
U.S. Geological Survey
Office of Acquisition and Grants
12201 Sunrise Valley Drive, MS205
Reston, VA 20192

Requests should be submitted on a quarterly basis. Request for the entire award amount will be denied. Payments may be drawn in advance only as needed to meet immediate cash disbursement.

3. Definitions

A. Grant Agreement

A grant agreement is the legal instrument reflecting a relationship between the Federal Government and a State or local government or other recipient whenever:

- (1) the principal purpose of the relationship is the transfer of money, property, services, or anything of value to the State or local government or other recipient in order to accomplish a public purpose of support or stimulation authorized by Federal statute, rather than acquisition, by purchase, lease, or barter, of property or services for the direct benefit or use of the Federal Government; and
- (2) no substantial involvement is anticipated between the executive agency, acting for the Federal Government, and the State or local government or other recipient during performance of the contemplated activity.

B. Cooperative Agreement

A cooperative agreement is the legal instrument reflecting a relationship between the Federal Government and a State or local government or other recipient whenever:

- (1) the principal purpose of the relationship is the transfer of money, property, services, or anything of value to the State or local government or other recipient to accomplish a public purpose of support, or stimulation authorized by Federal statute, rather than acquisition, by purchase, lease, or barter, of property or services for the direct benefit or use of the Federal Government; and
- (2) substantial involvement is anticipated between the executive agency, acting for the Federal Government, and State or local government or other recipient during performance of the activity.

C. Grantee /Cooperator

Grantee or cooperator means the nonprofit corporation or other legal entity to which a grant or cooperative agreement is awarded and which is accountable to the Federal Government for the use of the funds provided. The grantee or cooperator is the entire legal entity even if only a particular component of the entity is designated in the award document. For example, a grant or cooperative agreement award document may name as the grantee one school or campus of a university. In this case, the granting agency usually intends, or actually requires, that the named component assume primary or sole responsibility for administering the grant-assisted project or program. Nevertheless, the naming of a component of a legal entity as the grantee or cooperator in a grant or cooperative agreement award document shall not be construed as relieving the whole legal entity from accountability to the Federal Government for the use of the funds provided.

The term “grantee” or “cooperator” does not include secondary recipients such as sub grantees, contractors, etc., who may receive funds from a grantee pursuant to a grant.

D. Recipient

Recipient means grantee or cooperator.

E. Principal Investigator

The Principal Investigator is the individual designated by the Recipient (and approved by the USGS) who is responsible for the technical direction of the research project. The Principal Investigator cannot be changed or become substantially less involved than was indicated in the Recipient's proposal, without the prior written approval of the Contracting Officer.

F. Grants Program Manager

- (1) The Grants Program Manager will work closely with the Principal Investigator to ensure that all technical requirements are being met. The Grants Program Manager's responsibilities include, but are not limited to, providing technical advice on the accomplishment of the proposal's objectives; reviewing the technical content of reports and the other information delivered to the USGS; determining the adequacy of technical reports; and conducting site visits, in coordination with the Regional Coordinator and the Contracting Officer, as frequently as practicable.
- (2) The Grants Program Manager is Elizabeth Lemersal, External Research Support Manager, U.S. Geological Survey, 905 National Center, 12201 Sunrise Valley Drive, Reston, VA 20192. The Grants Program Manager does not have the authority to issue any technical direction which constitutes an assignment of additional work outside the scope of the award; in any manner causes a change in the total cost or the time required for performance of the award; or change any of the terms, conditions, or general provisions of the award.

G. Regional Coordinator

- (1) Regional Coordinators are in charge of conducting the peer review panels to evaluate both internal USGS and external research proposals in their region or area of expertise. A Regional Coordinator will work closely with the Grants Program Manager and the Principal Investigator to ensure coordination with other appropriate Principal Investigators and appropriate USGS project scientists working in the same region for overall conformance with USGS program goals and objectives within that region. The Regional Coordinator's responsibilities include, but are not limited to, providing technical advice on the accomplishment of the proposal's objectives; reviewing the technical content of reports and other information delivered to the USGS; determining the adequacy of the technical reports; and conducting site visits, in coordination with the Grants Program Manager and contract personnel, as frequently as practicable.
- (2) The Regional Coordinator does not have the authority to issue any technical direction which constitutes an assignment of additional work outside the scope of the award; in any manner causes a change in the total cost or the time required for performance of the award; or changes any of the terms, conditions, or general provisions of the award.

H. Contracting Officer (CO)

Contracting officers are individuals who have been delegated in writing by the USGS Office of Acquisition and Grants as the sole authority designated to obligate Federal funds and create terms and conditions of awards. They are the only individuals who have authority to negotiate, enter into, and administer awards resulting for this program. Contracting officers have responsibility to ensure the effective use of Federal funds.

Functions of the contracting officer include but are not limited to:

- (1) Issuing the grant program announcement in coordination with the grants program manager.
- (2) Receiving grant proposals and related documents in response to a grant program announcement. The contracting officer as receiving official shall mark all proposals with a control number and the date officially received. He shall notify each applicant of the receipt of its proposal.
- (3) Approving the grant program manager's Technical Evaluation Plan, which describes in detail the evaluation process for a competitive grant/cooperative agreement program. The contracting officer shall

ensure the openness and fairness of the evaluation and selection process.

- (4) Serving in an advisory capacity at peer review panel meetings. He shall interpret grant management policies to panel members.
- (5) Notifying grant program applicants whether or not they were selected for funding or of any other disposition of their application.
- (6) Negotiating, as necessary, the final grant/cooperative agreement budget.
- (7) Issuing grant/cooperative agreement awards and revisions to awards.
- (8) Approving invoice payments.
- (9) Receiving all requests for changes to an award. The contracting officer shall serve as the mandatory control point for all official communications with the grantee which may result in changing the amount of the grant/cooperative agreement, the grant/cooperative agreement budget, or any other terms and conditions of the grant.
- (10) Receiving financial reports required by the terms and conditions of the award.
- (11) Closing out grant/cooperative agreement awards when all applicable award requirements have been complied with.

4. Dissemination of Results and Reporting Requirements

The Grantee is strongly encouraged to disseminate research results promptly to the scientific community and appropriate professional organizations; local, state, regional and federal agencies; and the general public. It is the expectation of the USGS that Grantees will publish the results of any funded project in peer-reviewed scientific or technical journals. In addition, all data products and computer codes must be made readily available to the public. In accordance with 43 CFR 12.935 and 2 CFR 200.315(b), the Federal Government is hereby granted a royalty-free, nonexclusive and irrevocable right to reproduce, publish, or otherwise use the work for Federal purposes, and to authorize others to do so.

Data generated as a part of work funded under this program must be made readily available; there is no provision for Grantees to have exclusive access to data for a proprietary period of time. In accordance with 43 CFR 12,935 and 2 CFR 200.315(b), the Federal Government is hereby granted the right to receive, reproduce, publish, or otherwise use all data developed as a result of this award in any manner and for any purpose, without limitation, and may authorize others to do the same for federal purposes. Any project funded under the Earthquake Hazards Program External Support shall fall under this clause. Should any questions arise, both the USGS Contracting Officer and the Recipient will determine which data fall in this category.

A Data Management Plan is required for all grants. The Data Management Plan should describe standards and intended actions for acquiring, processing, analyzing, preserving, publishing and other means of sharing data, and should describe data and metadata, identify how quality will be maintained, address how data will be backed up, and how data holdings will be secured. More information about Data Management can be found at <http://www.usgs.gov/datamanagement/plan.php>.

Grantees are subject to applicable regulations governing patents and inventions, including government-wide regulations issued by the Department of Commerce at 37 CFR part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements." Grantee agrees to disclose every subject invention which may be patentable or otherwise protectable within 60 days

of the time that an inventing party reports such invention to the person(s) responsible for patent matters in the inventing organization. These disclosures should be in sufficient enough detail to enable a reviewer to make and use the invention. Grantees may retain the entire right, title, and interest throughout the world to each subject invention subject to the provisions of this clause, and 35 U.S.C. 203. With respect to any subject invention in which the Grantee retains title, the Federal Government shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States the subject invention throughout the world.

If Grantees enters into an Award with a contractor, consultant, grantee, or third-party collaborator to perform any portion of this Project, such Grantee shall notify all parties to the Project and provide information about the third party involvement within 7 days of engagement. The Grantee agrees that they will comply with and advise any contractors, consultants, or third party collaborators to comply with all applicable Executive Orders, statutes, and regulations related to this Award.

A. **Required reports/documents.** The Principal Investigator or Director, Sponsored Research Office is required to submit the following reports or documents:

Report/ Document	No. of Copies and Method of Transmittal	Submit To	When Due
(1) Publication*	Adobe Acrobat PDF file as an email attachment (or 1 reprint if PDF not possible)	Grants Program Manager	Immediately following publication. See Section B(1).
(2) Final Technical Report **	Send Adobe Acrobat PDF file as an email attachment; Maximum size: 10 MB	Grants Program Manager	Within 90 calendar days after the end of the award project period See details of formatting in section B(2) below.
(3) Annual Financial Reports, SF 425, Federal Financial Report	Electronic submission	USGS via Fedconnect (www.fedconnect.net)	See Section 4.B(3)
(4) Final SF 425 Federal Financial Report	Electronic submission	USGS via Fedconnect (www.fedconnect.net)	See Section 4.B(4)

* Publication means any book, report, photograph, map, chart, or recording published or disseminated to the scientific community. Preprints of articles accepted for publications will be accepted as final reports.

** One Final Technical Report is to be submitted for each set of collaborative research grants with all PIs, Institutions, and grant numbers cited.

B. **Report preparation instructions.** The Recipient shall prepare the reports/documents in accordance with the following instructions:

(1) **Publications.**

(a) Acknowledgment of Support

Recipient is responsible for assuring that an acknowledgment of USGS support:

1. is made in any publication (including World Wide Web pages) of any material based on or developed under this Agreement, in the following terms:

“This material is based upon work supported by the U.S. Geological Survey under Grant/Cooperative Agreement No. (*insert award number*).”

2. is orally acknowledged during all news media interviews, including popular media such as radio, television and news magazines.

(b) Disclaimer

Recipient is responsible for assuring that every publication of material (including World Wide Web pages) based on or developed under this Agreement, contains the following disclaimer:

“The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Geological Survey.”

(c) Publication

Publication of the results of any project carried out under this assistance award is authorized in professional journals, trade magazines, or may be made by the USGS. Such manuscripts or publications submitted to journals or professional publications for publication shall be accompanied by the following notation:

“This manuscript is submitted for publication with the understanding that the United States Government is authorized to reproduce and distribute reprints for Governmental purposes.”

(d) Copies for USGS

One copy of each article planned for publication shall be submitted to the USGS Project Officer simultaneously with its submission for publication. One reprint of each published article shall be submitted to the USGS Project Office immediately following publication.

Submit an Adobe Acrobat PDF file of publications to: gd-erp-coordinator@usgs.gov

- (2) **Final Technical Report.** Final Technical Reports shall describe in detail the work performed and results obtained during the grant period. Final Technical Reports are due 90 days after the conclusion of the project period. Any information contained in a previously submitted progress report shall be repeated or restated in the Final Technical Report. Please note that one Final Technical Report is to be submitted for each set of collaborative research grants.

- (a) Submit the Final Technical Report as an Adobe Acrobat PDF file with all figures, photographs, maps, and illustrations embedded, and all pages numbered. Submit the report as an e-mail attachment in PDF format to:

gd-erp-coordinator@usgs.gov

Maximum size; 10 MB

- (b) Final Technical reports shall consist of the following sections:

- (1) **Cover page** with the following information:
Award Number

Title. For collaborative projects the title should be in the form "Title: Collaborative Research with First Institution name, and Second Institution name."

Author(s) and Affiliation(s) with Address and zip code

Author's Telephone numbers, fax numbers and E-mail address

Term covered by the award (start and end dates)

(2) **Abstract**

(3) **Main body of the report.** The main body of the report and all illustrations and figures shall be single-spaced on 8 ½" x 11" paper.

(4) **Bibliography** of all publications resulting from the work performed under the award. One copy of each publication is required if the Recipient has not previously submitted them to the Grants Program Manager.

(3) **Annual Financial Reports.** The recipient will submit annual STANDARD FORM 425, FEDERAL FINANCIAL REPORT(S) for each individual USGS award. The SF-425 is available at - http://www.whitehouse.gov/omb/grants_forms. The SF-425 will be due ninety (90) calendar days after the grant year (i.e., 12 months after the approved effective date of the grant agreement and every 12 months thereafter until the expiration date of the grant agreement). USGS acknowledges that this annual reporting schedule may not always correspond with a specific budget period. The SF-425 must be submitted electronically through the FedConnect Message Center (www.fedconnect.net). If after 90 days, the recipient has not submitted a report, the recipient's account in ASAP will be placed in a manual review status until the report is submitted.

(4) **Final Financial Report.**

a. The recipient will liquidate all obligations incurred under the award and submit a final STANDARD FORM 425, FEDERAL FINANCIAL REPORT through FedConnect (www.fedconnect.net) no later than 90 calendar days after the grant completion date. The SF-425 is available at - http://www.whitehouse.gov/omb/grants_forms. Recipient will promptly return any unexpended federal cash advances or will complete a final draw from ASAP to obtain any remaining amounts due. Once 120 days has passed since the grant completion date, the ASAP subaccount for this award may be closed by USGS at any time.

b. Subsequent revision to the final SF 425 will be considered only as follows

(i) When the revision results in a balance due to the Government, the recipient must submit a revised final Federal Financial Report (SF 425) and refund the excess payment whenever the overcharge is discovered, no matter how long the lapse of time since the original due date of the report.

(ii) When the revision represents additional reimbursable costs claimed by the recipient, a revised final SF 425 may be submitted to the Contracting Officer with an explanation. If approved, the USGS will either request and pay a final invoice or reestablish the ASAP subaccount to permit the recipient to make a revised final draw. Any revised final report representing additional reimbursable amounts must be submitted no later than 1 year from the due date of the original report, i.e., 15 months following the agreement completion date. USGS will not accept any revised SF 425 covering additional expenditures after that date and will return any late request for additional payment to the recipient.

C. **Adherence to reporting requirements.** A Recipient's failure to submit the required Final Technical Report and/or final financial report by the due dates noted above will likely result in delay or non-issuance of new awards. Failure to submit a Progress Report for multi-year awards will likely result in delayed renewal of funds.

5. **Continuation Proposal for Second-Year Funding**

Required Continuation proposal documents. The Recipient, approved for two-year funding, shall submit the

following documents for continued funding in year 2:

Document	No. of Copies	Submit To	Due Date
Progress Report	Send Adobe Acrobat PDF file as an email attachment	Grants Program Manager	At least 60 calendar days prior to the end of the budget period.

Progress Report. Recipients of two-year awards shall submit a report that summarizes the progress of the project during the first funding period. Collaborative awardees should submit one report for all collaborators. Work that was proposed for the first year should have been completed in that year. **Please note** that Progress Report will not be published on the USGS website, so all research data described in a Progress Report must be repeated or restated in the Final Technical Report. Submit a Word or PDF file (maximum size: 10 MB) with embedded graphics as an E-mail attachment to:

gd-erp-coordinator@usgs.gov.

The subject of your email should be **“Progress Report - insert your grant / project number here”**.

Format the Progress Report as follows:

- Single spaced and formatted for 8 ½ x 11” paper
- Number all pages
- Embed figures in the Word or PDF file
- Place figure captions directly under figures
- 2 to 5 pages.

At the top of the first page the heading should be centered and include:

- Title of the project, as stated on the original proposal
- External Grant award number (see your award documents)
- Investigator(s) name(s)
- Institution
- Address
- Telephone number, FAX number, E-mail address, and website
- Term covered by the report.

The body of the report should consist of the following:

- Investigations undertaken
- Accomplishments to date
- Problems encountered
- Reports published
- Funding expended for the term covered by the report.

6. Adherence to Original Research Objective and Budget Estimate

- A. Any commitments or expenditures incurred by the Recipient in excess of the funds provided by this award shall be the responsibility of the Recipient. Expenditures incurred prior to the effective date of this award cannot be charged against award funds.
- B. The following requests for change **require advance written approval by the Contracting Officer shown on your award. Your request must be submitted to the Contracting Officer at least 45 calendar days prior to the requested effective date of the change:**
 - (1) Changes in the scope, objective, or key personnel referenced in the Recipient's proposal.
 - (2) Request for supplemental funds.

- (3) Transfer of funds between direct cost categories when the cumulative amount of transfers during the project period exceeds 10 percent of the total award.
- (4) Acquisition of nonexpendable personal property (equipment) not approved at time of award.
- (5) Creation of any direct cost line item not approved at time of award.
- (6) Any other significant change to the award.
- (7) No-cost Extensions to the Project Period. **No cost extensions are discouraged.** The Earthquake Hazards Program (EHP) awards grants and cooperative agreements for research that extends or supplements ongoing research within the USGS. The timely conduct of funded projects is of great importance to the achievement of EHP goals. Applicants should consider their time commitments at the time of application for a grant. Requests for no cost extensions will be considered on a case-by-case basis. The USGS reserves the right to limit the length of time and number of no-cost extensions. Please note that no-cost extensions are not intended to be used merely for the purpose of expending unobligated balances. Applicants must supply documentation supporting their request for an extension.

The Recipient **shall include** in the request:

- the cause of the needed extension,
- a description of the remaining work to be completed,
- the proposed new end date, and
- the amount of funds remaining.

A request for an extension that is received by the Contracting Officer after the expiration date shall **not** be honored. Requests for no-cost extensions shall be submitted to the Contracting Officer **at least 45 days** before the grant end date.

C. The Contracting Officer will notify the Recipient in writing within 30 calendar days after receipt of the request for revision or adjustment whether the request has been approved.

7. Government Furnished Property Or Property Authorized For Purchase

The recipient shall comply with 2CFR Part 215, Section 215.34. Title to nonexpendable personal property acquired wholly or in part with Federal funds shall be vested in the Recipient unless otherwise specified in the award document. The Recipient shall retain control and maintain a property inventory of such property as long as there is a need for such property to accomplish the purpose of the project, whether or not the project continues to be supported by Federal funds. When there is no longer a need for such property to accomplish the purpose of the project, the Recipient shall use the property in connection with other Federal awards the Recipient has received. Under no circumstances shall title to such property be vested in a sub-tier recipient. Disposal of nonexpendable personal property shall be in accordance with the applicable OMB circular.

(select this box if no GFP) There is no non-expendable personal property authorized on this grant/cooperative agreement.

(select this box if GFP is provided) The following equipment will be vested with the recipient: (list equipment)

8. Record Retention Period

Unless a longer period is requested by the award, a Recipient shall retain all records for 3 years after the end of the project period for which it uses USGS award funds.

9. Pre-agreement Costs

Pre-agreement costs are not authorized under this program. Costs must be obligated during the project period.

10. Site Visits

Site visits may be made by USGS representatives to review program accomplishments and management control systems and to provide technical assistance, as required.

11. Award Closeout

Awards will be closed out once all requirements have been met. Technical and financial reports must be submitted on time as specified in section 3, above. Failure to adhere to the reporting requirements may result in no future awards.

12. Partnership with Grantees/Cooperators

The USGS, through its federal grant/cooperative agreement awards, will collaborate with universities, federal state, local and tribal governments, and private organizations and businesses to provide relevant, timely, objective knowledge and information on natural resources, hazards, and the environment.

13. Seat Belt Provision (Executive Order 13043)

Recipients of grants/cooperative agreements and/or sub-awards are encouraged to adopt and enforce on-the-job seat belt use policies and programs for their employees when operating company-owned, rented, or personally owned vehicles. These measures include, but are not limited to, conducting education, awareness, and other appropriated programs for their employees about the importance of wearing seat belts and the consequences of not wearing them.

14. Federal Leadership on Reducing Text Messaging while Driving (Executive Order 13513)

Recipients are encouraged to adopt and enforce policies that ban text messaging while driving, including conducting initiatives of the type described in section 3(a) of the order.

(http://www.whitehouse.gov/the_press_office/Executive-Order-Federal-Leadership-on-Reducing-Text-Messaging-while-Driving/)

15. Use of U.S. Flag Air Carriers

Any air transportation to, from, between or within a country other than the U.S. of persons or property, the expense of which will be paid in whole or in part by U.S. Government funding, must be performed by, or under a code-sharing arrangement with, a U.S. flag air carrier if service provided by such a carrier is "available" (49 U.S.C. 40118, commonly referred to as the Fly America Act). Tickets (or documentation for electronic tickets) must identify the U.S. flag air carrier's designator code and flight number. See the Federal Travel Regulation §301-10.131 - §301-10.143 for definitions, exceptions, and documentation requirements. (See also Comp. Gen. Decision B-240956, dated September 25, 1991.)

16. Trafficking in Persons (2 CFR Part 175)

A. Provisions applicable to a recipient that is a private entity.

(i) You as the recipient, your employees, subrecipients under this award, and subrecipients' employees may not --

(a) Engage in severe forms of trafficking in persons during the period of time that the award is in effect;

- (b) Procure a commercial sex act during the period of time that the award is in effect; or
- (c) Use forced labor in the performance of the award or subawards under the award.

(ii) We as the Federal awarding agency may unilaterally terminate this award, without penalty, if you or a subrecipient that is a private entity --

- (a) Is determined to have violated a prohibition in paragraph a.1 of this award term; or
- (b) Has an employee who is determined by the agency official authorized to terminate the award to have violated a prohibition in paragraph a.1 of this award term through conduct that is either --
 - 1. Associated with performance under this award; or
 - 2. Imputed to you or the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 CFR part 180, "OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)," as implemented by our agency at 43 CFR Part 42.

B. Provisions applicable to a recipient other than a private entity. We as the Federal awarding agency may unilaterally terminate this award, without penalty, if a subrecipient that is a private entity --

- (i) Is determined to have violated a prohibition in paragraph a.1 of this award term; or
- (ii) Has an employee who is determined by the agency official authorized to terminate the award to have violated a prohibition in paragraph a.1 of this award term through conduct that is either --
 - (a) Associated with performance under this award; or
 - (b) Imputed to you or the subrecipient using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 CFR part 180, "OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)," as implemented by our agency at 43 CFR Part 42.

C. Provisions applicable to any recipient.

- (i) You must inform us immediately of any information you receive from any source alleging a violation of a prohibition in paragraph a.1 of this award term.
- (ii) Our right to terminate unilaterally that is described in paragraph a.2 or b of this section:
 - (a) Implements section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 U.S.C. 7104(g)), and
 - (b) Is in addition to all other remedies for noncompliance that are available to us under this award.
- (iii) You must include the requirements of paragraph a.1 of this award term in any subaward you make to a private entity.

D. Definitions. For purposes of this award term:

- (i) "Employee" means either:
 - (a) An individual employed by you or a subrecipient who is engaged in the performance of the project or program under this award; or
 - (b) Another person engaged in the performance of the project or program under this award and not compensated by you including, but not limited to, a volunteer or individual whose services are contributed by a third party as an in-kind contribution toward cost sharing or matching requirements.

(ii) “Forced labor” means labor obtained by any of the following methods: the recruitment, harboring, transportation, provision, or obtaining of a person for labor or services, through the use of force, fraud, or coercion for the purpose of subjection to involuntary servitude, peonage, debt bondage, or slavery.

(iii) “Private entity”:

(a) Means any entity other than a State, local government, Indian tribe, or foreign public entity, as those terms are defined in 2 CFR 175.25.

(b) Includes:

1. A nonprofit organization, including any nonprofit institution of higher education, hospital, or tribal organization other than one included in the definition of Indian tribe at 2 CFR 175.25(b).
2. A for-profit organization.

(iv) Severe forms of trafficking in persons,” “commercial sex act,” and “coercion” have the meanings given at section 103 of the TVPA, as amended (22 U.S.C. 7102).

17. Reporting Subawards and Executive Compensation Information (2 CFR Part 170).

a. *Reporting of first-tier subawards.*

1. *Applicability.* Unless you are exempt as provided in paragraph d. of this award term, you must report each action that obligates \$25,000 or more in Federal funds that does not include Recovery funds (as defined in section 1512(a)(2) of the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5) for a subaward to an entity (see definitions in paragraph e. of this award term).

2. *Where and when to report.*

i. You must report each obligating action described in paragraph a.1. of this award term to <http://www.fsrs.gov>.

ii. For subaward information, report no later than the end of the month following the month in which the obligation was made. (For example, if the obligation was made on November 7, 2010, the obligation must be reported by no later than December 31, 2010.)

3. *What to report.* You must report the information about each obligating action that the submission instructions posted at <http://www.fsrs.gov> specify.

b. *Reporting Total Compensation of Recipient Executives.*

1. *Applicability and what to report.* You must report total compensation for each of your five most highly compensated executives for the preceding completed fiscal year, if—

i. the total Federal funding authorized to date under this award is \$25,000 or more;

ii. in the preceding fiscal year, you received—

(A) 80 percent or more of your annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

(B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

iii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/excomp.htm>.)

2. *Where and when to report.* You must report executive total compensation described in paragraph b.1. of this award term:

- i. As part of your registration profile at <https://www.sam.gov>.
 - ii. By the end of the month following the month in which this award is made, and annually thereafter.
- c. *Reporting of Total Compensation of Subrecipient Executives.*
 - 1. *Applicability and what to report.* Unless you are exempt as provided in paragraph d. of this award term, for each first-tier subrecipient under this award, you shall report the names and total compensation of each of the subrecipient's five most highly compensated executives for the subrecipient's preceding completed fiscal year, if—
 - i. in the subrecipient's preceding fiscal year, the subrecipient received—
 - (A) 80 percent or more of its annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and
 - (B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts), and Federal financial assistance subject to the Transparency Act (and subawards); and
 - ii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/execomp.htm>.)
 - 2. *Where and when to report.* You must report subrecipient executive total compensation described in paragraph c.1. of this award term:
 - i. To the recipient.
 - ii. By the end of the month following the month during which you make the subaward. For example, if a subaward is obligated on any date during the month of October of a given year (*i.e.*, between October 1 and 31), you must report any required compensation information of the subrecipient by November 30 of that year.
- d. *Exemptions*

If, in the previous tax year, you had gross income, from all sources, under \$300,000, you are exempt from the requirements to report:

 - i. Subawards,
 - and
 - ii. The total compensation of the five most highly compensated executives of any subrecipient.
- e. *Definitions.* For purposes of this award term:
 - 1. *Entity* means all of the following, as defined in 2 CFR part 25:
 - i. A Governmental organization, which is a State, local government, or Indian tribe;
 - ii. A foreign public entity;
 - iii. A domestic or foreign nonprofit organization;
 - iv. A domestic or foreign for-profit organization;
 - v. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.
 - 2. *Executive* means officers, managing partners, or any other employees in management positions.
 - 3. *Subaward:*
 - i. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award to an eligible subrecipient.
 - ii. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, see Sec. __.210 of the attachment to OMB Circular A-133, “Audits of States, Local Governments, and Non-Profit Organizations”).
 - iii. A subaward may be provided through any legal agreement, including an agreement that you or a subrecipient considers a contract.
 - 4. *Subrecipient* means an entity that:

- i. Receives a subaward from you (the recipient) under this award; and
 - ii. Is accountable to you for the use of the Federal funds provided by the subaward.
5. *Total compensation* means the cash and noncash dollar value earned by the executive during the recipient's or subrecipient's preceding fiscal year and includes the following (for more information see 17 CFR 229.402(c)(2)):

- i. *Salary and bonus*.
- ii. *Awards of stock, stock options, and stock appreciation rights*. Use the dollar amount recognized for financial statement reporting purposes with respect to the fiscal year in accordance with the Statement of Financial Accounting Standards No. 123 (Revised 2004) (FAS 123R), Shared Based Payments.
- iii. *Earnings for services under non-equity incentive plans*. This does not include group life, health, hospitalization or medical reimbursement plans that do not discriminate in favor of executives, and are available generally to all salaried employees.
- iv. *Change in pension value*. This is the change in present value of defined benefit and actuarial pension plans.
- v. *Above-market earnings on deferred compensation which is not tax-qualified*.
- vi. Other compensation, if the aggregate value of all such other compensation (e.g. severance, termination payments, value of life insurance paid on behalf of the employee, perquisites or property) for the executive exceeds \$10,000.

18. System of Award Management and Universal Identifier Requirements (2 CFR Part 25)

a. Requirement for System of Award Management

Unless you are exempted from this requirement under 2 CFR 25.110, you as the recipient must maintain the currency of your information in the SAM until you submit the final financial report required under this award or receive the final payment, whichever is later. This requires that you review and update the information at least annually after the initial registration, and more frequently if required by changes in your information or another award term.

b. Requirement for Unique Entity identifier Numbers

If you are authorized to make subawards under this award, you:

- 1. Must notify potential subrecipients that no entity (*see* definition in paragraph C of this award term) may receive a subaward from you unless the entity has provided its unique entity identifier number to you.
- 2. May not make a subaward to an entity unless the entity has provided its DUNS number to you.

c. Definitions

For purposes of this award term:

- 1. *System of Award Management(SAM)* means the Federal repository into which an entity must provide information required for the conduct of business as a recipient. Additional information about registration procedures may be found at the SAM Internet site (currently at <http://www.sam.gov>).
- 2. *Unique entity identifier* means the identifier required for SAM registration to uniquely identify business entities.
- 3. *Entity*, as it is used in this award term, means all of the following, as defined at 2 CFR part 25, subpart C:
 - i. A Governmental organization, which is a State, local government, or Indian Tribe;
 - ii. A foreign public entity;
 - iii. A domestic or foreign nonprofit organization;
 - iv. A domestic or foreign for-profit organization; and
 - v. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.
- 4. *Subaward*:
 - i. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award

to an eligible subrecipient.

ii. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, see 2 CFR 200.330).

iii. A subaward may be provided through any legal agreement, including an agreement that you consider a contract.

5. *Subrecipient* means an entity that:

i. Receives a subaward from you under this award; and

ii. Is accountable to you for the use of the Federal funds provided by the subaward.

19. Prohibition on Members of Congress Making Contracts with Federal Government (41 USC Section 6306)

No member of or delegate to the United States Congress or Resident Commissioner shall be admitted to any share or part of this award, or to any benefit that may arise therefrom; this provision shall not be construed to extend to an award made to a corporation for the public's general benefit.

20. Pilot Program for Enhancement of Recipient and Subrecipient Employee Whistleblower Protection (41 USC Section 4712)

This requirement applies to all awards issued after July 1, 2013 and shall be in effect until January 1, 2017.

- a. This award and related subawards and contracts over the simplified acquisition threshold and all employees working on this award and related subawards and contracts over the simplified acquisition threshold are subject to the whistleblower rights and remedies in the pilot program on award recipient employee whistleblower protections established at 41 U.S.C. 4712 by section 828 of the *National Defense Authorization Act for Fiscal Year 2013* (P.L. 112-239).
- b. Recipients, and their subrecipients and contractors awarded contracts over the simplified acquisition threshold related to this award, shall inform their employees in writing, in the predominant language of the workforce, of the employee whistleblower rights and protections under 41 U.S.C. 4712.
- c. The recipient shall insert this clause, including this paragraph (c), in all subawards and contracts over the simplified acquisition threshold related to this award.

21. Patent Rights (37 CFR § 401.14)

Insert the following award term if the recipient is an individual, small business, non-profit organization, university or other institution of higher education. This award term does not apply to State, Local or Tribal governments or foreign entities.

Unless otherwise provided in the Agreement, if this Agreement is for experimental, developmental, or research work, the following clause (implementing the Bayh-Dole Act, [35 U.S.C. § 200 et seq.]) shall apply. The recipient shall include this clause in all subawards for experimental, developmental, or research activities.

a. *Definitions*

1. INVENTION means any invention or discovery which is or may be patentable or otherwise protectable under Title 35 of the USC, to any novel variety of plant which is or may be protected under the Plant Variety Protection Act (7 U.S.C. § 2321 et seq.).
2. SUBJECT INVENTION means any invention of the recipient conceived or first actually reduced to practice in the performance of work under this Agreement, provided that in the case of a variety of plant,

- the date of determination (as defined in section 41(d)) must also occur during the period of performance.
3. PRACTICAL APPLICATION means to manufacture in the case of a composition or product, to practice in the case of a process or method, or to operate in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is being utilized and that its benefits are to the extent permitted by law or Government regulations available to the public on reasonable terms.
 4. MADE when used in relation to any invention means the conception or first actual reduction to practice of such invention.
 5. SMALL BUSINESS FIRM means a small business concern as defined at section 2 of Pub. L. 85-536 (15 U.S.C. 632) and implementing regulations of the Administrator of the Small Business Administration. For the purpose of this clause, the size standards for small business concerns involved in government procurement and subcontracting at 13 CFR 121.3-8 and 13 CFR 121.3-12, respectively, will be used.
 6. NON-PROFIT ORGANIZATION means a domestic university or other institution of higher education or an organization of the type described in Section 501(c)(3) of the Internal Revenue Code of 1954 (26 U.S.C. § 501(c)) and exempt from taxation under Section 501(a) of the Internal Revenue Code (26 U.S.C. § 501(a)) or any domestic non-profit scientific or educational organization qualified under a State non-profit organization statute. b. Allocation of Principal Rights The recipient may retain the entire right, title, and interest throughout the world to each subject invention subject to the provisions of this Patent Rights clause and 35 U.S.C. § 203. With respect to any subject invention in which the recipient retains title, the Federal Government shall have a non-exclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the U.S. the subject invention throughout the world. If the Agreement indicates it is subject to an identified international agreement or treaty, the U.S. Geological Survey (USGS) also has the right to direct the recipient to convey to any foreign participant such patent rights to subject inventions as are required to comply with that agreement or treaty.

b. *Allocation of Principal Rights*

1. The recipient may retain the entire right, title, and interest throughout the world to each subject invention subject to the provisions of this Patent Rights clause, including (2) below, and 35 U.S.C. § 203. With respect to any subject invention in which the recipient retains title, the Federal Government shall have a non-exclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the U.S. the subject invention throughout the world. If the Agreement indicates it is subject to an identified international agreement or treaty, the U.S. Geological Survey (USGS) also has the right to direct the recipient to convey to any foreign participant such patent rights to subject inventions as are required to comply with that agreement or treaty.
2. If the recipient performs services at a Government owned and operated laboratory or at a Government owned and recipient operated laboratory directed by the Government to fulfill the Government's obligations under a Cooperative Research and Development Agreement (CRADA) authorized by 15 U.S.C. 3710a, the Government may require the recipient to negotiate an agreement with the CRADA collaborating party or parties regarding the allocation of rights to any subject invention the recipient makes, solely or jointly, under the CRADA. The agreement shall be negotiated prior to the recipient undertaking the CRADA work or, with the permission of the Government, upon the identification of a subject invention. In the absence of such an agreement, the recipient agrees to grant the collaborating party or parties an option for a license in its inventions of the same scope and terms set forth in the CRADA for inventions made by the Government.

If a known CRADA exists between the USGS and the recipient, include the CRADA as an attachment and include the following paragraph following b.2.:

USGS has determined that use of alternate paragraph (b) in the preceding clause is required to meet USGS' obligations under (identify CRADA). This determination may be appealed in accordance with 37 CFR 401.4. Recipient agrees that the work performed under this Award is directed by USGS to meet the obligations under the CRADA. Recipient further agrees to grant licenses to the government and (insert

additional CRADA partner names, if applicable) as necessary to meet USGS' obligations under the CRADA.

c. *Invention Disclosure, Election of Title and Filing of Patent Applications by Recipient*

1. The recipient will disclose each subject invention to USGS within two months after the inventor discloses it in writing to recipient personnel responsible for the administration of patent matters. The disclosure to USGS shall be in the form of a written report and shall identify the Agreement under which the invention was made and the inventor(s). It shall be sufficiently complete in technical detail to convey a clear understanding of the nature, purpose, operation, and, to the extent known, the physical, chemical, biological or electrical characteristics of the invention. The disclosure shall also identify any publication, on sale or public use of the invention, whether a manuscript describing the invention has been submitted for publication and, if so, whether it has been accepted for publication, at the time of disclosure. In addition, after disclosure to USGS, the recipient will promptly notify USGS of the acceptance of any manuscript describing the invention for publication, or of any on sale or public use planned by the recipient.
2. The recipient will elect in writing whether or not to retain title to any such invention by notifying USGS within two years of disclosure to USGS. However, in any case where publication, on sale, or public use has initiated the one-year statutory period wherein valid patent protection can still be obtained in the U.S., the period for election of title may be shortened by USGS to a date that is no more than 60 days prior to the end of the statutory period.
3. The recipient will file its initial patent application on an invention to which it elects to retain title within one year after election of title or, if earlier, prior to the end of any statutory period wherein valid patent protection can be obtained in the U.S. after a publication, on sale, or public use. The recipient will file patent applications in additional countries or international patent offices within either ten months of the corresponding initial patent application, or six months from the date when permission is granted by the Commissioner of Patents and Trademarks to file foreign patent applications when such filing has been prohibited by a Secrecy Order.
4. Requests for extension of the time for disclosure to USGS, election, and filing under subparagraphs 1., 2., and 3. may, at the discretion of USGS, be granted.

d. *Conditions When the Government May Obtain Title*

The recipient will convey to USGS, upon written request, title to any subject invention:

1. if the recipient fails to disclose or elect the subject invention within the times specified in paragraph c. above, or elects not to retain title, provided that USGS may only request title within 60 days after learning of the failure of the recipient to disclose or elect within the specified times;
2. in those countries in which the recipient fails to file patent applications within the times specified in paragraph c. above, but prior to its receipt of the written request of USGS, the recipient shall continue to retain title in that country; or in any country in which the recipient decides not to continue the prosecution of any application for, to pay the maintenance fees on, or defend in a reexamination or opposition proceeding on, a patent on a subject invention.

e. *Minimum Rights to Recipient*

1. The recipient will retain a non-exclusive royalty-free license throughout the world in each subject invention to which the Government obtains title, except if the recipient fails to disclose the subject invention within the times specified in paragraph c. above. The recipient's license extends to its domestic subsidiaries and affiliates, if any, within the corporate structure of which the recipient is a party and includes the right to grant sublicenses of the same scope to the extent the recipient was legally obligated to do so at the time the Agreement was made. The license is transferable only with the approval of USGS except when transferred to the successor of that part of the recipient's business to which the invention pertains.
2. The recipient's domestic license may be revoked or modified by USGS to the extent necessary to achieve

expeditious practical application of the subject invention pursuant to an application for an exclusive license submitted in accordance with applicable provisions at 37 CFR Part 404. This license will not be revoked in that field of use or the geographical areas in which the recipient has achieved practical application and continues to make the benefits of the invention reasonably accessible to the public. The license in any foreign country may be revoked or modified at discretion of USGS to the extent the recipient, its licensees, or its domestic subsidiaries or affiliates have failed to achieve practical application in that foreign country.

3. Before revocation or modification of the license, USGS will furnish the recipient a written notice of its intention to revoke or modify the license, and the recipient will be allowed thirty days (or such other time as may be authorized by USGS for good cause shown by the recipient) after the notice to show cause why the license should not be revoked or modified. The recipient has the right to appeal, in accordance with applicable regulations in 37 CFR Part 404 concerning the licensing of Government-owned inventions, any decision concerning the revocation or modification of its license.

f. *Recipient Action to Protect Government's Interest*

1. The recipient agrees to execute or to have executed and promptly deliver to USGS all instruments necessary to: (i) establish or confirm the rights the Government has throughout the world in those subject inventions for which the recipient retains title; and (ii) convey title to USGS when requested under paragraph d. above, and to enable the Government to obtain patent protection throughout the world in that subject invention.
2. The recipient agrees to require, by written agreement, its employees, other than clerical and non-technical employees, to disclose promptly in writing to personnel identified as responsible for the administration of patent matters and in a format suggested by the recipient each subject invention made under this Agreement in order that the recipient can comply with the disclosure provisions of paragraph c. above, and to execute all papers necessary to file patent applications on subject inventions and to establish the Government's rights in the subject inventions. The disclosure format should require, as a minimum, the information requested by paragraph c.1 above. The recipient shall instruct such employees through the employee agreements or other suitable educational programs on the importance of reporting inventions in sufficient time to permit the filing of patent applications prior to U.S. or foreign statutory bars.
3. The recipient will notify USGS of any decision not to continue prosecution of a patent application, pay maintenance fees, or defend in a reexamination or opposition proceeding on a patent, in any country, not less than 30 days before the expiration of the response period required by the relevant patent office.
4. The recipient agrees to include, within the specification of any U.S. patent application and any patent issuing thereon covering a subject invention, the following statement: "This invention was made with Government support under (identify the Agreement) awarded by the U.S. Geological Survey. The Government has certain rights in this invention."
5. The recipient or its representative will complete, execute and forward to USGS a confirmation of a License to the U.S. Government and the page of a United States patent application that contains the Federal support clause within two months of filing any domestic or foreign patent application.

g. *Subcontracts*

1. The recipient will include this Patent Rights clause, suitably modified to identify the parties, in all subcontracts, regardless of tier, for experimental, developmental or research work. The subcontractor will retain all rights provided for the recipient in this Patent Rights clause, and the recipient will not, as part of the consideration for awarding the subcontract, obtain rights in the subcontractors' subject inventions.
2. In the case of subcontracts, at any tier, when the prime award by USGS was a contract (but not a cooperative agreement), USGS, subcontractor, and contractor agree that the mutual obligations of the parties created by this Patent Rights clause constitute a contract between the subcontractor and the Foundation with respect to those matters covered by this Patent Rights clause.

h. *Reporting on Utilization of Subject Inventions*

The recipient agrees to submit on request periodic reports no more frequently than annually on the utilization

of a subject invention or on efforts at obtaining such utilization that are being made by the recipient or its licensees or assignees. Such reports shall include information regarding the status of development, date of first commercial sale or use, gross royalties received by the recipient and such other data and information as USGS may reasonably specify. The recipient also agrees to provide additional reports in connection with any march-in proceeding undertaken by USGS in accordance with paragraph j. of this Patent Rights clause. As required by 35 U.S.C. § 202(c)(5), USGS agrees it will not disclose such information to persons outside the Government without the permission of the recipient.

i. *Preference for United States Industry*

Notwithstanding any other provision of this Patent Rights clause, the recipient agrees that neither it nor any assignee will grant to any person the exclusive right to use or sell any subject invention in the U.S. unless such person agrees that any products embodying the subject invention or produced through the use of the subject invention will be manufactured substantially in the U.S. However, in individual cases, the requirement for such an agreement may be waived by USGS upon a showing by the recipient or its assignee that reasonable but unsuccessful efforts have been made to award licenses on similar terms to potential licensees that would be likely to manufacture substantially in the U.S. or that under the circumstances domestic manufacture is not commercially feasible.

j. *March-in Rights*

The recipient agrees that with respect to any subject invention in which it has acquired title, USGS has the right in accordance with procedures at 37 CFR § 401.6 and USGS regulations at 45 CFR § 650.13 to require the recipient, an assignee or exclusive licensee of a subject invention to grant a non-exclusive, partially exclusive, or exclusive license in any field of use to a responsible applicant or applicants, upon terms that are reasonable under the circumstances and if the recipient, assignee, or exclusive licensee refuses such a request, USGS has the right to grant such a license itself if USGS determines that:

1. such action is necessary because the recipient or assignee has not taken or is not expected to take within a reasonable time, effective steps to achieve practical application of the subject invention in such field of use;
2. such action is necessary to alleviate health or safety needs which are not reasonably satisfied by the recipient, assignee, or their licensees;
3. such action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by the recipient, assignee, or licensee; or
4. such action is necessary because the agreement required by paragraph i. of this Patent Rights clause has not been obtained or waived or because a licensee of the exclusive right to use or sell any subject invention in the U.S. is in breach of such agreement.

k. *Special Provisions for Agreements with Non-profit Organizations*

If the recipient is a nonprofit organization, it agrees that:

1. rights to a subject invention in the U.S. may not be assigned without the approval of USGS, except where such assignment is made to an organization which has as one of its primary functions the management of inventions, provided that such assignee will be subject to the same provisions as the recipient;
2. the recipient will share royalties collected on a subject invention with the inventor, including Federal employee co-inventors (when USGS deems it appropriate) when the subject invention is assigned in accordance with 35 U.S.C. § 202(e) and 37 CFR § 401.10;
3. the balance of any royalties or income earned by the recipient with respect to subject inventions, after payment of expenses (including payments to inventors) incidental to the administration of subject inventions, will be utilized for the support of scientific or engineering research or education; and
4. it will make efforts that are reasonable under the circumstances to attract licensees of subject inventions that are small business firms and that it will give preference to a small business firm if the recipient determines that the small business firm has a plan or proposal for marketing the invention which, if executed, is equally likely to bring the invention to practical application as any plans or proposals from applicants that are not small business firms; provided that the recipient is also satisfied that the small

business firm has the capability and resources to carry out its plan or proposal. The decision whether to give a preference in any specific case will be at the discretion of the recipient. However, the recipient agrees that the Secretary of Commerce may review the recipient's licensing program and decisions regarding small business applicants, and the recipient will negotiate changes to its licensing policies, procedures or practices with the Secretary when the Secretary's review discloses that the recipient could take reasonable steps to implement more effectively the requirements of this paragraph k.4.

1. *Communications*

All communications required by this Patent Rights clause must be submitted through Benjamin Henry, Technology Transfer Specialist, Office of Policy and Analysis (OPA), U.S. Geological Survey, Reston, VA 20192, (703) 648-4344, bhenry@usgs.gov.

22. Research Integrity

A. USGS requires that all grant or cooperative agreement recipient organizations adhere to the Federal Policy on Research Misconduct, Office of Science and Technology Policy, December 6, 2001, 65 Federal Register (FR) 76260, http://www.ostp.gov/html/001207_3.html. The Federal Policy on Research Misconduct outlines requirements for addressing allegations of research misconduct, including the investigation, adjudication, and appeal of allegations of research misconduct and the implementation of appropriate administrative actions.

B. The recipient must promptly notify the USGS Project Office when research misconduct that warrants an investigation pursuant to the Federal Policy on Research Misconduct is alleged.

23. Access to Research Data

A. By regulation (43 CFR 12.936), recipients that are institutions of higher education, hospitals, or non-profit organizations are required to release research data first produced in a project supported with Federal funds that are cited publicly and officially by a Federal agency in support of an action that has the force and effect of law (e.g., regulations and administrative orders). "Research data" is defined as the recorded factual material commonly accepted in the scientific community as necessary to validate research findings. It does not include preliminary analyses; drafts of scientific papers; plans for future research; peer reviews; communications with colleagues; physical objects (e.g., laboratory samples, audio or video tapes); trade secrets; commercial information; materials necessary to be held confidential by a researcher until publication in a peer-reviewed journal; information that is protected under the law (e.g., intellectual property); personnel and medical files and similar files, the disclosure of which would constitute an unwarranted invasion of personal privacy; or information that could be used to identify a particular person in a research study.

B. These requirements do not apply to commercial organizations or to research data produced by State or local governments. However, if a State or local governmental grantee contracts with an educational institution, hospital, or non-profit organization, and the contract results in covered research data, those data are subject to these disclosure requirements.

C. Requests for the release of research data subject to this policy are required to be made to USGS, which will handle them as FOIA requests under 43 CFR 2.25. If the data are publicly available, the requestor will be directed to the public source. Otherwise, the USGS Contracting Officer/Grants Officer, in consultation with the affected recipient and the PI, will handle the request. This policy also provides for assessment of a reasonable fee to cover recipient costs as well as (separately) the USGS costs of responding.

24. Conflict of Interest

The Recipient must establish safeguards to prohibit its employees and Subrecipients from using their positions for purposes that constitute or present the appearance of a personal or organizational conflict of interest. The Recipient

is responsible for notifying the USGS Contracting Officer in writing of any actual or potential conflicts of interest that may arise during the life of this award. Conflicts of interest include any relationship or matter which might place the Recipient or its employees in a position of conflict, real or apparent, between their responsibilities under the agreement and any other outside interests. Conflicts of interest may also include, but are not limited to, direct or indirect financial interests, close personal relationships, positions of trust in outside organizations, consideration of future employment arrangements with a different organization, or decision making affecting the award that would cause a reasonable person with knowledge of the relevant facts to question the impartiality of the Recipient and/or Recipient's employees and Sub-recipients in the matter.

The USGS Contracting Officer and the servicing Ethics Counselor will determine if a conflict of interest exists. If a conflict of interest exists, the USGS Contracting Officer will determine whether a mitigation plan is feasible. Mitigation plans must be approved by the USGS Contracting Officer in writing. Failure to resolve conflicts of interest in a manner that satisfies the government may be cause for termination of the award.

Failure to make required disclosures may result in any of the remedies described in 2 CFR § 200.338, Remedies for Noncompliance, including suspension or debarment (see also 2 CFR Part 180).

25. Program Income

A. The recipient will have no obligation to the Federal Government for program income earned from license fees and royalties for copyrighted material, in accordance with 43 CFR 12.924(h) (for A-110 recipients) or 43 CFR 12.65(e) (for A-102 recipients).

B. If a purpose of this award is to support a conference, symposium, or similar event, income related to that event will be deducted from total allowable costs to determine the net allowable costs before calculating the Government's share of reimbursable costs, as provided in 3 CFR 12.65(g)(1) (for A-102 recipients) or 43 CFR 12.924(b)(3) (for A-110 recipients).

C. If the recipient is an educational institution or nonprofit research organization, any other program income will be added to funds committed to the project by the Federal awarding agency and recipient and be used to further eligible project or program objectives, as described in 43 CFR 12.924(b)(1).

D. For all other types of recipients, any other program income will be deducted from total allowable costs to determine the net allowable costs before calculating the Government's share of reimbursable costs, as provided in 3 CFR 12.65(g)(1) (for A-102 recipients) or 43 CFR 12.924(b)(3) (for A-110 recipients).

End of Special Terms and Conditions

COST PRINCIPLES, AUDIT, AND ADMINISTRATIVE REQUIREMENTS

The Recipient shall be subject to the following regulations, which are incorporated herein by reference. Copies of these regulations can be obtained from the Internet at: http://www.whitehouse.gov/omb/grants_docs

Educational Institutions / State and Local Governments / Non-Profit Organizations

2 CFR Part 200, *Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards*, as implemented by the Department of the Interior in 2 CFR Part 1402 and 43 CFR Part 12.

Foreign Entities

- **Administrative Requirements**

Foreign entities are subject to the requirements applicable to non-Federal entities in 2 CFR Part 200, Subparts A through D and:

Foreign public entities are also subject to the requirements specific to States, with the following exceptions:

- The State payment procedures in 200.305(a) do not apply. Foreign public entities must follow the payment procedures in 200.305(b).
- The requirements in 200.321 “Contracting with small and minority businesses, women’s business enterprises, and labor surplus area firms” do not apply.
- The requirements in 200.322 “Procurement of recovered materials” do not apply.

Foreign non-profit organizations (see definition in 2 CFR 200.70) are also subject to the requirements specific to non-profit organizations.

Foreign Institutions of Higher Education (IHEs) (i.e., institutions located outside the United States that meet the definition in 20 U.S.C. 1001) are also subject to the requirements specific to IHEs.

- **Cost Principles**

Foreign for-profit entities are subject to the cost principles in 48 CFR 1, Subpart 31.2.

Foreign hospitals (i.e., a facility licensed as a hospital under the law of any foreign governmental entity or a facility operated as a hospital by a foreign public entity) are subject to the cost principles in 45 CFR Part 74, Appendix E.

All other foreign entities are subject to the requirements applicable to non-Federal entities in 2 CFR Part 200, Subpart E.

Foreign public entities are also subject to the requirements specific to States.

- **Indirect Cost Rate Negotiations**

Foreign IHEs: Appendix III to Part 200—Indirect (F&A) Costs Identification and Assignment, and Rate Determination for IHEs. The U.S. Department of Health and Human Services (HHS) is the cognizant agency for indirect costs for foreign IHEs. Visit HHS’ Cost Allocation Services website at <https://rates.psc.gov/> for more information.

Foreign non-profit organizations: Appendix IV to Part 200—Indirect (F&A) Costs Identification and Assignment, and Rate Determination for Nonprofit Organizations.

Foreign public entities: Appendix VII to Part 200—States and Local Government and Indian Tribe Indirect Cost Proposals.

Foreign for-profit entities: Contact the National Interior Business Center (IBC), Indirect Cost Services by telephone at (916) 566-7111 or by e-mail at: ics@ibc.doi.gov. Visit the IBC's Indirect Cost Services website at http://www.doi.gov/ibc/services/Indirect_Cost_Services/index.cfm for more information.

Foreign hospitals: 45 CFR Part 74, Appendix E—Principles for Determining Cost Applicable to Research and Development Under Grants and Contracts with Hospitals. HHS is the cognizant agency for indirect costs for foreign hospitals. Visit HHS' Cost Allocation Services website at <https://rates.psc.gov/> for more information.

For-Profit Entities, Individuals, and Others Not Covered Above

- **Administrative Requirements**
2 CFR Part 200, Subparts A through D, *Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards*
- **Cost Principles**
48 CFR 1, Subpart 31.2, *Contracts with Commercial Organizations*
- **Indirect Cost Rate Negotiations**
For information on indirect cost rate negotiations, contact the Interior Business Center (IBC) Indirect Cost Services Division by telephone at (916) 566-7111 or by e-mail at: ics@ibc.doi.gov. Visit the IBC Indirect Cost Services Division website at http://www.doi.gov/ibc/services/Indirect_Cost_Services/index.cfm for more information.

II. ADDITIONAL REGULATIONS

This award is subject to the following additional Governmentwide regulations:

- 2 CFR 180, Governmentwide Debarment and Suspension (Nonprocurement)
- 2 CFR 182, Governmentwide Requirements for Drug-Free Workplace (Financial Assistance)

This award is subject to the following additional regulations of the U.S. Department of the Interior:

- 2 CFR Part 1400, Nonprocurement Debarment and Suspension
- 2 CFR Part 1401, Requirements for a Drug Free Workplace (Financial Assistance)
- 43 CFR Part 17, Nondiscrimination in Federally Assisted Programs of the Department of the Interior
- 43 CFR Part 18, New Restrictions on Lobbying
 - Submission of an application also represents the applicant's certification of the statements in 43 CFR Part 18, Appendix A, Certification Regarding Lobbying
- 43 CFR Part 41, Nondiscrimination on the Basis of Sex in Education Programs or Activities Receiving Federal Financial Assistance [*Applies only if this award provides assistance to an education program or student(s)*]