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WM Record File WM-RES D1021 NWCI

WM Project 10,11,16
Docket No.
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LPDR ✓ (B,N,S)

Distribution:
Pohle

(Return to WM, 623-SS)

July 8, 1986

MEMO TO: JEFF POHLE, PROJECT OFFICER

FROM: BARB BASSE

SUBJECT: Review of EPA Standards for Individual and Groundwater Protection

The enclosed letters were inadvertently omitted from Communication No. 66 dated June 16, 1986. I regret any inconvenience this may have caused you.

3188

Water, Waste & Land, Inc.
CONSULTING ENGINEERS & SCIENTISTS

May 19, 1986 WWL #4001

Mr. Mark Logsdon
Nuclear Waste Consultants, Inc.
8341 So. Sangre de Cristo Rd., Suite 6
Littleton, CO 80127

Re: Review of EPA Standards for Ground Water Protection

Dear Mark:

This letter provides our response to your request that we review the pertinent sections (191.15 and 191.16) of 40 CFR 191 as promulgated by the Environmental Protection Agency (EPA). These sections of the Final Rule, which are reproduced in the following paragraphs, deal with ground water protection and individual dose protection:

Section 191.15 Individual Protection Requirements

Disposal systems for spent nuclear fuel or high-level or transuranic radioactive wastes shall be designed to provide a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the disposal system shall not cause the annual dose equivalent from the disposal system to any member of the public in the accessible environment to exceed 25 millirems to the whole body or 75 millirems to any critical organ. All potential pathways (associated with undisturbed performance) from the disposal system to people shall be considered, including the assumption that individuals consume 2 liters per day of drinking water from any significant source of ground water outside of the controlled area.

Section 191.16 Ground Water Protection Requirements

(a) Disposal systems for spent nuclear fuel or high-level or transuranic radioactive wastes shall be designed to provide a

reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the disposal system shall not cause the radionuclide concentrations averaged over any year in water withdrawn from any portion of a special source of ground water to exceed:

1. 5 picocuries per liter of radium -226 and radium -228.

2. 16 picocuries per liter of alpha-emitting radionuclides (including radium -226 and radium -228 but excluding radon); or

3. The combined concentrations of radionuclides that emit either beta or gamma radiation that would produce an annual dose equivalent to the total body or any internal organ greater than 4 millirems per year if an individual consumed 2 liters per day of drinking water from such a source of ground water.

(b) If any of the average annual radionuclide concentrations existing in a special source of ground water before construction of the disposal system already exceed the limits in 191.16 (a), the disposal system shall be designed to provide a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the disposal system shall not increase the existing average annual radionuclide concentrations in water withdrawn from that special source of ground water by more than the limits established in 191.16 (a).

Sections 191.15 and 191.16 refer to several types of ground waters. Each of these types are described in the following paragraphs:

Significant Source of Ground Water:

(1) An aquifer that:

(i) is saturated with water having less than 10,000 milligrams per liter of total dissolved solids;
(ii) is within 2500 feet of the land surface;
(iii) has a transmissivity greater than 200 gallons per day per foot, provided that any formation or part of a formation included within the source of ground water has a hydraulic conductivity greater than 2 gallons per day per square foot; and
(iv) is capable of continuously yielding at least 10,000 gallons per day to a pumped or flowing well for a period of at least a year.

or, (2) an aquifer that provides the primary source of water for a community water system as of the effective date of this Subpart.

Special Source of Ground Water:

Those Class I ground waters identified in accordance with the Agency's Ground-Water Protection Strategy published in August, 1984 that: (1) Are within the

controlled area encompassing a disposal system or are less than five kilometers beyond the controlled area; (2) are supplying drinking water for thousands of persons as of the date that the Department chooses a location within that area for detailed characterization as a potential site for a disposal system (e.g., in accordance with Section 112(b)(1)(B) of the NWPA); and (3) are irreplaceable in that no reasonable alternative source of drinking water is available to that population.

Class I Ground Water:

Special Ground Waters are those that are highly vulnerable to contamination because of the hydrological characteristics of the areas under which they occur and that are also characterized by either of the following two factors:

a. Irreplaceable, in that no reasonable alternative source of drinking water is available to substantial populations; or

b. Ecologically vital, in that the aquifer provides the base flow for a particularly sensitive ecological system that, if polluted, would destroy a unique habitat.

Using the above rule descriptions and definitions, the ground water system in the vicinity of Yucca Mountain was evaluated. Section 191.15 refers to any significant source of ground water outside of the controlled area. Data obtained from well J-13, which is outside the controlled area as shown in Figure 1, was used to evaluate the Section 191.15. Thordarson[1] reported that the principal aquifer, the Topopah Spring Member of the Paintbrush Tuff, was penetrated from depths of 207.3 to 449.6 meters, with a static water level of 282.2 meters (925.9 feet). The water has significantly less than 10,000 milligrams per liter of total dissolved solids. A pumping test indicated its transmissivity is 120 meters squared per day (9,664 gal/day-ft) and its hydraulic conductivity is 1.0 meters per day (24.54 gpd/ft^2). The well is capable of yielding significantly more that 10,000 gallons per day for a period of at last a year. Therefore, the aquifer in which well J-13 is completed is covered by Section 191.15 and must be considered a significant source of ground water outside of the controlled area.

Section 191.16 refers to special sources of ground water which are those Class I ground waters identified in the EPA's Ground-Water Protection Strategy. Part of the requirements of the special source is that the ground water is supplying drinking water for thousands of persons as of the date that the DOE chooses the site for detailed characterization. Therefore, water in the saturated zone within the controlled area is not covered by Section 191.16.

Based on the above discussion, our position is that the saturated portions of the Topopah Springs hydrogeologic unit represent a significant source of ground water outside the controlled area. In our opinion, there are no special

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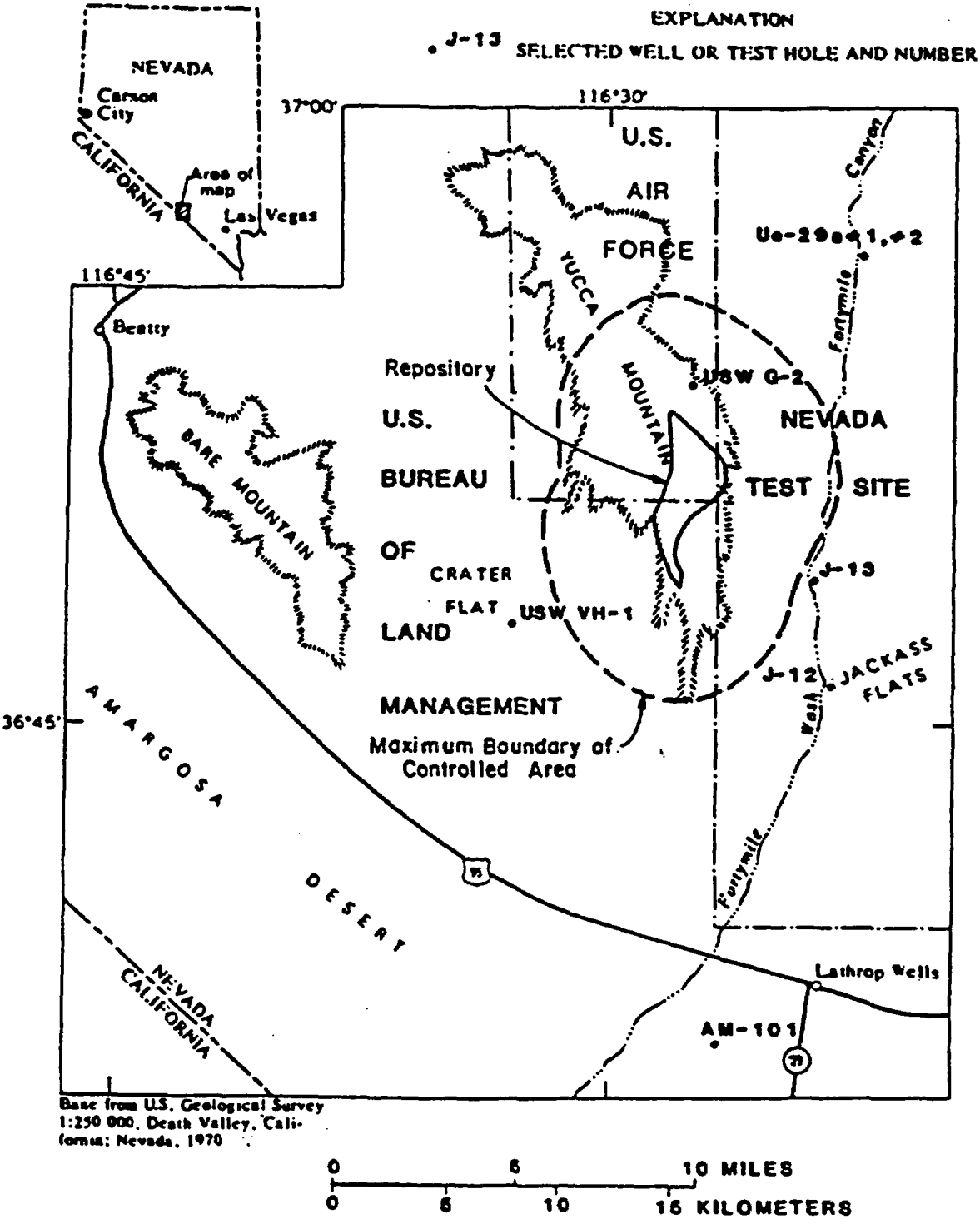
[1]Thordarson, William, 1983. Geohydrologic Data and Test Results from Well J-13, Nevada Test Site, Nye County, Nevada. USGS WRI 83-4171.



Water, Waste & Land Inc.	FIGURE I. CONTROLLED AREA AT THE YUCCA MOUNTAIN SITE	Date: 5/86 Project: 4001

sources of ground water in the Yucca Mountain vicinity. Hopefully, this is the type of analyses that you wanted. Please feel free to contact either myself or Tom Sniff if you have any questions.

Sincerely,

WATER, WASTE AND LAND, INC.

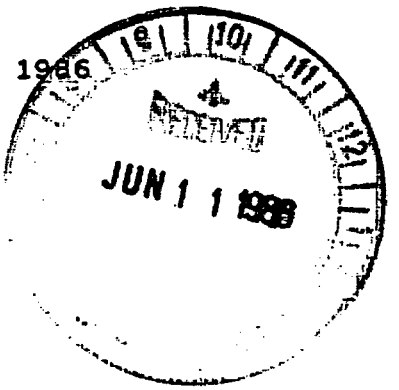
Lyle A. Davis
Executive Vice President

LAD:dml

DANIEL B. STEPHENS & ASSOCIATES, INC.
CONSULTANTS IN GROUND-WATER HYDROLOGY

• GROUND-WATER CONTAMINATION • UNSATURATED ZONE INVESTIGATIONS • WATER SUPPLY DEVELOPMENT •

June 10, 1986



Mr. Mark Logsdon
Nuclear Waste Consultants, Inc.
8341 S. Sangre de Cristo Rd., Suite 14
Littleton, CO 80127

Dear Mark,

As per your request in the monthly update dated April 11, 1986, I am enclosing a brief statement outlining the "significant" and "special" sources of ground water that occur in the Palo Duro Basin, Deaf Smith County Site. I hope that this Attachment meets with your approval.

If you have any questions regarding this work, please do not hesitate to call.

Yours truly,

Robert G. Knowlton, Jr.

Robert G. Knowlton, Jr.
Project Manager

RGKjr/mt

Attachment

600 NEEL AVENUE SOCORRO, NEW MEXICO 87801 (505) 835-3162

ATTACHMENT

The Federal Register, Article 40 CFR Part 191, defines the Environmental Protection Agency's interpretation of "significant sources of ground water" and "special sources of ground water'. These guidelines must be addressed in regards to the aquifers in the Palo Duro Basin, Texas. Significant sources of ground water include any aquifer which provides the primary source of water for a community water system, or any aquifer which satisfies the following conditions:

1) Water saturating the aquifer contains less than 10,000 mg/l total dissolved solids.
2) Depth to the aquifer from land surface is less than 2,500 feet.
3) Transmissivity is at least 200 gal/day/ft.
4) Each part of the underground formation or aquifer has a hydraulic conductivity of 2 gal/day/ft2.
5) Is capable of a sustained yield of 10,000 gpd to a pumped or flowing well. The transmissivity and sustained yield requirements roughly correspond to a "community water system" (about 20 households).

"Special sources of ground water" must meet the following conditions:

1) Within the controlled area, or less than 5 km beyond.
2) Supplying drinking water for thousands of persons as of the date the Department of Energy (DOE) selects the site for extensive exploration as a potential

location of a disposal system.

3) No reasonable alternative source of drinking water is available.

Addressing each requirement revealed that none of the aquifers complied with all of them. Total dissolved solids exceeds 10,000 mg/l in wells tapping all of the aquifers below the Ogallala and Dockum formations (Senger, 1983; TWDB, 1972; Dutton, 1985; Duffin, 1984).

Based on the DOE well closest to the proposed site, J. Friemel No. 1, the formations that are less than 2500 feet deep are the Ogallala, Dockum, Dewey Lake, Alibates, Salado, Yates, Seven Rivers, Queen-Grayburg, Upper San Andres, Lower San Andres Units 5 & 4 (SWEC, 1983).

The Dockum and Ogallala aquifers are the only aquifers reported to have transmissivity values greater than 200 gpd/ft.

Aquifers with a hydraulic conductivity greater than 2 gpd/ft2 are: Dockum fluvial /lacustrine system, 20 gpd/ft2; Ogallala fluvial system, 200 gpd/ft2; Permian salt dissolution zone, with 2gpd/ft2 (Smith and Orr, 1982).

A "substantial yield" for the Dockum is recorded in the following municipal wells:

1) Happy, Texas 36,650 gpd
2) Hereford, Texas 49,800 gpd
3) Tulia, Texas 87,909 gpd

The municipal well in Tulia, Texas also taps the Ogallala aquifer. However, these wells are not located within 5 km of the proposed site boundary.

Based on the information at our disposal, the Ogallala and Dockum hydrogeologic units are possible "significant or special sources of ground water" within or near (less than 5 km) the proposed site in Deaf Smith County.

References

1) Senger, R., Richter, B.C., (1983), "Identification of Recharge-Discharge Areas of the Palo Duro Basin, Texas Panhandle", Texas Bureau of Economic Geology, Report, OF-WTWI-1983-4.

2) Duffin, G.L., 1984, "Ground-water Conditions in the Triassic Aquifer in Deaf Smith and Swisher Counties", Texas Department of Water Resources, Report L-196.

3) Texas Water Development Board, Saline Water Resources Survey, "A survey of the Saline Water of Texas Vol. 2", TWDB, R157, V2, C3.

4) Dutton, A.R., (1985), "Hydrologic Testing in the Salt-Dissolution Zone of the Palo Duro Basin, Texas Panhandle", Texas Bureau of Economic Geology, Report OF-WTWI-1985-35.

5) Stone and Webster Engineering Corporation, 1983, "Well Completion Report, J. Friemel No. 1 (PD-9), Palo Duro Basin: prepared for Office of Nuclear Waste Isolation", Battelle Memorial Institute, Columbus, OH, ONWI/SUB/E512-05000-T32.

6) Smith, A., Orr, E.D., (1982), "Potentiometric Surfaces, Palo Duro Basin, Texas Panhandle", Texas Bureau of Economic Geology, Report OF-WTWI-1982-3.

TERRA THERMA, INC.

WATER CONSULTANTS AND ENGINEERS

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May 23, 1986

Mark Logsdon
Nuclear Waste Consultants, Inc.
8341 So. Sangre De Cristo Rd. Suite 14
Littleton, Colorado 80127

RE: Review of EPA Standards for Ground Water Protection

Dear Mark:

This letter provides our response to your request that we review the pertinent sections (191.15 and 191.16) of 40 CFR 191 as promulgated by the Environmental Protection Agency (EPA). These sections of the Final Rule, which are reproduced in the following paragraphs, deal with ground water protection and individual protection:

> **SECTION 191.15 INDIVIDUAL PROTECTION REQUIREMENTS**
> Disposal systems for spent nuclear fuel or high-level or transuranic radioactive wastes shall be designed to provide a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the system shall not cause the annual dose equivalent from the disposal system to any member of the public in the accessible environment to exceed 25 millirems to the whole body or 75 millirems to any critical organ. All potential pathways (associated with undisturbed performance) from the disposal system to people shall be considered, including the assumption that individuals consume 2 liters per day of drinking water from any significant source of ground water outside of the controlled area.

> **SECTION 191.16 GROUND WATER PROTECTION REQUIREMENTS**
> (a) Disposal systems for spent nuclear fuel or high-level or transuranic radioactive wastes shall be designed to provide a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the disposal system shall not cause the radionuclide concentrations averaged over any year in water withdrawn from a portion of a special source of ground water to exceed:
>
> 1. 5 picocuries per liter of radium -226 and radium -228.
>
> 2. 161 picocuries per liter of alpha-emitting radionuclides (including radium -226 and radium -228 but excluding radon); or
>
> 3. The combined concentrations of radionuclides that emit either beta or gamma radiation that would produce an annual dose equivalent to the

total body or any internal organ greater than 4 millirems per year if an individual consumed 2 liters per day of drinking water from such a source of ground water.

(b) If any of the average annual radionuclide concentrations existing in a special source of ground water before construction of the disposal system already exceed the limits in 191.16 (a), the disposal system shall be designed to provide a reasonable expectation that, for 1,000 years after disposal, undisturbed performance of the disposal system shall not increase the existing average annual radionclide concentrations in water withdrawn from that special source of ground water by more than the limits established in 191.16 (a).

Sections 191.15 and 191.16 refer to several types of ground waters. Each of these types are described in the following paragraphs:

Significant Source of Ground Water:

(1) An aquifer that:

a. is saturated with water having less than 10,000 milligrams per liter of total dissolved solids;
b. is within 2500 feet of the land surface;
c. has a transmissivity greater than 200 gallons per day per foot, provided that any formation or part of a formation included within the source of ground water has a hydraulic conductivity greater than 2 gallons per day per square foot; and
d. is capable of continuously yielding at least 10,000 gallons per day to a pumped or flowing well for a period of at least a year.

or, (2) an aquifer that provides the primary source of water for a community water system as of the effective date of this Subpart.

Special Source of Ground Water:

Those Class 1 ground waters identified in accordance with the Agency's Ground Water Protection Strategy published in August, 1984 that: (1) Are within the controlled area encompassing a disposal system or are less than five kilometers beyond the controlled area; (2) are supplying drinking water for thousands of persons as of the date that the Department chooses a location within that area for detailed characterization as a potential site for a disposal system (e.g., in accordance with Section 112(b)(1)(B) of the NWPA); and (3) are irreplaceable in that no reasonable alternative source of drinking water is available to that population.

Class 1 Ground Water:

Special Ground Waters are those that are highly vulnerable to contamination because of the hydrological characteristics of the areas under which they occur and that are also characterized by either of the following two factors:

a. Irreplaceable, in that no reasonable alternative source of drinking water is available to substantial populations: or

b. Ecologically, in that the aquifer provides the base flow for a particularly sensitive ecologic system that, if polluted, would destroy a unique habitat.

Using the above rule descriptions and definitions, the ground water system in the vicinity of the BWIP site was evaluated. With respect to any significant source of ground water outside the controlled area (Section 191.15), data presented in Summers, Weber, and Schwab (1978, Table 9) for wells drilled into basalt aquifers outside the controlled area provide estimates of transmissivity, hydraulic conductivity, and discharge. These wells are open to basalt aquifers between altitudes of 27 and 458 feet, which is within 2500 feet of the surface. Although there is considerable variation in the estimates, wells within 18 miles (29 km) of the controlled area are capable of producing significantly more than 10,000 gallons per day and have transmissivities up to 1500 ft2/d and conductivities up to 40 ft/d. Water quality is not reported in the reference document specifically for each well, but regional basalt water quality data (Figure 13, Summers, Weber, and Schwab, 1978) indicates that regionally, total dissolved solids concentrations do not exceed 1200 mg/l, which is significantly below the 10,000 mg/l requirement.

Based on Section 191.16 requirements for special sources of ground water under the Class 1 ground waters of the EPA's Ground Water Protection Strategy, ground water within 5 km of the controlled area is not providing drinking water for thousands of persons.

REF: Summers, W.K., Weber, P.A., and Schwab, G.E., A survey of the Ground-Water Geology and Hydrology of the Pasco Basin, Washington, DOE doc # RHO-BWI-C-41

Conclusion

Given the reported information provided above, it is our conclusion that ground water within 5 km of the controlled area can not be classified as a special source of ground water under the applicable definitions. However, based on the available data, we conclude that ground water which occurs in the basalt outside of the controlled area, with no apparent distance limitation, does qualify as a significant source of ground water within the definitions provided by the rule. It should be kept in mind that the actual Reference Repository Location (RRL) is within the Hanford Reservation which is a controlled area. The reservation boundary is generally more than 5 km from the RRL boundary.

Should you need any further discussion or clarifications, please do not hesitate to call.

Sincerely,
TERRA THERMA, INC.

Michael Galloway
BWIP Team Manager