102 PDR-1 LPDR-Wm-11 (2)

AUG 05 1987

SC 8/6 M2 FILES

- 1 -

WM Record File 102

WM Project 11
Docket No.
PDR ✓
LPDR ✓ (N)

Distribution:
(Return to WM, 623-SS)

MEMORANDUM FOR: Files

FROM: John Trapp
Geology-Geophysics Section
Technical Review Branch
Division of High-Level Waste Management

Seth Coplan, Section Leader
Compliance Demonstration Section
Operations Branch
Division of High-Level Waste Management

SUBJECT: REVISION OF ENCLOSURES TO MEMORANDA--VOLCANISM AT NNWSI

Attached is a revision of the enclosures to the July 3 and July 9, 1987, memoranda from Ronald L. Ballard to John J. Linehan regarding volcanism at NNWSI. Changes to the original enclosures were made as a result of discussion that we have had and provide clarification of the following:

- the nature of the EPA standard
- the relationship of "EPA ratios" to the EPA standard
- that an EPA ratio of 0.9 approaches the high rather than low probability limit of the standard; and
- the significance of differences between values for repository size, radionuclide inventory and dike width used by Link et. al. in their analysis and more realistic values based on the EA and geologic considerations.

The revised enclosure should be transmitted to DOE.

Original Signed By:

John Trapp
Geology-Geophysics Section
Technical Review Group
Division of High-Level Waste Management

Original Signed By:

Seth Coplan, Section Leader
Compliance Demonstration Section
Operations Branch
Division of High-Level Waste Management

Enclosure:
As stated

1449

AUG 0 5 1987

SC 8/6 M2 FILES

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

MEMORANDUM FOR: Files

FROM: Trapp, HLTR
Coplan HLOB

SUBJECT: REVISION OF ENCLOSURES TO MEMORANDA--VOLCANISM AT NNWSI

DATE:

DISTRIBUTION

HLWM/SF file: 102	NMSS RF	RBrowning, HLWM	MBell, HLWM
JBunting, HLSE	JLinehan, HLOB	RBallard, HLTR	SCoplan, HLOB
JTrapp, HLTR	CAbrams, HLTR	KMcConnell, HLTR	PJustus, HLTR
KStablein, HLOB	RJohnson, HLOB	PPrestholt, HLWM	

CONCURRENCES

ORGANIZATION/CONCUREE	INITIALS	DATE CONCURRED
HLOB/SCoplan	SC	8/ 5 /87
HLTR/JTrapp	JT	8/5/87
HLTR/RBallard:km	RB	8/5/87

(original not received in the WMDCC)
8/6/87 9:55
Date / Time

CONCERNS RELATED TO VOLCANIC INTRUSION INTO THE REPOSITORY AT NNWSI

Probability Concerns

The work of Crowe, et. al. (1982), is the main reference for the probability calculation presented in the EA for renewed volcanism at NNWSI. Crowe, et. al., utilized a variety of approaches to try to determine the rate of volcanic activity in the area of NNWSI including geochronological studies, variations in magma volume versus time and counting Quaternary volcanic centers. While the geologic staff has not yet done a complete reassessment of this study, if the 20,000 years before present or younger date for latest volcanism in the area of NNWSI is correct, rather than the 270,000 year value presented in the EA, the probability of volcanism intruding a repository at NNWSI, utilizing geochronological studies or studies which rely on the volume of magma produced versus time, may be greater than the values presented in the EA as these calculations are sensitive to the age data input.

Release Calculation Concerns

The geologic staff has a greater concern, however, with the way in which the release estimates of Link, et. al. (1982), were used in the EA. In the EA, Section 6.3.1.7.6. discusses the probabilities presented by Crow and compares them to the "expected values" presented in table 8-4 of Link, et. al., as calculated in accordance with formula 8-2 of the referenced report. On that basis, the EA concludes that the EPA standard (40 CFR 191) would be met with a margin of several orders of magnitude if volcanism were to occur and intersect a repository at NNWSI. This comparison is not valid, however, as the expected value of .038 curies per 1000 MTHM reported in table 8-4 in Link, et. al., was obtained utilizing the following formula:

$$A_i = \sum_{n=1}^{N} C_i(n)\, R_i\, P_i\, \Delta t(n)$$

where

A_i = curies of radionuclide i released
C_i = curies of radionuclide i in inventory during time increment n
R_i = release fraction
P_i = probability of release occurrence and
Δt = increment of time, years.

As stated in Link et. al., this calculation produces the "expected release" due to volcanism by assuming that volcanism could occur in 3.4 X 10E+7 years (the reciprocal of 2.9 X 10E-8), determining the resulting release, and assigning the prorated share of release to a 10,000 year time frame. This is a way of reporting "risk" but is not the correct way to plot releases against the EPA standard.

The EPA standard is represented by a distribution function which relates the probability of the cumulative release to the accessible environment over a 10,000 year period exceeding a given cumulative release. Hunter et. al. (1987), presents an overview of methodology that the NRC staff considers appropriate for implementing this standard. The EA would have been more in

line with this methodology if it had used Link's "expected release if volcanism occurred between 100 and 10,000 years after emplacement" as reported in table 8-6 of Link et. al., rather than Table 8-4. The values presented in table 8-6 are approximately 4 orders of magnitude higher than the values presented in table 8-4 and the EA. The value as presented in the EA of .038 curies per 1000 MTHM is an EPA ratio[1] of approximately .00025, much below the EPA standard, while a summation of the values from table 8-6 would give an EPA ratio of approximately .9, very close to the high probability limit of the EPA standard.

Additional concerns

The values presented in tables 8-4 and 8-6 of Link et. al., assume random intersection of the repository by dikes. As shown in Link et. al., non-random intersections, such as might result from structural control of the dike emplacement, could increase the release by several orders of magnitude. Also, Link et. al. assumed a repository that was smaller in both size and total radionuclide inventory than has been assumed in the EA, and assumed an effective dike width of zero. Assuming a dike width of 1 meter and a repository of the size given in the EAs would increase the total amount of radionuclides released to the accessible environment. A new analysis would be needed to determine whether the EPA ratio would also change.

Significance of Concerns

It is the opinion of the NRC Geologic staff that neither the available information on volcanism, nor the analyses performed to date are sufficient to make a licensing determination with respect to the significance of volcanism to meeting the performance objectives of 10 CFR 60. To make this determination would require more reliable geologic data and a much more sophisticated analysis than presented by DOE in the EA. With the present data base, uncertainties in probability calculations can range 3 to 4 orders of magnitude. Link et. al., for example, quotes probabilities ranging from 10E-7 to 10E-10. Even calculations which utilize more accurate ages for the past volcanic activity in the area of NNWSI will probably not significantly reduce this probability range. If site characterization activities show that the centers of volcanism in the area of the site are structurally controlled, and the relationship of these structures to the site could be established, this information, together with more reliable age dates, would allow for an informed decision on the significance of the phenomena of volcanism to the performance objectives. The staff recommends that the DOE consider the concerns identified above in the plans for testing and analysis during site characterization.

---

1 In showing compliance with the EPA standard, cumulative releases to the accessible environment are expressed as ratios that are determined in accordance with the procedures in Appendix A to 40 CFR 191.

REFERENCES:

Crowe, B.M., M.E. Johnson, and R.J. Beckman, 1982. Calculation of the Probability of Volcanic Disruption of a High-Level Radioactive Waste Repository within Southern Nevada, USA, "Radioactive Waste Management and the Nuclear Fuel Cycle, Vol. 3, No. 2, pp 167-190.

Link, R.L., S.E. Logan, H.S. Ng, F.A. Rockenback, and K.J. Hong, 1982. Parametric Studies of Radioactive Consequences of Basaltic Volcanism, SAND81-2375, Sandia National Laboratories, Albuquerque, New Mexico

Hunter, R.L., R.M. Cranwell, and M.S.Y. Chu, 1987. Assessing Compliance With the EPA High-level waste Standard: An Overview, NUREG/CR-4510,SAND86-0121, Sandia National Laboratories, Albuquerque, New Mexico