Recommendation 2.2: Plan to Ensure Ongoing Assessment of Natural Hazard Information

Contents

Acronym List

ACRS	Advisory Committee on Reactor Safeguards
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
EHCOE	External Hazards Center of Expertise
FTE	Full Time Equivalent
NOAA	National Oceanic and Atmospheric Administration
NRC	U.S. Nuclear Regulatory Commission
NRO	Office of New Reactors
NRR	Office of Nuclear Reactor Regulation
NTTF	Near-Term Task Force
R2.1	NTTF Recommendation 2.1
R2.2	NTTF Recommendation 2.2
R2.3	NTTF Recommendation 2.3
RES	Office of Nuclear Regulatory Research
USGS	United States Geological Survey

1. Background

Following the accident at Fukushima Dai-Ichi, the U.S. Nuclear Regulatory Commission's (NRC's) post-Fukushima Near-Term Task Force (NTTF) Recommendation 2.2 (R2.2) recommended that the NRC initiate a rulemaking to require that licensees confirm seismic and flooding hazards every 10 years. Specifically, R2.2 recommended that licensees address any new and significant information and, if necessary, take actions that could include updating the design basis for structures, systems, and components important to safety to protect against the updated hazards. Other studies conducted after the Fukushima Dai-Ichi accident also include recommendations that emphasized the importance of assessing new information. For example, Finding 3.1 of the National Academies of Science report, "Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of U.S. Nuclear Plants," dated July 2014, states: "[t]he overarching lesson learned from the Fukushima Dai-ichi accident is that nuclear plant licensees and their regulators must actively seek out and act on new information about hazards that have the potential to affect the safety of nuclear plants."

The staff's subsequent assessment concluded that the NRC can meet the intent of R2.2 using an approach other than rulemaking. In SECY-15-0137, "Proposed Plans for Resolving Open Fukushima Tier 2 and 3 Recommendations," dated October 29, 2015, Enclosure 2 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15254A008), the staff found that current practices to assess new external hazard information are generally effective, but identified a number of ways to enhance existing processes. In addition, the staff recognized that there is no dedicated NRC process that systematically identifies available new hazard information and assesses its risk significance in a timely manner. In SECY-15-0137, the staff identified the following opportunities to enhance existing practices:

- Ensure more timely identification and evaluation of new information (e.g., data, models, and methods).

- Facilitate a methodical evaluation of the cumulative effect of new data, models, and methods that accrue over time.

- Update existing hazard models with new information found to be significant so they are readily available.

As a result, in SECY-15-0137, the staff proposed to enhance existing processes and develop associated staff procedures to ensure that the staff proactively and routinely aggregates and assesses new external hazard information. The staff proposed that the enhanced internal process would leverage and augment existing programs and agreements with domestic and international organizations.

The proposed enhanced process would guide the staff in collecting, aggregating, reviewing, and assessing information on an ongoing basis. This process would enable the staff to achieve the underlying intent of R2.2 in a manner that is timely, integrates well with NRC's existing regulatory framework, and is less burdensome on the agency and licensees than imposing a new rule. To ensure the process is durable and executed consistently, the proposed enhanced process would be institutionalized via a joint Office of New Reactors (NRO) and Office of Nuclear Reactor Regulation (NRR) office instruction and by necessary additional documents (e.g., Office of Nuclear Regulatory Research (RES) office instruction, user needs, or research plans) that will define a series of activities associated with periodic technical engagement, information collection and management, risk-informed assessment of information, and documentation of program activities.

2. Introduction

The purpose of this enclosure is to provide the Commission with additional details regarding the staff's plan to enhance existing processes to ensure ongoing assessment of new information and reconfirmation of natural hazards consistent with R2.2. Specifically, this enclosure describes the actions that the staff would take to implement the proposed framework.

While R2.2 focused on seismic and flooding hazards, the proposed framework is intended to accommodate a range of natural hazards (e.g., seismic, flooding, and extreme weather such as high winds). The staff concluded that it is not necessary to include man-made hazards in the proposed framework because of fundamental differences in the types of changes that arise due to natural and man-made hazards. Specifically, changes related to natural hazards generally arise due to a gradual evolution in the fundamental state of knowledge regarding natural phenomena and available assessment tools. As a result, consistent with the observations of the NTTF, the staff concluded that enhancements to existing processes are warranted to address this type of evolving information. Conversely, changes in man-made hazards arise due to discrete, well-defined, and site-specific events (e.g., construction of a new facility or pipeline in the vicinity of a plant) and existing regulatory processes have been shown to be sufficient without the need for enhancements.

The staff's proposed framework for addressing new natural hazard information is shown in Figure 1 and consists of three primary components:

1. **Knowledge base activities**, which include (1) a series of preparatory, near-term activities to develop an infrastructure that will collect and archive materials that have been docketed by licensees or developed by the staff as part of activities associated with NTTF Recommendation 2.1 and 2.3 (R2.1/2.3), new reactor reviews, and other regulatory activities related to natural hazards; and (2) longer-term activities to maintain and update the archives.

2. **Active technical engagement and coordination**, which involves leveraging and enhancing ongoing interactions with internal and external partners (including other Federal agencies, academia, industry, regulators from other countries, and other technical and scientific organizations) to ensure that the staff routinely and systematically collects pertinent new hazard information from a variety of sources.

3. **Assessment activities**, which include aggregation and evaluation of the significance of new information (e.g., data, models, and methods) as well as referral of potentially significant issues to appropriate regulatory programs.

Section 4 of this enclosure provides greater detail on the above components.

3. Attributes of the Proposed Framework

The framework described in this enclosure has the following key attributes:

- ***Enhances safety***: A large and varied set of organizations and researchers evaluate natural hazards in the United States. These evaluations could identify new information that affects a single plant or multiple sites. The proposed framework enhances the ability of the NRC to (1) identify new information affecting individual sites or larger geographic regions that might otherwise go unrecognized and (2) evaluate whether the information has potential safety significance.

- ***Efficiently integrates with existing processes***: The proposed framework integrates with existing regulatory activities (e.g., collects information from research and oversight activities as well as from operating experience), uses NRC's risk-informed regulatory framework, requires coordination between relevant regulatory offices, and facilitates transfer of issues to the appropriate regulatory program. In addition, the proposed framework better integrates NRC processes with the broader natural hazards technical community.

  By using existing infrastructure and expertise (e.g., knowledge gained in previous work, existing resources and programs), the process offers several efficiencies:

  - *Infrastructure*: The proposed framework realizes efficiencies by leveraging information from R2.1/2.3 activities and new reactor reviews (including software and models) for initial development of the knowledge base. This ensures the agency continues to benefit from resources expended as part of the R2.1/2.3 activities. Moreover, maintenance and routine updating of the knowledge base means the staff will be prepared and readily able to efficiently assess the significance of new information when it is identified. The information will also support emergent event response and other regulatory activities. Experience gained from the R2.1/2.3 activities will be useful in extending the knowledge base to natural hazards other than seismic and flooding hazards.

  - *Staff capabilities*: While licensees' regulatory responsibilities related to identifying and evaluating new information have not changed, the proposed framework relies primarily on internal NRC resources, particularly the External Hazards Center of Expertise (EHCOE) staff, for implementation. It enhances the technical capabilities of the cohort of subject matter experts in the EHCOE, as well as their RES counterparts, who will remain involved in the broader scientific and technical community through deliberate engagement and periodic coordination with external organizations. This will allow the staff to proactively seek information rather than rely on passive receipt of information from external parties. By leveraging existing staff resources, requests for action and information from licensees will be limited to situations in which the staff has demonstrated the potential significance of new information through a deliberate and systematic assessment, including consideration of backfitting requirements and issue finality provisions. In addition, partnering with external organizations (including other Federal agencies) will increase consistency in the treatment of natural hazards and permit overall cost-savings.

- ***Provides stability and predictability***: Stability of the proposed framework will be ensured by institutionalizing and clearly documenting the systematic process in an NRO/NRR office instruction and any necessary additional documents (e.g., RES office instruction, user needs, or research plans). In addition, to promote predictability, the process includes an interoffice technical advisory committee, when warranted.

4. Description of Proposed Framework

The staff has developed details of the proposed framework that expands upon the concepts described in SECY-15-0137 and provides a graded approach that allows NRC to proactively seek, evaluate, and respond to new hazard information. As noted previously, the framework consists of three key components, each of which are described below:

- Knowledge Base Activities (Section 4.1)
- Active Technical Engagement and Coordination (Section 4.2)
- Ongoing Assessment Activities (Section 4.3)

4.1. Knowledge Base Activities

The knowledge base activities provide the foundation for the proposed framework. Program preparation activities include the development of the knowledge base, which involves the compilation and organizing of currently available data, models, documentation, and other insights to ensure availability for future staff use. As part of the program implementation, the staff will maintain and routinely update the knowledge base to reflect information collected as part of activities performed under the proposed framework, as well as other regulatory activities and operating experience.

4.1.1. Knowledge Base Development and Organization

Knowledge base development will include a series of near-term activities to gather and preserve relevant existing information related to natural hazards that has been submitted by licensees or developed by the staff as part of the R2.1/2.3 activities, new reactor reviews, and other regulatory activities (e.g., Generic Issues and Individual Plant Examination of External Events). In addition to supporting the activities associated with the proposed framework, the knowledge base will also ensure information is available and can be used to support other agency activities, including:

- assisting the agency in responding to events associated with natural hazards by promptly providing relevant information;
- engaging external stakeholders, including responding to allegations and petitions;
- evaluating natural hazard-related inspection findings under the NRC's Significance Determination Process;
- formulating and implementing research plans associated with natural hazards; and
- updating regulatory and staff guidance.

To populate the knowledge base, the staff will organize the existing resources and plant-specific information gathered through previous work (e.g., data, models, methods, insights, and lessons-learned) so that the staff can readily retrieve and apply it. Examples of available seismic hazard resources include data, models, and methods used to estimate site-specific hazards (e.g., seismic source, ground motion, and site response characterizations). Examples of available flood hazard resources include climatologic and meteorological assessments, as well as hydrologic and hydraulic models. The staff will also identify and compile relevant information

regarding mitigating strategies for beyond design basis external events (e.g., FLEX strategies and alternate and targeted hazard mitigating strategies).

In addition, the staff will identify appropriate information and analyses that provide insights on plant margins that are relevant to assessing the impact of natural hazards on plant safety. This information will support the staff's ability to conduct efficient evaluations of new hazard information.

To ensure the knowledge base is readily accessible and can be updated in response to new information, the staff will develop infrastructure that is capable of preserving and cataloguing diverse and dynamic information types. This infrastructure will include digital archives containing the aforementioned existing licensee- or staff-generated information.

A portion of the knowledge base development work is already underway. For example, EHCOE staff has developed a relational database that contains site-specific information related to flooding design bases and reevaluated flooding hazards. In addition, RES (with support from the EHCOE) is developing a flood hazard information resource (often referred to as the "flood information digest") as part of the flooding research activities, which will be leveraged in the knowledge base development.

4.1.2. Knowledge Base Maintenance and Updating

The staff will maintain the knowledge base to reflect the information collected, aggregated, and assessed as part of the framework for ongoing assessment of natural hazards as well as from other regulatory programs and operating experience. The maintenance of the knowledge base will include updating of site-specific information and hazard models as well as relevant plant-specific information, as needed. In addition, the staff will maintain supporting documentation and associated information (which this enclosure refers to as "cumulative information records") for potentially significant topics. The cumulative information records will document the accumulation of new natural hazards information over time (e.g., occurrences of extreme natural phenomena; changes to the state of practice, including new data, models, and methods). The cumulative information records will facilitate the aggregation of information and allow the staff to identify when further assessments are warranted.

4.2. Active Technical Engagement and Coordination

The active technical engagement and coordination component of the proposed framework involves periodic interactions with internal and external organizations (e.g., Federal agencies, industry, and international counterparts) as well as academia and other technical and scientific organizations. These activities will help facilitate identification of new data, models, and methods. As part of program preparation activities, the staff will augment existing technical coordination activities and partnerships and establish new agreements, if necessary, to ensure the appropriate frequency of interactions between the staff and the following groups:

- Federal partner agencies (e.g., Department of Energy; United States Geological Survey (USGS) for seismic hazards; USGS, National Oceanic and Atmospheric Administration (NOAA), United States Army Corps of Engineers, Federal Energy Regulatory Commission, United States Bureau of Reclamation, and Department of Homeland Security/Federal Emergency Management Agency for flooding hazards; and NOAA and National Institute of Standards and Technology for wind hazards);

- industry stakeholders (e.g., Nuclear Energy Institute, Electric Power Research Institute);

- professional societies and consensus standards organizations (e.g., ANSI/American Nuclear Society; American Society of Civil Engineers; American Society of Heating, Refrigerating, and Air-Conditioning Engineers); and

- international counterparts (e.g., Canadian Nuclear Safety Commission, Organisation for Economic Co-operation and Development/Nuclear Energy Agency, International Atomic Energy Agency).

To ensure the staff maintains awareness of new developments to support program implementation, the staff will coordinate periodic interactions with organizations that develop natural hazards data and models. Specifically, the staff will periodically coordinate and document the outcomes of meetings during which NRC and the aforementioned groups will review and discuss the evolution in knowledge (e.g., changes in data, models, and methods). In addition, the staff will remain engaged in the broader technical and scientific community, which will ensure the staff are aware of, and are contributors to, advances in data, models, and methods (including opportunities for leveraging more sophisticated models and refinements). This systematic engagement effort also ensures the staff has the appropriate knowledge and capabilities to assess the potential significance of new information. In general, this external engagement enhances staff capabilities while minimizing burden on licensees. This is achieved by allowing the staff to gather and evaluate information on an ongoing basis and requiring licensees to provide information only when the responsible program office deems it necessary to make a decision on a regulatory action (e.g., a request for information under Title 10 of the *Code of Federal Regulations*, paragraph 50.54(f)). Thus, the proposed framework provides an alternative to requiring that licensees evaluate information at a predefined periodicity regardless of its potential significance to a site or group of sites. The staff will identify focus areas for technical engagement and coordination, including identification of key partner organizations, in hazard-specific research plans.

4.3. Ongoing Assessment Activities

As part of the program implementation, the staff will collect information from the ongoing technical coordination and engagement activities, as well as other NRC sources (e.g., operating experience, licensing experience, and research activities). When the staff identifies new hazard information, it will aggregate the information with previously collected information. Thus, the staff will assess new information for potential significance in the context of accumulated hazard information, rather than in isolation. This assessment will evaluate the change in the hazard represented by the aggregated information and consider available risk insights to determine whether the change in the hazard has a potentially significant effect on plant safety.

The assessment of hazard significance will involve a determination of whether the new information indicates that the hazard is more severe than that considered in previous evaluations as well as an assessment of its potential significance. To assess the potential significance of an increase in hazard severity, the staff will use available information and risk insights. For example, additional information may be available based on the outcomes of activities associated with R2.1. Such additional information could include available seismic capacities, available physical margin for flooding, and cliff-edge effects. As another example, to inform the assessment of hazard significance, the staff can consider the characteristics of the increased hazard severity (e.g., screening criteria used in R2.1 seismic reevaluations). Depending on the nature of the new information, the assessment may be based on site-specific evaluations, consider groups of representative sites (e.g., based on geographic location), or use generic assessments.

The assessment will be performed by subject matter experts in the EHCOE, augmented, as needed, by staff from other NRC organizations. Assessment activities are intended to require limited resources and use information contained within the knowledge base to perform a limited scope quantitative or qualitative assessment to determine if the change in hazard is potentially significant.

The division director responsible for the EHCOE may, as needed, convene a technical advisory committee to assess hazard significance and to recommend appropriate next steps to address the issue. The technical advisory committee will be composed of senior technical staff with expertise in relevant disciplines (e.g., seismology, hydrology, meteorology, plant operations) and will be expanded, as needed, to include other program offices and relevant personnel to address site-specific issues and ensure results are presented in a manner that supports an assessment of next steps to be considered by relevant program offices.

The overall objective of the assessment of hazard significance is to determine if the new information could have a potentially significant effect on plant safety. If the staff finds that the new hazard information is of low safety significance (e.g., that it would be unlikely to lead to the need for a generic or plant-specific backfit or other regulatory action), the staff will document the results of the assessment in updates to the cumulative information records. These updates will include a short summary of the new hazard information and the staff's basis for concluding that the new hazard information is not significant at that point from a plant safety perspective.

If the staff finds that the new hazard information has a potentially significant effect on plant safety, it will refer the issue to appropriate regulatory programs for detailed assessment and further action. Regulatory programs for these referrals include:

- transfer of an issue to the relevant program office for resolution (e.g., via plant-specific assessment and regulatory action),

- transfer of the issue to the Generic Issues Program, if the new information could potentially affect safety at multiple plants and the issue meets other Generic Issues Program screening criteria, or

- identification of the need for further research if a better understanding of the new information could improve the staff's understanding of the hazard and the resulting potential effects on plant safety.

The relevant program office will decide if the agency should issue requests for additional information, and whether to issue these generically or on a site-specific basis. The program office will also decide whether and how regulatory analysis and decisionmaking should proceed, consistent with existing regulatory processes (e.g., backfit, operability). In addition, the staff will document the results of the assessment in updates to the cumulative information records and a periodic (e.g., annual) report to be released publically. The staff will also use insights from the R2.2 activities to inform updates to regulatory guidance. Consistent with current NRC practices, the staff will engage external stakeholders at appropriate times in the process (e.g., via public meetings and public comment periods).

5. Infrastructure, Roles, and Responsibilities

Technical staff responsible for the execution of the R2.1/2.3 activities and new reactors reviews (i.e., staff in the EHCOE, with support from RES) will gather the majority of information the agency needs to initially develop the knowledge base. The effort will require support from staff in RES and Office of the Chief Information Officer to support development of the infrastructure associated with the knowledge base.

Consistent with current functions (e.g., standards development), RES will have the primary responsibility for facilitating the technical coordination and engagement between NRC and external organizations. EHCOE and RES staff will jointly participate in the periodic information exchange meetings and other activities to remain engaged in the broader technical and scientific communities. Research plans for the relevant natural hazards will include technical coordination and engagement activities.

EHCOE and RES staff will share responsibility for information collection and aggregation. The efforts will likely include input and participation from other program offices and the NRC's regional offices. The assessment of hazard significance will use subject matter experts from the EHCOE, augmented (as needed) by representatives from other offices and external organizations. The appropriate regulatory office, with appropriate coordination with the regional offices and other internal stakeholders, will make regulatory decisions using existing agency processes.

To ensure successful execution of the proposed framework for ongoing collection, aggregation, review, and assessment of natural hazards information, the staff recognizes the importance of having a defined structure and process. Therefore, procedures, roles, and responsibilities associated with the framework for ongoing assessment of natural hazards will be institutionalized through an office instruction developed and maintained by the EHCOE and will be supplemented, as needed, by additional documents (e.g., RES office instruction, user needs, or research plans). The office instruction(s) will provide details regarding roles and responsibilities, as well as relevant activities, such as the expected structure and minimum periodicity of technical engagement and coordination activities, the conduct of the information aggregation and assessment processes, procedures to ensure timely updates to the cumulative information record and knowledge base, and periodic reporting.

6. Stakeholder Interactions

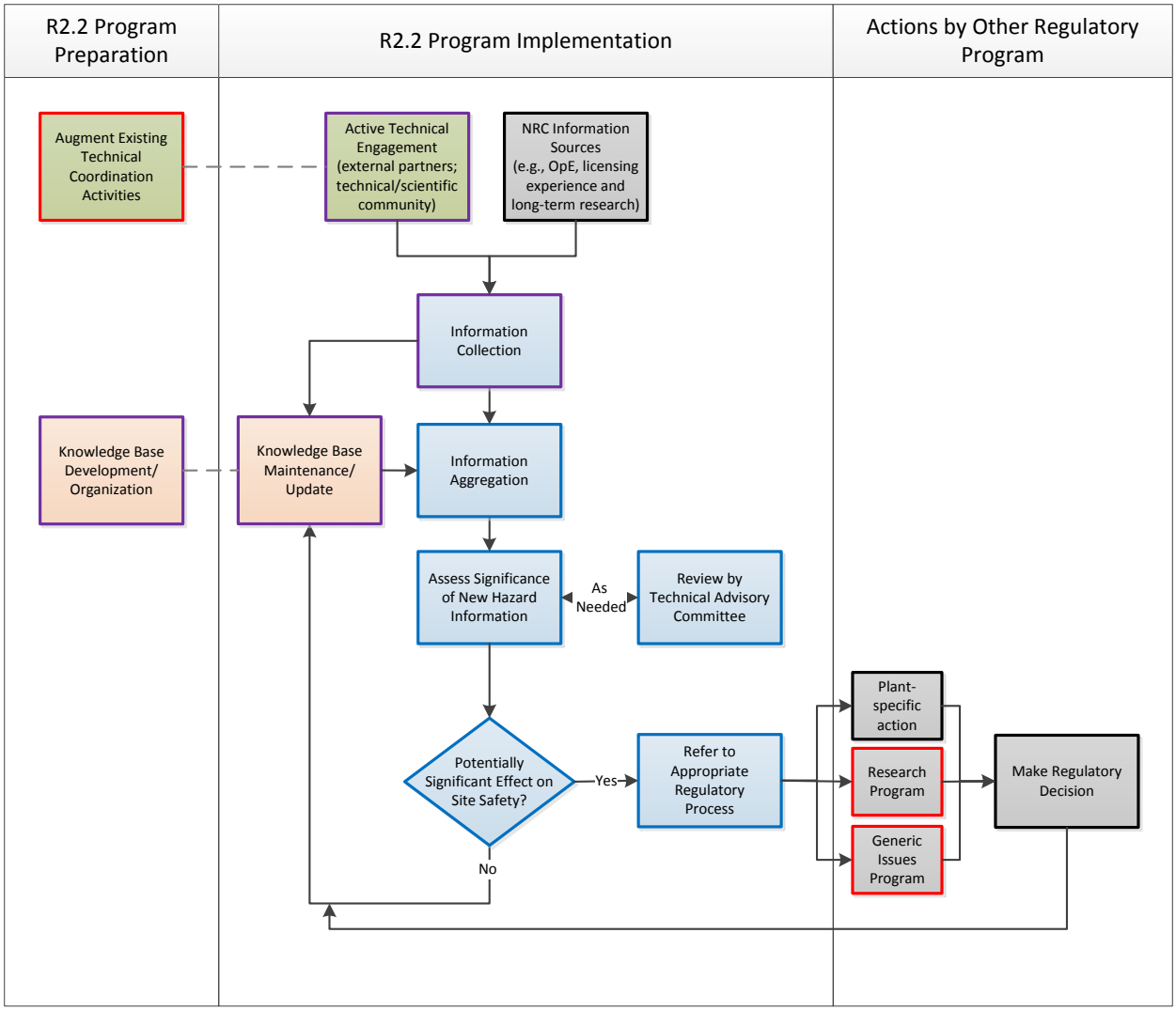
The staff discussed the framework described in this enclosure with external stakeholders during a Fukushima Joint Steering Committee meeting held on August 25, 2016. In addition, the staff issued a white paper on September 22, 2016 (ADAMS Accession No. ML16230A384), that provided much of the staff's plan found in this enclosure. This white paper was used to support more detailed discussion of the framework with external stakeholders during a public meeting held on September 28, 2016. A summary of the September 28, 2016, public meeting can be found in ADAMS at Accession No. ML16277A176. The staff briefed the Advisory Committee on Reactor Safeguards (ACRS) Fukushima Subcommittee on October 19, 2016, and the ACRS Full Committee on November 30, 2016. The ACRS issued a letter on December 13, 2016 (ADAMS Accession No. ML16341B333) providing its conclusions and recommendations associated with the staff's plan. The staff considered the ACRS recommendations in finalizing the proposals in this paper and intends to respond formally in January 2017.

7. Resource Estimates

While the framework described above leverages existing processes and activities, the staff recognizes that a commitment of a limited amount of resources is needed to support implementation. These resource estimates are provided in Enclosure 5 to this paper.

8. Conclusion

Based on the evaluation described in this enclosure, the staff recommends that the Commission approve an ongoing assessment of natural hazards information through the enhancement of internal processes. The process will establish a more routine, proactive, and systematic program for identifying and evaluating new information related to natural hazards.



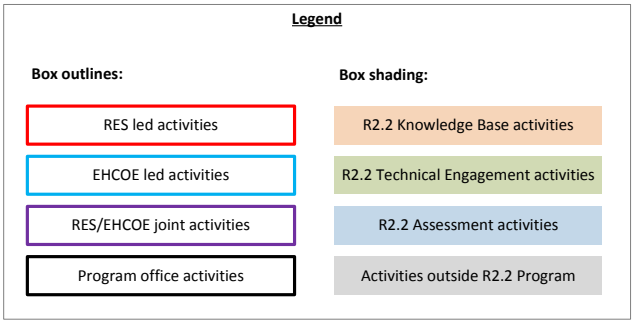


Figure 1: Key Elements of Proposed Framework for Assessment of Natural Hazards