

APR 30 1993

MEMORANDUM FOR: Joseph Holonich, Director
Repository Licensing and Quality Assurance
Project Directorate
Division of High-Level Waste Management

FROM: Margaret Federline, Chief
Hydrology and Systems Performance Branch
Division of High-Level Waste Management

SUBJECT: DOE REQUEST FOR RESOLUTION OF SCA COMMENTS 21
AND 22 [RITS 411415, TAC L60249]

DOE has proposed that, based on the attached letter from J. Roberts (DOE) to J. Holonich (NRC), SCA comments 21 and 22 can be resolved. Comment 21 relates to the sampling programs for Tc-99 and I-129. Comment 22 expresses concerns about the use of packers to isolate saturated zone intervals for the collection of groundwater samples. It recommends that groundwater sampling be performed at the time the water table is first encountered during drilling.

After reviewing the latest DOE response to these comments, we consider that both Comments 21 and 22 should remain "open." The basis for this conclusion is contained in the attached comment-response package. This review was performed by Neil Coleman, who may be reached at 504-2530 if you have any questions.

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Margaret Federline, Chief
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Attachment:
As stated

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- Section 8.3.1.2.3.2 Study: Characterization of the saturated zone hydrochemistry
- Section 8.3.1.2.3.2.1 Activity: Assessment of saturated-zone hydrochemical data availability and needs
- Section 8.3.1.2.3.2.2 Activity: Hydrochemical characterization of water in the upper part of the saturated zone
- Section 8.3.1.2.3.2.3 Activity: Regional hydrochemical characterization

SCA COMMENT 21

Technetium-99 and iodine-129 are not explicitly included in studies to characterize groundwater flow and radionuclide background concentrations in groundwater.

EVALUATION OF DOE RESPONSE

- o This comment was originally prepared under NRC's Site Characterization Analysis (SCA), published in August, 1989. The DOE responded to this and other SCA comments on December 14th, 1990. The DOE stated that sampling and analyses for Tc-99 and I-129 would be performed under the Radiological Monitoring Plan (RMP) rather than under the Site Characterization Plan. The NRC's evaluation of this response was transmitted on July 31st, 1991. The staff considered that DOE's commitment to collect the data through the radiological monitoring program would not in itself resolve the comment. In order to make progress toward comment resolution, the NRC staff would have to review DOE's Radiological Monitoring Plan (DOE, 1988) and relevant study plans, including DOE 1990, 1991, 1992, and 1993.
- o The DOE provided additional information relevant to Comment 21 on January 7, 1993 [letter from J. Roberts (DOE) to J. Holonich (NRC)]. The letter stated that, based on the information provided, DOE regards this open item as resolved. The DOE noted that all of the study plans that NRC needed to review had been sent to the staff. However, the RMP was not sent to NRC, and DOE stated that it is not relying on the RMP to address this open item. The RMP reportedly explains Tc-99 and I-129 sampling that will be done for the YMPO environmental program requirements.
- o The DOE asserts that the following references "clearly indicate" that sampling of Tc-99, I-129, tritium, and Cl-36 is "intended to be part of the sampling programs for assessing the age and movement of groundwater in the unsaturated and saturated zones":

Study Plan 8.3.1.2.2.7, Table 2.2-1
Study Plan 8.3.1.2.3.2, Table 3.2-2
Study Plan 8.3.1.2.2.2

However, the above citations address Cl-36 and tritium, but not Tc-99 and I-129. DOE also states that the study program for Tc-99 and I-129

(in the upper part of the saturated zone) is described on p. 3.2-16 of Study Plan 8.3.1.2.3.2 (Characterization of the Yucca Mountain Saturated-Zone Hydrochemistry). Unfortunately, it appears the work related to Tc-99 and I-129 will be performed under the RMP, which DOE states will not be relied on to address this open item. As stated on pages 3.2-16 and 3.2-17 of that plan:

"Investigators responsible for the RMP will coordinate the analyses of samples for ⁹⁹Tc, ¹²⁹I, and other radioisotopes of principal concern ... Activities of ⁹⁹Tc and ¹²⁹I are anticipated to be so low that sampling for them will be so difficult that their inclusion in an analytical suite for all samples collected would have little or no benefit. These determinations will be performed on samples from the first two or three sites visited, however, and if significant activities are detected, additional determinations will be made on subsequent samples."

- o Although the NRC has not received or reviewed the RMP, the staff is concerned about the approach to sampling under the RMP described in the above paragraph from a study plan. The staff considers that the "first two or three sites visited" may not be the best locations for determining whether continued groundwater sampling for Tc-99 and I-129 may be needed. Rather, the DOE should initially target areas where the greatest infiltration and recharge have probably occurred. This would include wells along the eastern margin of the drainage channels of Fortymile Wash, and those located in the lower parts of major washes on Yucca Mountain. The sampling should be performed in such a way that samples are representative of the upper part of the saturated zone, or of any perched zone that is encountered in drilling new wells in these areas. The DOE needs to include this rationale in the RMP (and in the discussion in Study Plan 8.3.1.2.3.2) to ensure that initial groundwater sampling for Tc-99 and I-129 will occur in areas where higher background concentrations can be expected.
- o Table 2.1-2 of the Study Plan "Hydrochemical Characterization of the Unsaturated Zone" clearly shows the intent to sample perched water wherever it is found. According to Table 1.2-1 of the study plan, chemical species to be analyzed include C-14, tritium, and Cl-36; I-129 and Tc-99 are not included.
- o I-129 and Tc-99 are among those radioisotopes identified in Appendix A of EPA (1985) regarding release limits for containment requirements. The background levels and variability of these radioisotopes in the saturated zone at the site should be assessed as part of site characterization to provide baseline information for the performance confirmation program at the site. Insofar as perched groundwater represents localized zones of saturation, perched zones that are discovered during drilling or excavations should likewise be sampled and analyzed for these radioisotopes (given that sufficient amounts of water can be obtained for sampling).
- o The need for data on Tc-99 and I-129 in the saturated flow system is consistent with guidance provided in Regulatory Guide 4.17, Standard Format and Content Guide for HLW SCP's (NRC, 1987). In Section 3.9.1.3

of that document (hydrochemistry), it is stated that "at sites where human activity may have introduced radioactivity into the groundwater, analysis should be done for those radioisotopes that are known or suspected to have been added to the system. Using this information, provide assessments of temporal and spatial variations of the hydrochemistry." At Yucca Mountain, anthropogenic sources of mobile radioisotopes, such as I-129 and Tc-99, would include underground nuclear testing at the nearby Nevada Test Site, and groundwater recharge from precipitation containing contaminants from past atmospheric nuclear tests.

- o Data on subsurface migration of anthropogenic radioisotopes, including tritium and long-lived species like Tc-99, I-129, and Cl-36, will provide important insight about groundwater flow paths and groundwater travel time. These data may provide a means to help calibrate numerical flow and transport models of the unsaturated and saturated zones.
- o Tc-99 and I-129 should be added to the group of radioisotopes that will be analyzed from water samples collected in the upper part of the saturated zone and in any discovered zones of perched groundwater. The DOE should identify site characterization studies and activities under which Tc-99 and I-129 will be sampled and analyzed.
- o In summary, it appears that sampling for Tc-99 and I-129 will only be done under the RMP. The NRC staff is not aware of any other studies or activities where sampling will be done for these radioisotopes. Therefore, since DOE is not relying on the RMP to address this open item, DOE's response does not resolve SCA comment 21.
- o The NRC staff considers this comment open.

REFERENCES

DOE (U.S. Dept. of Energy), "Study Plan: Hydrochemical Characterization of the Unsaturated Zone," YMP-USGS-SP 8.3.1.2.2.7, R0, September 18, 1990.

DOE (U.S. Dept. of Energy), "Study Plan: Characterization of the Unsaturated-Zone Infiltration," YMP-USGS-SP 8.3.1.2.2.1, R0, January 25, 1991.

DOE (U.S. Dept. of Energy), "Study Plan: Characterization of the Yucca Mountain Saturated-Zone Hydrochemistry," YMP-USGS-SP 8.3.1.2.3.2, R0, April 22, 1992.

DOE (U.S. Dept. of Energy), "Study Plan: Water Movement Test," YMP-LANL-SP 8.3.1.2.2.2, R1, February 10, 1993.

EPA (U.S. Environmental Protection Agency), "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes; Final Rule," Federal Register, Vol. 50, No. 182, September 19, 1985, pp. 38066-38089.

NRC (U.S. Nuclear Regulatory Commission), "Standard Format and Content of Site Characterization Plans for High-Level Waste Geologic Repositories," Regulatory Guide 4.17, Revision 1, U.S. Nuclear Regulatory Commission, Washington, D.C., 1987.

Section 8.3.1.2.3.2.2 Activity: Hydrochemical characterization of water in the upper part of the saturated zone

SCA COMMENT 22

Use of packers to isolate saturated zone intervals for water sample collection has the potential to compromise sample collection.

EVALUATION OF DOE RESPONSE

- o This comment was originally prepared under NRC's Site Characterization Analysis (SCA), published in August, 1989. The DOE responded to this and other SCA comments on December 14th, 1990. In general, DOE concluded that sufficient precautions were being taken to ensure the integrity and representativeness of samples collected from the upper part of the saturated zone. The NRC's evaluation of this response was transmitted on July 31st, 1991. The staff considered that DOE's commitment to collect discrete samples did not in itself resolve the open item. In order to make progress toward comment resolution, the NRC staff would have to review Study Plan 8.3.1.2.3.2, "Characterization of the Saturated Zone Hydrochemistry."

- o The DOE provided additional information relevant to Comment 21 on January 7, 1993 [letter from J. Roberts (DOE) to J. Holonich (NRC)]. The letter stated that, based on the information provided, DOE regards this open item as resolved. DOE clarified the sequence for drilling and testing, citing discussion from DOE (1992), page 3.2-10. The sequence described is shown below:
 - Selected new wells will be cored for about 25 m immediately above the saturated zone. On reaching the water table, a packer or removable plug will be installed above the bottom of the hole.
 - Gas samples will then be collected from the unsaturated zone directly above the water table, using a peristaltic pump.
 - After gas sampling, the well will be cored about 25 m into the saturated zone to obtain core samples for hydrochemical analysis of water content.
 - The well will be drilled to the planned total depth, and geophysical data will be obtained if needed.
 - A multi-level sampling system will then be installed to obtain discrete water samples from various depths.

- o The DOE response did not address NRC's original recommendation regarding this open item. The staff had recommended that "In order to avoid potential contamination (or modification of the water quality due to mixing), it is recommended that plans be made to collect water samples first in the upper portion of the saturated zone and then in deeper portions (as necessary) as drilling advances into the units beneath the water table."

- o Sampling from the uppermost part of the saturated zone has the potential to detect the presence of "modern" water. This would include groundwater with elevated concentrations of anthropogenic radioisotopes such as tritium, Cl-36, Tc-99, and I-129. Identification of "modern" water in the upper part of the saturated zone may indicate rapid groundwater flow from the surface through the unsaturated zone. Hence, reliability of data from the hydrochemical tests is potentially very important with respect to groundwater travel time.
- o The NRC staff considers that a unique opportunity exists to collect water samples from the upper portion of the saturated zone, without the added complications introduced by the entire sequence of activities listed above. These complications include the potential for introducing contaminants during drilling and coring, gas sampling, geophysical logging, and installation of the multi-level sampling equipment. The geophysical logging work requires a continuously open borehole, and will unavoidably cause some mixing of groundwater between deeper and shallower units. Why run the greater risk of mixing water over the entire saturated borehole column when an opportunity exists to sample immediately after coring 25 m into the saturated zone?
- o For new wells, to minimize the potential contamination of hydrochemical samples, it is recommended that water samples be collected from the saturated zone immediately after coring 25 m below the water table. This would be in addition to samples collected after installation of multi-level sampling equipment.
- o The NRC staff considers this comment open.

REFERENCE

DOE (U.S. Dept. of Energy), "Study Plan: Characterization of the Yucca Mountain Saturated-Zone Hydrochemistry," YMP-USGS-SP 8.3.1.2.3.2, RO, April 22, 1992.