To: Ron Ballard/Don Chery/Neil Coleman
MS 623SS
HLTR

Ballard/Chery/Coleman/

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

87-BWI-12

OCT 21 1987

President
Westinghouse Hanford Company
Richland, Washington

Dear Sir:

IMPLEMENTATION OF IODINE STRATEGY

This letter transmits a copy (Attachment 1) of the completed Iodine Strategy Agreement for your implementation. My staff has reviewed your comments to an earlier draft and Attachment 2 summarizes our review. At this point, please (1) implement the attached strategy; (2) reassess your readiness to drill DC-24, 25, 32, and 33; (3) initiate discussions with my staff to resolve questions raised in Attachment 2; and (4) provide me a letter indicating your readiness to initiate drilling activities.

Should you have any questions, please contact me, D. H. Dahlem, or K. M. Thompson.

Sincerely,

R. D. Izatt for

John H. Anttonen, Assistant Manager
for Commercial Nuclear Waste

BWI:RDI

Attachments

cc w/attachments:
D. C. Gibbs, WHC
F. R. Cook, NRC
A. Alkezweeny, On-Site Tribal Representative
S. Armstrong, Yakima Indian Nation Representative

PROBLEM STATEMENT

Introduction of unknown concentrations and quantities of ^{129}I into basalt groundwaters may preclude the future evaluation of the insitu concentrations of ^{129}I. This may limit the usefulness of ^{129}I as an indicator of the potential presence of a disqualifying condition, specifically groundwater travel time less than 1,000 years.

BACKGROUND

The vertical and areal distribution of concentrations of ^{129}I and other species in and around the CASZ can be indicative of vertical hydraulic communication. ^{129}I has a long half-life, exhibits conservative behavior and can thus be used as a tracer to determine whether hydraulic communication between the unconfined and confined aquifers exists, thus providing a potential measure of radionuclide transport from the repository to the accessible environment.

The iodine data must be interpreted in terms of the associated occurrence of stable and unstable isotopes, introduced and natural tracers, geologic structure, and the hydraulic regime.

Fluids from the unconfined and confined aquifers, up and down gradient from the proposed repository location will be analyzed for ^{129}I and associated species. Samples for iodine analyses should be from (existing and future) wells developed under appropriate conditions for optimal clean up. Well yield must be sufficient to provide adequate sample size to achieve the required analytical sensitivity. A geochemical baseline of drilling fluids will also be developed while drilling and developing new monitoring facilities to use in interpreting future hydrochemical samples.

In implementing this strategy the Project will attempt to provide a reasonable balance between obtaining "perishable" hydraulic data identified in the Options Paper and data pertinent to the iodine concern. Acquiring these data is part of the hydrologic and hydrochemical characterization programs.

Proposal

This proposal addresses questions raised about the presence of ^{129}I in Hanford groundwater and provides information during the Pre-ES Geohydrology program to initiate resolution of these questions. Recommendations include sampling suitable wells throughout the reservation, collecting and analyzing drilling fluid, analyzing existing samples, and completing drilling and sampling of borehole DC-18.

The objectives of this program are:

(1) minimize, to the extent practicable, contaminating the basalt aquifers with ^{129}I from activities associated with the pre-ES geohydrology program through appropriate drilling, development and construction practices,

(2) obtain aerial and vertical ^{129}I data in the near-term to begin defining the ^{129}I baseline throughout the Hanford Reservation within the deep basalts. In addition to ^{129}I, ^{127}I, ^{3}H, ^{14}C, ^{99}Tc and a comprehensive suite of major anions, cations and stable isotopes will be analyzed; and,

(3) minimize interference with the implementation of the pre-ES geohydrology program.

(4) differentiate, as much as is practicable, among the possible sources of ^{129}I that may be present in the deep ground water (see attachment).

It is possible to achieve analytical sensitivities in off-site laboratories as low as 10^{-7} to 10^{-8} pCi/L from samples of 1 to 10 L in volume. Onsite laboratories may achieve sensitivities of 10^{-5} pCi/L. Analysis for ^{129}I is a complex chemical process at the trace level concentrations expected and may require a minimum of 2 months to complete. The ^{129}I results, therefore, of samples taken during drilling will not be available for real-time decisions during well construction and development. Details of the proposed program are presented below:

1. Tentatively plan to use Hanford System water ($^{129}I = 10^{-6}$ to 10^{-5} pCi/L), for the drilling and installation of the piezometers. Alternate sources of drilling fluid make-up water will be investigated and used if practicable and significantly lower in ^{129}I than current plant sources. Alternate sources may include groundwater from borehole DB-11 or the McGee Well. Investigations will include expedited analysis of the ground water from these wells for ^{129}I. Consultation and concurrence with DOE-HQ is required prior to initiating drilling with Hanford system water

   If the decision is made to use Columbia River water for the drilling of wells in the Pre-ES testing program, planning will immediately begin to mitigate the contamination of deep basalt aquifers that may result from drilling activities in the post-ES program and to verify that any residual contamination will not significantly interfere with the ability to successfully perform the hydrochemistry progra_ As part of this program, alte_ate sources of drilling fluids will be investigated, alternate drilling procedures will be investigated and experiments will be carried out to assess the potential for the degree of contamination that could be expected from surface-based activities associated with drilling; increases in contamination due to drilling will be addressed through monitoring drilling fluids while drilling DC-24, etc.. These plans will be incorporated into the appropriate Study Plans.

To mitigate the contamination of deep basalt aquifers in the pre-ES program, new drilling fluids will be used after each string of casing is installed in DC-24, DC-25, DC-32 and DC-33.

Baseline all drilling fluid used (mud and water).

- Sample drilling fluid pit prior to cycling through borehole
- Sample fluid returns while drilling through 12 horizons

• Data will be used to evaluate hydrochemistry data in future tests where evaluation criteria of Option Paper will be applied

3. Sample selected existing facilities outside the CASZ for ^{129}I and other information as described in objective 2 above. Wells to be evaluated for sampling include those listed below:

• Enyeart or Ford wells (Rosalia)

• DC-6 [composite Grande Ronde (mainly from top of N2/R2 break)]

• DC-14 (two flows below the Umtanum)

• DB-15 (Wanapum)

• DB-7 (Mabton)

• DB-15 (Grande Ronde)

• Four wells east of Columbia River near Ringold (upper to middle Saddle Mountains)

  - Webber Ranch (12/29-30 J1)
  - Ringold Association (12/29-32 R1)
  - Sunset Association (11/29-16A1)
  - White Bluffs Association (11/29-20N1)

4. The drilling fluids for DC-24, 25, 32 and 33 and the drilling fluids used in the deepening of RRL-2B will be tagged with an appropriate chemical tracer (e.g. Lithium Bromide) to provide real-time time-series clean-up data during well development. Wells will be developed sufficiently to provide future hydrochemical, including

^{129}I, data of sufficient quality to evaluate insitu conditions if practicable, balanced against baseline needs and future data sources. To assure adequate development, time series tracer samples, including ^{129}I, will be taken during pumping.

During LES testing at RRL-2B, time-series groundwater samples will be taken to determine clean-up success and for evaluation of insitu conditions (which may have been impacted by previous activities).

5. Analysis and evaluation of existing samples and data will be performed. Archived samples such as those listed below will be evaluated for analysis:

   - DC-23 GR (Rosalia, Sentinel Gap, Ginkgo and Umtanum)
   - DC-18 (Wanapum)
   - RRL-2C (Development samples from composite Grande Ronde [mainly the Birkett flow top]).

   Analytical results (as opposed to achievable analytical sensitivity) are a function of (1) borehole development (i.e., cleanup), and (2) the respective ^{129}I concentrations of the insitu groundwater and the contaminated drilling fluid injected into formations.

6. The program will utilize opportunistic tests to obtain further data such as drilling, sampling and analysis at DC-18.

Approve: *[signature]* Ralph Stein, Director
Engineering and Geotechnology Division
Date: 10/14/87

Approve: *[signature]* John Antonnen, Assistant Manager
for Commercial Nuclear Waste
Richland Operations Office
Date: 10/19/87

DIFFERENTIATION OF POSSIBLE SOURCES OF ^{129}I IN DEEP GROUNDWATER

Groundwater geochemistry, including Iodine-129, will be used to differentiate between native groundwater and water that may have been introduced from other systems. The sources of water other than native groundwater include groundwater that has infiltrated through the geologic system from overlying contaminated units, water introduced through previous drilling activities that has carried foreign chemistries into the lower aquifers, and waters that may be introduced through planned drilling activities. The specific question that should be answered is:

How will BWIP differentiate Iodine-129 contaminated waters from the following sources:

A. Naturally occurring iodine in the deep confined aquifers,

B. Groundwater infiltrating through the rock system from the unconfined aquifer,

C. Contaminated water and drilling fluids introduced during past drilling?

D. Potentially contaminated water to be used during planned drilling?

Response should not be limited to Iodine solely, but should include any companion elements or nuclides that may be used to differentiate between groundwaters on the Hanford Site.

Naturally Occurring Iodine

Naturally occurring iodine-129 in the deep confined aquifers should be found at levels significantly less than 1 x 10-5 pCi/L. Accompanying low levels of iodine-129 should be relatively high elemental iodine concentrations in the part per million range. Tritium and recent carbon-14 should be absent from these waters.

Downward Migrating Groundwater

Groundwater infiltrating through the rock system from the unconfined aquifer may contain defense waste leachates. In this case, the iodine-129 activity can be well over one pCi/L. In addition, nitrate and sulfate may be present. Other isotopic tracers that may be present include tritium, technetium-99 and carbon-14 because of the recent age of the groundwaters. The concentration of elemental iodine in these waters can be on the order of several parts per billion, due to flushing of salts from the rocks by actively flowing groundwater.

Previous Drilling Operations

Water introduced to the confined aquifers by previous drilling operations should be identifiable on the basis of the iodine-129 to elemental iodine ratio, the presence of tritium, and reduced concentration of chloride ion. The iodine-129 to iodine-127 ratio from this source will be similar to that potentially derived from downward migrating water, however, the occurrence of nitrate and sulfate ions should be significantly different.

Planned Drilling Operations

Water that is to be used will be analyzed to ascertain the concentrations of critical constituents and also be tagged with an appropriate tracer such as fluorescein dye or lithium bromide. Analysis of recirculating drilling muds will be made to track any changes in concentrations as the drilling process continues. Following completion of drilling a pumping program to remove a sufficient amount of water from the flow top to purge contaminating fluids (development testing) will be carried out. By monitoring the tracers introduced during drilling, tritium (present in the system water used for drilling but not present in the confined basalt aquifers), and chloride (present at higher concentrations in the formation water than in the system water), a representative sample of the formation water can be collected. This sample will provide the maximized opportunity to distinguish background I-129 concentrations from introduced contamination. Columbia River water contains iodine-129 at a concentration of about 10-5 pCi/L. Development testing within a flow top should result in a formation water sample having less than this iodine-129 activity.

SCENARIO	I-129/I-127	Tc-99	H-3	C-14	NO_3	SO_4	Cl	TRACE
CONFINED AQUIFER (background)	L	L	VL	VL	VL	M-H	H	----
AQUIFER INTERCOM.	H	H	H	H	H	L-M	L-M	----
PAST DRILLING	M	M	M	L-M	L	M	M	----
PLANNED DRILLING	M	M	M	M	L	L	L	YES

LEGEND
VL VERY LOW
L LOW
M MODERATE
H HIGH
---- NOT EXPECTED

GROUNDWATER DISCRIMINATORS

Attachment 2

COMMENTS TO 10/16/87 LETTER, GIBBS TO ANTTONEN

The following are specific comments to the letter of October 16, 1987, and are provided to help clarify the Iodine strategy.

- Your letter refers to the Iodine strategy as being "proposed." The strategy has been signed and is herewith transmitted in final form.

- An intent of the strategy is not to "define the areal and vertical distribution of I-129 and other groundwater constituents in the deep basalts throughout the Hanford reservation." The stated objective is to obtain near-term data and begin defining the I-129 baseline. An objective of the post-ES hydrochemistry program is to characterize the areal and vertical distribution of chemical constituents, including I-129.

- Evaluation of existing boreholes for sampling and analysis opportunities and evaluation of archived samples for analysis are not limited to the examples listed in the strategy. WHC is requested to develop evaluation criteria and perform the evaluation on all available opportunities. A recommended list of sample opportunities will result from the evaluation.

- Differentiation of the sources of I-129 in samples taken under the strategy, to the extent practicable (i.e., given a limited data base, using the suite of analyses for each sample and the existing data), is a key feature in the responsiveness of the strategy to the I-129 "issue." Criteria need to be developed and employed to differentiate the sources of I-129 as much as practicable.

- Changing drilling fluids after running each string of casing is not addressed.

- Unless a signature from the naturally occurring chemical species in the drilling fluids is adequate for differentiation, a chemical tracer is required. Use of the historical development ratio with chemical recovery curves may be adequate for source identification, but will require "proof of concept" before use.

- The first alternative to the strategy (e.g., packing off selected intervals for sampling) has merit if it can be incorporated into the existing strategy without impacting the start of drilling and the pre-ES geohydrology testing program. This position must be justified before implementation.

- The second alternative to the strategy (e.g., drill-test and sample) is recognized to severely impact the implementation of the pre-ES geohydrology testing program and should not be considered.

WM DOCKET CONTROL
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WM Record File	WM Project 10
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Distribution:

R.Ballard	DChery
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(Return to WM, 623-SS)

From Cook, NRC

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