



Department of Energy

Washington, DC 20585

NOV 5 1992

Mr. Joseph J. Holonich, Director
Repository Licensing & Quality Assurance
Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Holonich:

Enclosed are the U.S. Department of Energy's (DOE) responses to two comments and three questions from the U.S. Nuclear Regulatory Commission's (NRC) Phase II review of Study Plan 8.3.1.2.1.2, "Characterization of Runoff and Streamflow," (enclosure 1). Enclosure 2 contains the response to these comments and questions.

For comments on DOE-approved study plans, the Yucca Mountain Site Characterization Project Office (YMPO) asks the responsible participant organization (in this case, the U.S. Geological Survey [USGS]) and principal investigator to perform an assessment of the impact of the comments on the planned study. Such assessments include discussions of: (1) how appropriate concerns could be addressed within the planned program, i.e., justify why changes are or are not appropriate, and (2) how appropriate concerns could be addressed at a later stage in the site characterization program.

As a result of this assessment, DOE has asked the USGS to undertake a minor revision to the study plan before the end of 1992. Per our response to Question 1, the revision will note that prototype testing activity to evaluate the most favorable instrumentation for gathering site characterization data is to be undertaken early whenever possible, but that this activity may be conducted in parallel with selection and emplacement of equipment.

As for all NRC comments on study plans, these comments and questions have been given a unique identifier for tracking purposes at YMPO.

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If you have any questions, please contact Mr. Chris Einberg of my office at 202-586-8869.

Sincerely,



JPR

John P. Roberts
Acting Associate Director for
Systems and Compliance
Office of Civilian Radioactive
Waste Management

Enclosures:

1. Ltr, 8/14/92, Holonich to Roberts,
w/encls
2. Responses to NRC Comments and
Questions

cc: w\enclosures
Alice Cortinas, CNWRA, San Antonio, TX

cc: w\enclosures
C. Gertz, YMPO
R. Loux, State of Nevada
T. Hickey, Nevada Legislative Commission
M. Baughman, Lincoln County, NV
J. Bingham, Clark County, NV
B. Raper, Nye County, NV
P. Niedzielski-Eichner, Nye County, NV
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J. Hayes, Esmeralda County, NV
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B. Mettam, Inyo County, CA
C. Abrams, NRC



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

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Key/Suggs M-
Tess *Geer/Williamson*
Leonard

Mr. John P. Roberts, Acting Associate Director
for Systems and Compliance
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Dear Mr. Roberts:

SUBJECT: DETAILED TECHNICAL REVIEW OF U.S. DEPARTMENT OF ENERGY STUDY PLAN FOR
CHARACTERIZATION OF THE YUCCA MOUNTAIN REGIONAL SURFACE-WATER RUNOFF
AND STREAMFLOW

8/20/92
Boqueron
Head of
Section

In a letter to the U.S. Department of Energy (DOE) dated May 14, 1991, the Nuclear Regulatory Commission informed DOE that the NRC staff's Phase I Review had identified no objections with any of the activities proposed in the study plan for "Characterization of the Yucca Mountain Regional Surface-Water Runoff and Streamflow" (Study Plan 8.3.1.2.1.2). At that same time, NRC also indicated that it had decided to proceed with a Detailed Technical Review of that study plan. The purpose of this letter is to transmit the results of the NRC staff's Detailed Technical Review.

The subject study plan has two activities: 1) surface-water runoff monitoring (8.3.1.2.1.2.1) and 2) transport of debris by severe runoff (8.3.1.2.1.2.2). These activities consist of measuring and recording the temporal, spatial, and physical characteristics of runoff and streamflow, and the locations, quantities, and characteristics of debris transport. The NRC staff considers that the results of these activities are important as they will be used in the evaluation of design and performance issues.

In its Detailed Technical Review the NRC staff identified two comments and three questions relative to the study plan. The detailed review comments and questions (enclosed) on this study plan will be tracked by the NRC staff as open items similar to SCA objections, comments, and questions. NRC recommends timely resolution of these comments and questions and is prepared to interact with DOE upon DOE's request to work toward resolution.

In order for the NRC staff to be able to complete its review in a timely manner, DOE should provide its responses to the enclosure within 60 days of the date of this letter. If DOE is unable to provide the information within the requested time, please notify the NRC staff of when the responses will be provided.

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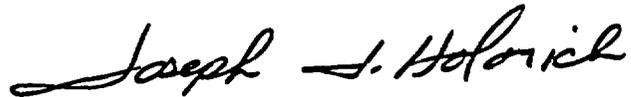
ENCLOSURE 1

Mr. John P. Roberts

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If you have any questions concerning this letter or the enclosure, please contact Charlotte Abrams, of my staff, at (301) 504-3403.

Sincerely,



Joseph J. Holonich, Director
Repository Licensing and Quality Assurance
Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosures: As stated

cc: R. Loux, State of Nevada
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M. Baughman, Lincoln County, NV
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Activity 8.3.1.2.1.2.1 Surface-water runoff monitoring

COMMENT 1

The NRC staff considers that specific attention should be given to the study of surface runoff flows from the west face of Yucca Mountain and in Solitario Canyon.

BASIS

In response to the objectives of the study plan, an impressive array of surface-runoff measuring sites have been proposed and the program has been divided into two types of stream-gaging networks. One is for a regional study and the other is for a site study. However, the focus of the investigations and location of the majority of the runoff gaging sites are associated with an attempt to assess the contribution of channel flow to the regional groundwater table.

DOE acknowledges that the "regional streamflow-measurement network is not of adequate areal density, or of a needed level of detail, to satisfy the information needs" (p. 3.1-25) to determine the contribution (if any) of infiltration and surface runoff to the moisture flow in the "deep" unsaturated zone. Because of this need, DOE has proposed the 23 locations shown on Figure 3.1-4.

With respect to the input to the unsaturated flow regime above the repository and an evaluation of repository performance, the site study aspect of the plan is as important, if not more important, than the regional study. Also given the nature of the precipitation and runoff events of this region, a network of small watershed sites may also provide more data and information over the duration of the study.

The geologic formations dip from the Solitario Canyon fault zone to the east under Yucca Mountain. There is a possibility that ephemeral flows from the face of Yucca Mountain and in Solitario Canyon could be a supply of water (amounts, duration, and ponded heads) for porous and fracture groundwater flow in the geologic formation above and in which it is proposed to locate the repository. In this regard, consideration should also be given to locating the gaging stations with respect to the site characterization wells proposed in other parts of the SCP (e.g., 8.3.1.2.2.3.2, 8.3.1.2.2.3.3, 8.3.1.2.2.4.9, and 8.3.1.4.3.1.1). Also, the shortest distance from the ground surface to the repository is from the Solitario Canyon face of Yucca Mountain. NRC recognizes that three gaging stations are proposed for Solitario Canyon from the information in Figure 3.1-4. Although gaging sites are proposed for the east side of the mountain (i.e., SY1,6,8,10, and 11), no sites are proposed for the west face of the mountain.

RECOMMENDATION

DOE should consider placing some gaging sites on the western side of the mountain, show the boundaries of the drainage areas for all watersheds, and develop in more detail the relationship of the three proposed Solitario Canyon gaging sites and any additional sites with respect to the existing wells, proposed wells, raingage locations, soils and surficial deposits, channel incisions, and exposed geologic formations in the Solitario Canyon area.

Activity 8.3.1.2.1.2.1 Surface-water runoff monitoring

COMMENT 2

The NRC staff cautions against rejecting evaluating the probabilities of runoff magnitudes by any regionalization procedure or method.

BASIS

In the paragraphs discussing the estimation of runoff frequencies (p.3.1-28), it is stated that the alternatives to at site evaluation of runoff magnitude recurrence frequencies of 1) using precipitation and basin characteristics and 2) regionalized runoff relations were rejected. In the publication "Estimating Probabilities of Extreme Floods; Methods and Recommended Research" (National Research Council, 1988, p. 8), it is stated that:

[i]nitially a single at-site analysis can be preformed. This is a good starting point, and it uses recorded data at the point of interest. However, it must be recognized that data at a single site are too limited to permit more than a rough estimate and then only for relatively common floods.

After some discussion about the consideration of appropriate probability distributions, it is stated in the report:

After these preliminaries, the emphasis should be on increasing the data pool as much as practicable. There are two ways to do this: use of historical and other data, and the use regional analysis. (NRC, 1988, p. 8)

RECOMMENDATION

The NRC staff refers DOE to guidance of the 1988 publication by the National Research Council and suggests that regional methods be included in the site characterization analyses.

REFERENCE

National Research Council (NRC), 1988, "Estimating Probabilities of Extreme Floods; Methods and Recommended Research," Committee on Techniques for Estimating Probabilities of Extreme Floods, Water Science and Technology Board, National Academy Press, Washington, D.C.

Activity 8.3.1.2.1.2.1, Surface-water runoff monitoring

QUESTION 1

Have the field-tests of the surface runoff measurement devices, systems, and proposed techniques been completed? And, if not, when will they be completed?

BASIS

DOE has indicated that it is important to have the site runoff measuring stations operating as soon as possible, "in the near future (FY 1991 and 1992)" (p. 3.1-25). However, this operational phase is dependent upon the completion of field-tests of the measurement devices, systems, and proposed techniques that were to be done "hopefully" in FY 1990 (p. 3.1-26). However, the NRC staff has no knowledge that such field-testing has been accomplished. If the site runoff measurement locations are not instrumented at the beginning of the restart of site characterization activities, it will be difficult to collect the needed information from these tests prior to the submittal of a license application.

RECOMMENDATION

Provide a discussion of the status and schedules for the planned field-test of the surface runoff measurement devices.

Activity 8.3.1.2.1.2.1 Surface-water runoff monitoring

QUESTION 2

Has DOE considered any other instrumentation for measuring in situ flow depth and velocity, especially for large ephemeral flows such as sonar, pressure transducers, and induction probes?

Basis

In Table 3.1-3 of the study plan, DOE has listed a number of technical procedures that will be used for this study. Two of these procedures (HP-116,RO and HP-100,RO) are associated with the measurement of channel flow. To augment or supplement the stilling well with float or bubbler measurements of stage, the DOE might consider the use of sonar and pressure transducers. Price current meters have limitations with respect to making velocity measurements in large ephemeral flows that occur in the semiarid environment. Thus, DOE may wish to consider using other types of instrumentation for measuring flow velocity, especially for the large ephemeral flows, in the planned measuring flumes. There has been some experience with induction velocity probes for the measurement of high velocity flow in flumes which might be considered (Smith and others, 1982).

RECOMMENDATION

Provide a discussion of the evaluations made and the types of flow measuring structures and instrumentation considered and selected (if appropriate) for the surface runoff monitoring activity.

REFERENCE

Smith, R. E., Chery, D.L., Jr., Renard, K.G., and Gwinn, W.R., 1982, Supercritical flow flumes for measuring sediment-laden flow: U.S. Department of Agriculture, Agricultural Research Service, Technical Bulletin 1655.

Activity 8.3.1.2.1.2.2, Transport of debris by severe runoff

QUESTION 3

Are there plans for taking sediment samples at the gaging stations?

BASIS

The debris transport activity is significantly different from that of the surface-water runoff monitoring activity (Section 3.1) in that it is a "field-reconnaissance" type of investigation as contrasted to the extensive field instrumentation planned for the 3.1 activity. Therefore, there will be limited quantifiable data except for the description (size and composition) of a debris flow and of selected point surface and channel erosion. The information about the storm events and size of runoff or flow that caused or deposited a debris flow can only be inferred. Therefore, the references to monitoring on pages 3.2-3 and 3.2-4 can only be associated with some aspects of the erosion part of the investigation unless there are plans to do sediment transport sampling at the gaging sites proposed in activity 3.1.

RECOMMENDATION

Provide a discussion of plans (if any) for sediment sampling.

Activity 8.3.1.2.1.2.1 Surface-water Runoff Monitoring

Comment 1

The NRC staff considers that specific attention should be given to the study of surface runoff flows from the west face of Yucca Mountain and in Solitario Canyon.

Response:

The three streamgages proposed for Solitario Canyon (SY17, SY18, and SY19) are in the best available locations to monitor surface flows which may run off the west face of Yucca Mountain as well as in Solitario Wash. Additional sites in Solitario Wash were considered, however no potential locations were found to be hydraulically acceptable for collecting runoff data.

The installation of streamgages on the west face of Yucca Mountain was not considered by project investigators to be worthwhile due to the extremely steep gradients along the face and the lack of developed drainages. The gradient along the face ranges from 0.6 to 0.3 (ratio of elevation to distance). With gradients this steep, it is highly unlikely that any accurate, quantitative data could be collected, even by installing flumes or other hydraulic controls.

The three streamgages in Solitario Wash, as planned, will provide data to other Yucca Mountain Site Characterization Project (YMP) activities which will utilize existing and planned wells along the west flank of Yucca Mountain. Site SY17, located slightly northwest of existing well USW-15 will provide data in the upper portion of Solitario Canyon, as well as provide data for proposed well WT-9 of Activity 8.3.1.2.3.1.1 (Solitario Fault Study In the Saturated Zone). Site SY18 will record runoff before the junction of existing well USW-H6 and the proposed well WT-8, which is also part of the Solitario Fault study. Site SY19, the farthest gage downstream, will record runoff prior to reaching existing well USW WT-7 and proposed wells USW.UZ-11 and 12 for Activity 8.3.1.2.2.3.2 (Site Vertical-Borehole Studies).

Activity 8.3.1.2.1.2.1 Surface-water Runoff Monitoring

Comment 2

The NRC staff cautions against rejecting evaluating the probabilities of runoff magnitudes by any regionalization procedure or method.

Response:

The U.S. Geological Survey (USGS) concurs with this statement. In Study Plan 8.3.1.2.1.2 (Characterization of the Yucca Mountain Regional Surface-Water Runoff and Streamflow), the statement is made that the use of regional methods to estimate runoff frequencies is rejected. This method was rejected because project investigators considered it inappropriate to use regional analysis exclusively without the availability of adequate gaged data to calibrate regional curves to local conditions.

Funding constraints keep the installation of the Yucca Mountain monitoring network from taking place. The network is now rescheduled for installation in fiscal year (FY) 1994 through FY 1996. Project investigators are concerned that site-specific data from the planned network become available before overreliance is placed on regionalized runoff relations.

Currently, two related studies—Regional Paleoflood Evaluation (Activity 8.3.1.5.2.1.1) and Transport of Debris by Severe Runoff (Activity 8.3.1.2.1.2.2)—are investigating regional runoff relationships using historic and paleoflood information. These studies will more clearly define possible inadequacies in the number or placement of stream gages in the existing monitoring network.

It is USGS's intention to continue to modify and improve this network so that accurate gage data are provided. Subsequently, a more thorough regional analysis will be possible.

Activity 8.3.1.2.1.2.1 Surface-water Runoff Monitoring

Question 1

Have the field test of the surface runoff measurement devices, systems, and proposed techniques been completed? And, if not, when will they be completed?

Response:

Due to significant funding constraints, most of the activities originally planned as "prototype testing" had to be postponed. The text of the study plan on page 3.1-26 regarding the conditions of siting and installing the monitoring networks would not have been written quite as restrictively had the USGS been able to anticipate constraints in funding. At the time the study plan was written and reviewed, there were several new or newly-emerging monitoring devices and systems representing the state of the art in instrumentation for monitoring stage and measuring discharges. It was USGS's intent to evaluate as many of these systems as were financially and logistically feasible before committing to a specific configuration. A revision to the study plan will be undertaken to note that prototype testing to evaluate the most favorable instrumentation for gathering site characterization data is to be undertaken early whenever possible, but that these evaluations may be conducted in parallel with selection and emplacement of gages.

Because funding was provided to install several additional streamgages for the regional network, certain operational decisions were made for conduct of the study without the benefit of prototype testing. The system selected had to meet project criteria for accuracy and be cost-effective to help allow for the installation of as many gages as possible. Within the last three years, certain monitoring instrumentation, which are listed below, were purchased and distributed to selected gages within the existing regional network. This strategy essentially resequenced our earlier plans and allowed us to expand the network and evaluate new equipment simultaneously.

The status of surface-water monitoring devices and systems still considered to be undergoing prototype testing are described in more detail below:

1. The ALERT telemetry system, which is a VHF radio-transmitting device, was installed at six streamflow sites; four are on the Nevada Test Site (NTS), and two are located at regional sites outside NTS boundaries. This system is for the express purpose of providing timely notification that flow is occurring at a particular gage. This allows USGS staff to respond to specific locations in a timely manner to collect valuable data. The system may also be used to collect and store redundant data in the event of a malfunction with the primary data acquisition system. The ALERT system is presently undergoing field testing, and it will continue as a prototype activity until it has gone through several actual flow events and the data are evaluated. It will continue to be expanded and will ultimately be installed at all existing streamflow sites. The ephemeral nature of runoff in southern Nevada precludes an immediate evaluation of the entire system.

2. The Fluid Data Manometer system is presently one of the new components of the primary data-acquisition system. It is being used because of its relatively low cost and because it interfaces easily with existing data recorders and with the ALERT system. The technical procedure for this system was approved in July of 1992. Four streamflow sites currently have Fluid Data systems on line. This system is planned to be installed at three additional streamflow sites in FY 1993. One is currently being installed on Pagany Wash which is the first gage for the planned Yucca Mountain network.
3. An ISCO suspended-sediment sampler was purchased for the project for prototype testing since FY 1990. In the absence of funding for the prototype flume phase of testing, this sampler was reprogrammed for installation and testing at one of the existing regional streamflow gages located in the Upper Fortymile Wash watershed. This site was chosen because of the higher annual precipitation total at this site as compared to other network sites. This will allow the project more opportunity to test the system under natural conditions within a shorter period of time. USGS investigators would also like to test and evaluate other sediment sampling systems, however, funding constraints and past delays in the permitting process for installing the equipment have hindered the progress of this activity.
4. Funding for the prototype flume, which was planned for fabrication and testing in FY 1990, has to date not been provided. Supercritical-flow flumes, however, are still planned as the primary hydraulic-control structure for the Yucca Mountain monitoring network. The scheduling for the installation of the 23 network sites is now in FYs 1994 through 1996. Most, if not all, of the field sites selected have some degree of natural hydraulic control available. This allowed us to develop our present strategy of installing the gages prior to the installation of the flumes. The monitoring systems in current inventories were selected because they would allow this flexibility. When the flumes are eventually in place, the equipment can be readily adapted with only minor modifications. If the flumes are not funded, the gages will continue to collect data, however, the accuracy of the records will be somewhat diminished.

Having gone this far into site characterization data collection, the fabrication and testing of a prototype flume is probably not necessary. Because the use of flumes is accepted as a standard technology, flumes can be fabricated and installed according to established specifications relatively easily. It is important to note that the intent of the original prototype testing was not to evaluate the flumes, but rather to evaluate the data acquisition systems.

Activity 8.3.1.2.1.2.1 Surface-water Runoff Monitoring

Question 2

Has DOE considered any other instrumentation for measuring in situ flow depth and velocity, especially for large ephemeral flows such as sonar, pressure transducers, and induction probes?

Response:

An early activity undertaken for this study was to convene a workshop in 1986 to consider instrumentation and hydraulic-control structures needed to gage ephemeral flows at, and in, the vicinity of Yucca Mountain. Experienced hydrologists and technicians from USGS Water Resources Division (WRD) offices in Colorado, Washington, Arizona, and Nevada, who were familiar with the problems of gathering runoff data in arid climates, were invited to the workshop that was sponsored by the USGS's WRD Nevada District office. A consensus was established that the standard stilling well with float-tape instrumentation and/or a gas purge system, such as a manometer, would work acceptably in conjunction with the installation of supercritical-flow flumes. The stilling well and manometer would monitor stage, and the rated flumes would provide the proper corresponding discharge.

The system, as designed, was to be sensitive and accurate for low to medium flows in order to meet the needs of other YMP studies. It was also designed on the premise that few, if any, discharge measurements would be made during periods of flow due to the geographically isolated nature of the network. The installation of flumes on the larger ephemeral channels, such as Fortymile Wash, was not considered, because the cost would be prohibitive.

A gas purge system was considered to be the most effective system to be installed, but it would be limited to monitoring only the stream stage. The development and/or confirmation of a flume rating table would be accomplished by several techniques. The use of the current meters during actual flow events would cover wadable stages. Indirect measurements of discharge by the slope area or slope conveyance methods would be used to estimate extreme flows. Flow simulation, with the assistance of DOE contractors, would also establish the rating for low stages for selected flumes. These systems were chosen because of their established reliability, ease of maintenance, and standardized use within the USGS field operations for what is planned as a large network over a poorly accessible area.

The use of pressure transducers, sonar, and acoustic velocity meters were not considered for several reasons. These instruments would all require fine-tuning and adjustments, which would need to be made at site locations during an event. It was considered that the inaccessibility to most sites during flows would limit the possibilities of these adjustments being made. The nature of the channels could limit the range of these instruments. The large streambeds contain loose sand, cobbles, and small boulders that have a tendency to scour and fill. The positioning of a sonar system, acoustic velocity meter, or transducers would be educated guesswork at best. Large streams usually have poorly defined banks, which would make it almost impossible to establish positioning of transponders. The heavy sediment load would also have an adverse effect on these systems.

The use of sonar or transducers in the proposed flumes was also deemed acceptable. The flumes are designed to provide accurate discharges to their specified limits. They require that only stage be monitored. However, streamflow measurements will be taken during several planned flow simulations or when possible during flow events. These flow simulations will be conducted on several of the flumes, if possible, for verifying the low end of the stage-discharge rating.

Activity 8.3.1.2.1.2.2 Transport of Debris by Severe Runoff

Question 3

Are there plans for taking sediment samples at the gaging stations?

Response:

Yes. As indicated on page 3.1-26 of Study Plan 8.3.1.2.1.2 (Characterization of the Yucca Mountain Regional Surface-Water Runoff and Streamflow), "fluvial suspended-sediment monitoring is planned for about six of the measurement sites." The primary purpose of the sediment monitoring, as the text states, is to define the "relative proportion of water and sediment in the streamflow mixtures." However, as the text further states, the sediment data collected from these sites "will also be useful to activities that relate debris transport to severe runoff and flooding (Activities 8.3.1.16.1.1.1 and 8.3.1.2.1.2.2), which address these concerns.

Six of the planned 23 streamflow gages for the Yucca Mountain network will have automatic sampling equipment installed. The exact locations have not been finalized at this time, because funding for the installation of the network is now programmed for FYs 1994 through 1996. Some of the equipment that may be used for the collection of sediment samples is still undergoing prototype testing and evaluation, as described in more detail in the response to NRC question 1.