

Project Annex
Repository Geoscience and PA Technology Development
Under the
Agreement Between the Department of Energy Of the United States of America
and the Japan Atomic Energy Agency
for Cooperation in Research and Development in Nuclear Science and Energy

Preamble

This Project Annex is developed under the auspices of Agreement in Research and Development in Nuclear Science and Energy of April 4, 2007, hereinafter referred to as the “Agreement” between the Department of Energy of the United States of America (DOE) and the Japan Atomic Energy Agency (JAEA), hereinafter the “Parties,” and is subject to the provisions therein.

This Project Annex establishes a framework, terms and conditions for the Parties’ collaboration on the “Repository Geoscience and PA Technology Development” project (“the Project”), to be carried out through cooperative research between JAEA and DOE’s Lawrence Berkeley National Laboratory (LBNL). It is designed to further develop science and technologies and to contribute to the knowledgebase related to radioactive waste management in order to ensure the safety and cost effectiveness of nuclear waste repository program. The Parties anticipate that the technology developed as part of this Project will help in furthering the confidence in the respective nuclear waste repository program.

Section 1 - Background

The “Repository Geoscience and PA Technology Development” Project will couple the scientific expertise available in the United States with the data sets available in the Japanese High Level Nuclear Waste (HLW) program to further the science and technologies for nuclear waste repository and to contribute to the knowledgebase for global consumption. To this end, JAEA is currently constructing two underground rock laboratories: one at Horonobe in sedimentary rock and another at Mizunami in crystalline rock. In addition, JAEA has an advanced aboveground facility, ENTRY, to conduct large-scale laboratory experiments. Vast amount of quality data have been coming out from these to site investigation program and PA, to which DOE’s expertise and tools can be applied, tested and improved. Furthermore, JAEA is undertaking the development of repository science knowledgebase. DOE can contribute to the accumulation of the knowledgebase from its experience with the Yucca Mountain Program and elsewhere for global significance.

Section 2 - Project

- 2.1 In light of JAEA’s extensive field and laboratory studies at Horonobe and Mizunami sites and at the ENTRY facility, the primary objective of the Project is to (a) improve the understanding of the fundamental physics and chemistry that governs the processes that will play a significant role in the safety of radioactive waste disposal, (b) further develop characterization and predictive technologies of release and transport of radionuclides in

heterogeneous geologic media, and (3) contribute to the compilation of knowledgebase of repository science and technology.

- 2.2 DOE shall conduct the research within the Project Annex at the Lawrence Berkeley National Laboratory (LBNL), Berkeley, California.
- 2.3 Details of the work under the objectives set forth in Section 2.1 will be developed annually through discussions and deliberations at the JAEA/DOE Technical Coordinators' annual meeting (see Section 4 below). Such details will be developed based on the progress made in the previous year and the needs of JAEA and DOE identified in the current year. The annual research program agreed by both sides will be documented in an Annual Work Statement. Work will only be started after the Annual Work Statement is finalized.
- 2.4 Annual reports from the Collaborative Program shall be prepared by LBNL and submitted to JAEA and DOE.
- 2.5 Technology and information developed under this Project Annex will be transferred to JAEA and DOE. The transfer shall be facilitated through such means as reports, workshops, and personnel visits. The mechanism of technology and information transfer will be in accordance with the articles set forth in the Agreement.

Section 3 - Project Intellectual Property

The Parties shall ensure adequate and effective protection of intellectual property created or furnished under this Project Annex and agree that all intellectual property arising from the Project activities shall be governed by the Annex to the Agreement.

Section 4 - Management Plan

DOE shall conduct the research outlined in the Attachment at the Lawrence Berkeley National Laboratories (LBNL), in Berkeley, California. Annual reports shall be prepared by LBNL and submitted to both Parties. The Parties shall designate one Technical Coordinator each to supervise the activities under this Project. The Technical Coordinator for DOE will work at Lawrence Berkeley National Laboratories and will be responsible for completion of the DOE components of all tasks. A coordinating group consisting of the Technical Coordinators and other participants from the Parties shall meet approximately semi-annually on dates and at locations mutually agreed upon. Decisions by this coordinating group shall be by agreement between the technical Coordinators, whose activities shall be under the oversight of the Parties' Principal Coordinators cited in Article 4 of the Agreement.

Section 5 - Funding

JAEA shall provide funding to DOE for the work outlined in the Attachment. The amount of funding and the work for each year shall be agreed upon in writing by the Technical Coordinators in the form of Annual Work Statement and Memorandum. JAEA's funding to DOE/LBNL for

Japanese fiscal year 2008 and after shall be subject to the approval of the budget by the Japanese Government. DOE through Lawrence Berkeley National Laboratory plans to make available laboratories and computer facilities, necessary equipment, ancillary staff services necessary to carry out the work mutually agreed upon. DOE/LBNL shall carry out its activities under this Project Annex subject to the availability of appropriated funds. JAEA shall be responsible for the services of necessary JAEA personnel and contractor staff to support the tasks outlined in the attachments to this Project Annex.

Section 6 - Dissemination of Project Information

The information derived from this Project is expected to be of global significance with respect to nuclear repository siting, characterization and license development. The Technical Coordinators will submit the results of the Project to the Parties. The Parties agree to disseminate the information as they see fit through professional meetings, technical reviews, specific documents and peer reviewed journals, workshops and other channels. Both Parties will strive for completely open distribution of the Project's research results.

Section 7 - Amendment of the Project Annex

This Project Annex may be amended by written agreement of the Parties.

Section 8 - Effective Date and Termination

1. This Project Annex shall become effective upon signature and shall remain in effect so long as the Agreement remains in effect. Definition, duration and funding of specific tasks or additional tasks under this Project Annex will be agreed upon in writing between the Technical Coordinators.
2. Either Participant may terminate this Project Annex at any time upon 3 months written notice to the other Participant.

SIGNED in duplicate in the English Language.

FOR THE DEPARTMENT OF ENERGY
OF THE UNITED STATES OF AMERICA:

FOR THE JAPAN ATOMIC ENERGY
AGENCY:



3/17/2008

Research in the following three areas will be carried out on a “best effort within available funding” basis at the Lawrence Berkeley National Laboratory under the collaborative program. Work for each year will start upon signature of the Memorandum.

A. Development of site characterization, monitoring, and modeling methodologies:

LBNL will develop advanced technologies for characterization, monitoring and modeling for two types of potential repository host rocks: crystalline and sedimentary rock (corresponding to the Mizunami and Horonobe sites). We will investigate the use of independent lines of evidence such as the temperature distribution, salinity and other non-hydrologic data to help increase the model reliability. By conducting scenario testing simulations, we will attempt to develop technologies to reduce major uncertainties that are commonly associated with site characterization such as the boundary conditions, recharge rate and other parameters that are difficult to measure directly. We will also address the cause of anomalous observations such as low/high pressure zones through the use of alternative interpretation. The study should help guide the field investigations by indicating what kind of measurement are needed at what locations, which will lead to advanced analysis methods and reduced uncertainties. Adaptation of emerging technologies to site investigation and monitoring, such as wireless MEMS sensors for distributed and continuous measurements, and remote sensing technology will also be investigated.

B. Development of understanding and methodology for modeling of solute transport in complex fractured rock and improvement of field method to provide needed heterogeneity data for such modeling:

Under this task, LBNL will continue to develop basic understanding of the role of the processes and features affecting flow and tracer transport in geological systems, and methods will be developed for field measurements of controlling parameters and for modeling tracer migration and breakthrough curves in such systems. Such understanding is critical for understanding data from field measurements and conducting performance and safety assessment of a nuclear waste geologic repository. More specifically, two complementary lines of research will be pursued. Firstly, the applicability of parameters determined from the scale field tests to predictive calculations on the scale appropriate to performance assessment will be evaluated and assessed. How to relate the two scales will be a question to be addressed. Secondly, research will be conducted on the flowing fluid electric conductivity logging method which has been shown to be a useful technique to obtain spatial variation of permeability along a borehole and, in particular, the permeabilities of all fractures intersected by the well. This method will be further developed so as to enabling the measurement of critical data necessary for characterizing a site and for modeling of solute transport over multiple scales in complex fractured rocks.

C. Scientific discussion and input to site investigation program and PA.:

LBNL will participate in meetings to discuss with JAEA on the site investigation program and PA. The experience and knowledge of LBNL scientists and the lessons learned through the Yucca Mountain Program and other international repository programs should be most useful.