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# PROGRESS OF THE TASK OF HDR EVALUATION UNDER IEA AGREEMENT

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## ABSTRACT

The scope of the IEA Hot Dry Rock task includes HDR geothermal technology as well as other existing and new technologies that can be used for commercial heat extraction. The ultimate objective of Subtask D (HDR Evaluation Task) is to understand how much, how fast, and how long, geothermal energy can be extracted from an HDR reservoir system. Subtask D will clarify the types of methods, techniques, and tools that are effective for reservoir evaluation, and establish which evaluation methods will be most useful to develop new HDR sites. With this in mind, a questionnaire has been prepared to solicit information on reservoir evaluation techniques from core members of HDR task groups in each country and/or other concerned researchers.

## 1. INTRODUCTION

Full-scale field R&D experiments of HDR technologies were carried out at Fenton Hill, New Mexico, beginning in the mid-1970's by Los Alamos National Laboratory. In 1977, the Camborne School of Mines started its HDR Geothermal Energy Project. These projects were concerned mainly with development of the technology of reservoir creation in granitic environments and evaluation of the performance of HDR geothermal systems. Both groups have established their heat extraction systems and completed their research. At present, three additional field experiments are being conducted - the European HDR project at Saultz-Sous-Forets by EU, the Hijiori project by NEDO, and the Ogachi project by CRIEPI).

Geologic conditions at each of these fields differs and, hence, creating a HDR geothermal system is a site-specific technology just like underground metal and/or coal mine developments. Thus, some specific technologies that were successfully applied to one field cannot necessarily be applied to other fields. However, some basic technological aspects of commercial HDR development are common to each. With exception of the European HDR project, the purpose of all the HDR projects is mainly R&D rather than commercialization. In these cases, up-to-date methods and tools have been used and excellent results have been obtained. The knowledge and experience and tools development should be very useful not only in developing a future commercial HDR geothermal system but also in conventional geothermal development.

From this point of view, work on Subtask D began by collecting information about technologies for reservoir evaluation. When the task was started in 1997, it was planned to submit a questionnaire survey to a limited number of researchers associated with HDR technology. After making the first draft of the questionnaire, we decided instead to conduct the survey using the Internet. This method makes it easier for many known and as yet unknown workers to respond to the issues involved in Subtask D. The authors of this paper will present an interim report on the results of the Internet questionnaire at the WGC 2000 meeting. Here, the authors describe the outline of the questionnaire.

## 2. FRAMEWORK OF THE QUESTIONNAIRE

The Internet questionnaire has been put on a NEDO server. The URL of the questionnaire is as follows.

http://www.nedo.go.jp/gec/taskd/

In order to answer the questionnaire, 'Java' function should be on, and 'Cookies' must be accepted in the browser software (for example Netscape Communicator, or Internet Explorer).

The questionnaire mainly consists of two parts; one is the 'Personal information part' to register the personal information and get the unique I.D. number. The other is the questionnaire itself.

## 3. ACQUIREMENT OF THE I.D. NUMBER

Those who wish to respond to the questionnaire first need to obtain an I.D. number. After entering the homepage shown below, the first page (this page is called main page) will appear. A flowchart of this section is shown in Figure 1. An ID number can be obtained by entering a 'Name' and 'E-mail address'. Information under 'Name' is upper case / lower case sensitive. That is, 'John Smith' and 'John SMITH' are recognized as different person even if they have the same E-mail addresses.

After entering a name and email address, other information , such as Organization, Address, Telephone number, Fax number can be entered as shown in Figure 1. Since the results of the questionnaire will be summarized and published as a report, a one can specifiy that certain information (e.g. name and email address) be kept confidential in the report. Such personal information will be used by Subtask D members to contact the those responding to questionnaire.

An I.D. consisting of 3 characters and 3 digits (for example JuX568 etc.) is unique for one person. The character part of this I.D. is also lower case / upper case sensitive.

After getting an I.D. number, the answerer can proceed to the questionnaire section without re-entering personal information again. If the answerer wants to correct or modify some items of personal information, for example Telephone number and so on, they could be corrected at here by using the I.D. number as is shown in Figure 1.

## 4. CATEGORIES IN THE QUENSTIONNAIRE

The questionnaire consists of five categories with some sub-

categories as listed below.

1. Numerical Simulation
2. Geology
3. Tracer
   3-1. Field Tracer Experiment
   3-2. Basic (Laboratory) Tracer Experiment
4. Geochemistry
   4-1. Water Chemistry
   4-2. Gas Chemistry
5. Measurement Techniques
   5-1. Microseismic Monitoring
   5-2. Logging Tools

Each question was designed to be finished within at most 20 minutes. However, in some categories this may be difficult. For example, in a logging tool category, the answerer will be asked for the diameter of the tool. If the answerer does not remember the value, it would take time to answer. In that case, the answerer can leave the specific questions unanswered and can submit temporary answer to the NEDO server.. After preparing the necessary data, the answerer will be able to re-enter the same category by using his unique I.D. number, and correct/modify the temporary data submitted before.

One answerer can provide answers in more than two categories using the same I.D. number as shown in Figure 2. If the answerer wants to answer both categories '4.1 Water Chemistry' and '4.2 Gas Chemistry', for example, then he can answer the category one by one.

On the other hand, one answerer may want to answer more than two different items in one category. For example 'category 1 Numerical Simulation' will ask the answerer the name of numerical simulator he is using and its principle, limitation, capability and so on. He might use more than two numerical simulators. The category 'Numerical Simulator' will at first ask for the name of the simulator. This name will act as a key word. If the name has been already registered (or answered), he will enter into modification mode. If the name of the simulation code has not been registered, he will enter into 'newly answering mode' to that code. This procedure is shown in Figure 3.

The same thing may happen with another category. For example 'category 2 Geology' will ask the answerer the name of the field he is working. He might have the data of the geology of more than two locations. In this case, the category 'Geology' will at first asks him the name of the field. This name of the field also will act as a key word. If the name of the field has been already registered, he will enter into modification mode of the geology of that field. Otherwise, he will enter into 'newly answering mode' regarding to the field. This flowchart is shown in Figure 4.

The keywords are lower case/upper case sensitive. The numerical simulator, for example, 'Geocrack' and 'GEOCRACK' are recognized as different numerical simulators. The same rule applies to name of fields. 'Fenton Hill', for example, is recognized to be different field from 'FENTON HILL'. Please keep this in mind when using keywords.

## 5. PUBLICATION OF THE RESULTS

This Internet questionnaire will continue to be available until the beginning of 2001. All the answers will be summarize into the IEA report and distributed to all the answerers. In addition, members of the Subtask D working group will distribute the results as a database to interested individuals. Any geothermal people who have an interest in this questionnaire can contact to the following E-mail addresses.

storm@nire.go.jp (Tsutomu YAMAGUCHI, NIRE)
tenma@nire.go.jp (Norio TENMA, NIRE)
karasawahrk@nedo.go.jp (Hirokazu KARASAWA, NEDO)

The Internet questionnaire has been discussed and distributed by the International Geothermal Cooperative Committee, HDR Task Force organized by NEDO. The Task Force consists of following members.

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Isao MATSUNGA (NIRE)
Tsutomu YAMAGUCHI (NIRE)
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Hiroaki NIITSUMA (Tohoku University)
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Kenzou KIHOU (CRIEPI)
Makoto MIYAIRI (JAPEX)
Haruya NAKATA (GERD)
Masakazu KADOWAKI (Mitsui MSC)
Masahiko YAGI (JAPEX)

## 6. REQUEST TO ALL THE GEOTHERMAL PEOPLE

We strongly request that those who attend the WGC2000 yo take part in this Subtask D Internet questionnaire via the following web site in order to make it a successful and fruitful effort.

http://www.nedo.go.jp/gec/taskd/

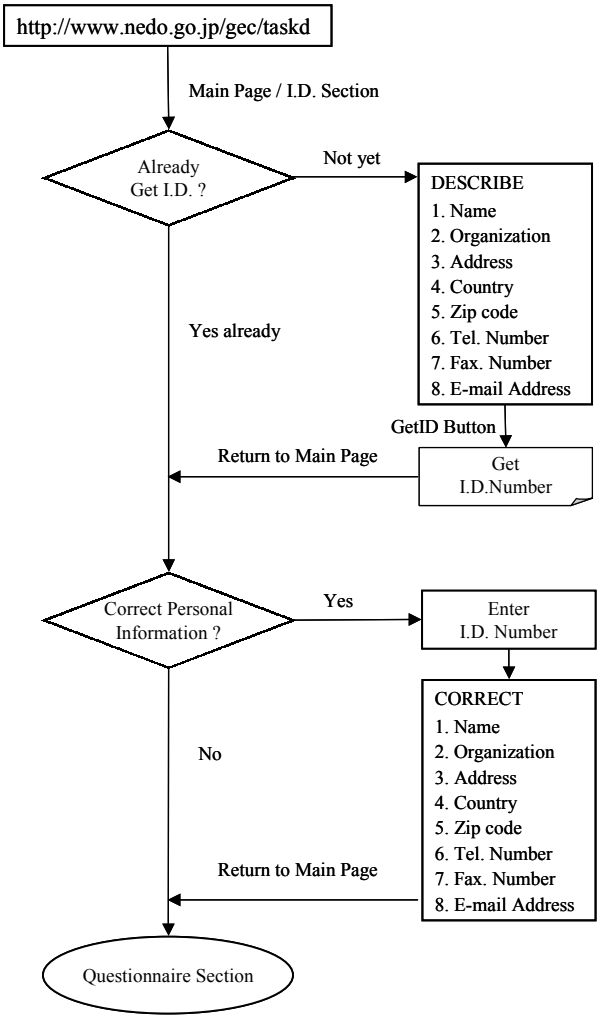


Figure 1 Flowchart of the I.D. section of Internet questionnaire. To obtain I.D. number, at least Name and E-mail Address are necessary.

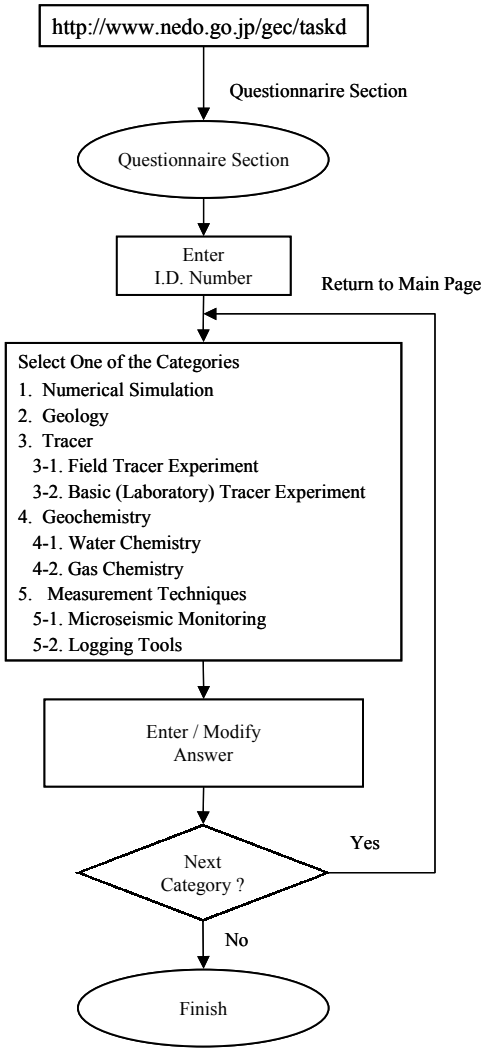


Figure 2 Flowchart of Questionnaire section.

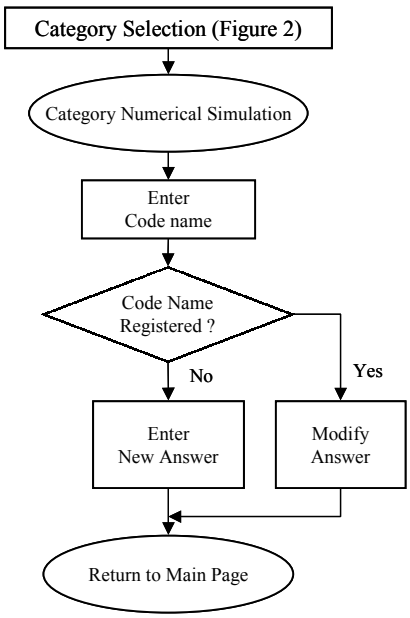


Figure 3 Flowchart for the category 'Numerical Simulation'

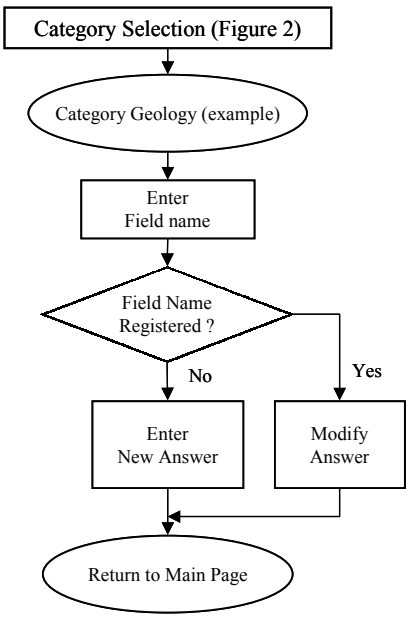


Figure 4 Flowchart for the category 'Geology'