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200 Area Section Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 West 4th Avenue
Kennewick, Washington 99336-6018



Dear Messrs. Sherwood and Skinnarland:

AN ANALYSIS OF POTENTIAL IMPACTS TO THE GROUNDWATER MONITORING NETWORKS IN THE CENTRAL PLATEAU, DOE/RL-95-101, REV. 1 (ATTACHMENT 1)

The subject document is attached for your information. Also provided as Attachment 2 are responses to comments received from the U.S. Environmental Protection Agency and the State of Washington, Department of Ecology, on Rev. 0. Issuance of this report completes actions associated with Hanford Federal Facility Agreement and Consent Order Milestone M-15-81A.

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If you have any questions or need further information, please feel free to contact Mr. Mike Thompson at 373-0750.

Sincerely,

K. Michael Thompson, Senior Project Manager
Groundwater Project

GWP:DMW

George H. Sanders, Administrator
for Hanford Tri-Party Agreement

Attachments: As stated

- cc w/attachs:
- P. Beaver, EPA
- S. Dahl, Ecology
- D. Faulk, EPA
- D. Goswami, Ecology
- R. Jim, YIN
- S. Leja, Ecology
- R. Patt, Oregon DOE
- D. Powaukee, NPT
- L. Selatsee, Wanapum
- J. Wilkinson, CTUIR
- P. Zielinski, EM-442

- cc w/o attachs:
- M. Buckmaster, BHI
- R. Chatman, BHI
- G. Henckel, BHI
- A. Knepp, BHI
- R. Morrison, WHC
- J. Rayner, BHI

**RESPONSES TO REGULATOR COMMENTS ON
AN ANALYSIS OF POTENTIAL IMPACTS TO THE
GROUNDWATER MONITORING NETWORKS IN THE
CENTRAL PLATEAU
DOE/RL-95-101, REV. 0**

RESPONSES TO GENERAL COMMENTS

- 1. This document emphasizes some of the changes that will occur due to pump-and-treat, the falling water table from ceasing discharges and also effects of discharges occurring in certain areas (W-049H specifically), but recommends that ground-water gradient changes, as it affects RCRA compliance, be examined in another document. The gradient changes are all part of what should be evaluated in this report if it is to meet milestone M-15-81A.**

Response: The purpose of the report was to scope the magnitude of the impacts to the monitoring system caused by ceasing discharges, pump and treat activities, and discharges from the W-049H project. DOE believes that this has met the milestone and continues to maintain its position that compliance issues are subject to continuing dialog and negotiation with regulatory agencies regarding not only the impacts of cleanup projects on specific facility monitoring activities but also the broader scope of the monitoring strategies themselves. This report addresses technical issues and it is not appropriate that these programmatic issues be addressed in this report.

- 2. This milestone specifies a report that includes "... recommendations for actions for approval by Ecology and EPA, to coordinate regulatory compliance decisions across RCRA and CERCLA groundwater monitoring programs for the 200 Area Plateau." Changes in the ground-water gradients is an integral part of this evaluation and should have been included.**

Response: See response to Comment 1.

- 3. It should be emphasized that if decisions are being made on the basis of only temporary conditions and these conditions will stabilize as they were previously (i.e., gradients will return to what they were prior to pump-and-treats, W-049 operations, etc) then it may not be necessary to modify monitoring systems around RCRA units. However, if gradients will change because of these various impacts to the ground water on a more permanent basis, decisions may need to be taken to replace or modify the monitoring wells.**

Response: Past operations have temporarily disrupted the natural west to east flow system in areas receiving artificial recharge. The effects of the resulting decline in water levels will occur over the next 50 years or so.

The report notes that 35 out of over 200 wells used for RCRA monitoring in the central plateau will *potentially* be affected by pump and treat activities which are CERCLA Interim Remedial Actions (IRM) that are considered temporary systems. However, in every case, pump and treat actions are

constructed as part of the natural flow system i.e., extraction is downgradient of the injection system. The report assumed that these impacts would continue for 10 years.

As discussed in the response to Comment 1, the need for modifying monitoring systems is subject to continuing dialog between DOE and the regulators to address issues such as these and broader issues as well.

- 4. This document only examines the head-level related impacts to monitoring systems by the addition of man-made recharge. It does not examine the quality of the water being discharged. Will the additional water dilute or increase contaminants of concern? Will the additional water have aqueous geochemistry that will mobilize contaminants in the vadose zone?**

Response: Reinjecting treated water from pump and treat systems may dilute the concentrations of the removed constituents in the area downgradient of reinjection but may also increase concentrations of constituents not removed (e.g., nitrates). It depends on where the reinjection wells are placed relative to the contaminants. Reinjecting water should not have an appreciable effect on the vadose zone because water level changes are small. Such effects should be determined in the specific pump and treat projects as part of their performance evaluation activities. Geochemistry impacts from discharges such as W-049H should be evaluated as part of that project. However, in general, such geochemical effects are difficult to predict and are best determined empirically in field programs. A discussion along these lines will be added to the text in Section 2.1.3.

RESPONSES TO SPECIFIC COMMENTS

- 1. Section 1.1, Page 3, Second Paragraph: Add information updating the status of ZP-1 and UP-1. Information concerning the pilot scale pump and treats (GPM) and the present scales of pump and treats.**

Response: Accept. Some of the requested information is contained in the second paragraph of Section 2.1, but it will be briefly mentioned here as well. The second paragraph of Section 2.1 will be expanded to explain the project phasing and the expected duration of operations.

- 2. Section 1.2, Page 3, Fifth Paragraph: Will these activities impact the vertical head magnitudes and direction relationships between the upper unconfined aquifer and both the lower unconfined aquifer and confined aquifer? This aspect should be examined.**

Response: This aspect was examined, but as the text suggests, these changes are not expected to have significant impacts to wells monitoring the confined system or lower portions of the unconfined system. Even though there are likely to be some impacts to vertical head magnitudes and directions, the impacts are considered to be small. For example, at 200-ZP-1 a downward gradient will be produced near the injection site and a local upward gradient will be produced near withdrawal sites. This is an area where there is already a downgradient from the residual U-Pond mound which operated from 1966 to 1984, and after 10 years is still a large groundwater feature. The magnitude and location of the gradient will change at and near the injection wells which are on the western edge of the U-Pond mound. These changes are minor compared to the effects of the U-Pond.

Also, as explained in the response to Comment #8 (and per the associated text change), the low vertical hydraulic conductivities in 200 West, the low conductivity units (lower mud and other silt units), and the low conductivity of the basalt confining zones, will prevent significant movement of groundwater either downward to the confined aquifers or upward to the unconfined aquifer.

3. **Section 1.2, Page 3, Sixth Paragraph: Raising the water level may be a concern. If any of the contaminant of concerns are LNAPLS - raising the water table past the screened zone would compromise the well's ability to detect lighter contaminants. Also if a well exists to monitor the upper portion of the water table in order to provide detection of contaminants first reaching the water table - then if the top of screen is submerged below the top of water table, the well is not as effective.**

Response: There are no known LNAPL contaminants on the central plateau. Most RCRA wells have been constructed with 5 feet of open screen above the water table. Most wells will be impacted by declining water levels rather than rising levels. Thus, rising levels is not expected to be a significant problem.

4. **Section 2.0, page 14, last paragraph of this section: This discussion centers on the potential impact of C-018H and pump-and-treat activities in BP-5 and why they have been excluded from this study. The C-018H was considered to have little impact because of the low recharge of 150 gpm to the ground and the few monitoring wells in the area. The questions that need to be asked are: how close is well 699-48-77 to SALDS (C-018H) and is there any mounding associated with C-018H in the 200 West Area? The next question pertains to the following section in which the pump-and-treat for UP-1 is addressed, in which one injection and one withdrawal well are operating at 40 to 50 gpm. Why is the UP-1 system addressed in this document and not the C-018H which will operate up to 150 gpm? Is the geology so different (both are located in or adjacent to the 200 West Area)?**

Response: Text changes will be made as follows:

- a. **Insert into paragraph 2, Section 2.0, after sentence 4 (...after word complete)- "There are no pump-and-treat activities planned for the 200-BP-5 operable unit."**
- b. **Insert after the word "area" and before the word "north" (sentence 5)- "about 1,400 ft".**
- c. **Rewrite the second to last sentence as: "Hydraulic impacts on existing monitoring systems will be minimal due to the low injection rates, the small number of monitoring wells around the facility, and the significant distance from other 200 West Area monitoring wells."**

In response to the questions in the comment:

- a. **How close is 699-48-77 to the SALDS? This well really consists of 4 wells: -77A, -77B, -77C, and -77D. Well B was abandoned during drilling. Well A is upgradient about 300 ft. Wells B and C are downgradient from the SALDS about 40 and 16 ft, respectively. These wells were installed as characterization wells and to monitor the facility during operation.**

b. **Is there any mounding in the 200 West Area from SALDS discharges?** The facility is over 1,400 ft north of 200 West, and so no mounding affects are expected in the 200 West area. The text was changed to indicate this.

c. **Why is UP-1 addressed and C-018H not?** UP-1 is located within 200 West near other wells that may be impacted from operations. C-018H is north of 200 West and will only influence the few wells that were installed to monitor facility effects.

5. **Section 2.1.2, Page 15, Last Sentence:** The text should provide additional information concerning the required geologic formational properties and indicate how the Hanford formation meets these requirements. Also, the formations in the West Area are not identical to the East Area. These differences need to be identified in the discussion.

Response: The comment is correct in that there are formational differences between the East and West Area. There are also significant variations within each area. The value of 2500 ft²/day was selected as representative of the Ringold Formation (regardless of location). The P&T projects only pump from the Ringold Formation, therefore, this property is the only one needed to perform the analysis.

6. **Section 2.1.2, Page 16, Second Paragraph:** Why were these injection and withdrawal rates used? What is the justification for these rates?

Response: At the time of the report was drafted, these were the predicted design values under consideration. UP-1 is currently operating at approximately 50 gpm which is quite close to the 40 gpm used in the calculations. ZP-1 has just begun Phase II operations at about 150 gpm which is near the rate used in the calculated drawdowns. This will be clarified in the text.

7. **Page 16, Sixth Paragraph:** The text indicates fifteen wells impacted by the pump and treat at UP-1. The text should indicate the well numbers, their locations, and the programs utilizing these wells.

Response: Well numbers impacted by the 200-UP-1 pump and treat are given in Table 2-1. Exact locations are given in Appendix B. A graphical representation showing well locations is found in Figures 1-1 thru 1-4. The name of the sampling program using each well (as of 1994) can be found in Appendix A. These references will be added to the text to guide the reader.

8. **Section 2.2.3, page 18:** The assumption is that for the purpose of the report, less than 5 ft of water above the bottom of the well screen defines a potentially impacted well. What about a system of wells used for monitoring purposes? This gets back to the impact of gradient changes and overall trend evaluation. The impacts are evaluated in relation to individual wells. What is the effect on a grouping of wells? What about the effect of vertical gradient (i.e., the relation of the potentiometric surface to the falling water table) changes? This is mostly important where "windows" are observed in the 200 Area and aquifer intercommunication can occur. In this case, with dropping unconfined water levels, movement should be from the confined aquifer to the unconfined and would result in potentially lower or diluted values in some wells. Has this been examined?

Response:

a. Effects on "system" of wells This report did not examine a "system" of wells, but rather identified levels of potential impacts to individual wells within monitoring networks. Individual groupings of wells were not examined but this could be done by simply examining the impacts to any desired grouping.

b. Effects of vertical gradients: Insert as last paragraph to section 2.1.3. "Vertical hydraulic gradients produced by mounding in the injection areas, and from groundwater removal in the extraction areas are not expected to affect water quality significantly in the upper unconfined aquifer. If there is an effect, it would be minor compared to the dominating influence from long-term artificial recharge due to the residual U-Pond mound in the ZP-1 area. Additionally, the potential for movement of groundwater from the shallow unconfined aquifer to the deeper confined aquifer and the basalt aquifers is minimal because of low vertical hydraulic conductivities in the suprabasalt sediments, the presence of mud and silt units in the lower part of the aquifer, and the low conductivities of the basalt flow interiors."

Additional discussion of vertical gradients is given in response #2 for 200 West. As stated, there is an existing downward gradient produced from residual U-Pond mounding. There will be mounding during ZP-1 operations, with only a change in locus, but within the current mound area, and relatively insignificant.

c. What about windows and aquifer intercommunication? Issues of aquifer communication through erosional "windows" are only applicable to the area north of 200 East. Aquifer intercommunication already occurs in this area, with an upward hydraulic gradient. No operations are expected in this area and so the current relationship would remain the same.

9. Section 2.3, Page 18: The text needs to update the information on W049H and B pond.

Response: Replace paragraph 1, sentence 3 "In 1995, liquids discharged to B Pond averaged about 3,000 gpm (DOE-RL 1996) and included the following:"

Replace last sentence of 2.3 "Remaining liquids now released to the C lobe of B Pond will be rerouted to the TEDF by October 1997."

10. Figure 2-2: Are these locations accurate to the latest plans? If not the modeling should be modified also.

Response: At the time of the draft report, the locations shown were correct. They have since been updated. For ZP-1, the injection system spreads more to the south. Injection wells are also more widely spaced. Some changes have occurred in the design of UP-1. Refining these estimates with more updated information will not likely change the conclusions of this report. Detailed modeling results are already part of each P&T design.

11. **Section 3.0, Page 29, First Sentence: The report should evaluate the interrelationships of the groundwater monitoring networks.**

Response: Replace paragraph 1 of 3.0 (Conclusions) "This report presents the results of a significant analytical effort evaluating the impacts to groundwater monitoring networks from cessation of discharges to the soil column, pump-and-treat activities, and the rerouting of liquid discharges on the 200 Area Plateau of the Hanford Site. Specifically, interrelationships were considered between the size of each discharge or withdrawal system, the number of shared wells, the impact of a declining water-table, and the potential impacts of pump-and-treat systems in the 200 West Area."

12. **Section 3.0, Page 29, Second Bullet: The full scale operation of the pump and treat at ZP-1 will impact the ability to perform RCRA monitoring at LLWMA-4. The statistical information will be invalid due to a reversal of gradient and potentially bringing contaminants under the unit from other areas. This statement is incorrect.**

Response: The statement says that the full scale operation will not impact the ability to pull samples from the wells. It also states, as the commenter notes, that the groundwater sampling results will likely change. It will also affect the statistical information previously obtained. Whether or not the statistical information is invalidated is subject to a more rigorous evaluation which is not in the scope of this study.

13. **Section 3.0, Page 29, Fourth Bullet: According to Milestone M-15-81A, this bullet is incorrect. Assessment of the impacts to each monitoring program and it's individual monitoring requirements is clearly within the scope of this document.**

Response: The stated purpose of this report is to evaluate potential impacts to groundwater monitoring well systems, not to determine whether those potential impacts will affect the ability of the monitoring program to meet its objectives. That task must be left to those responsible for the monitoring program(s) and the projects which use the data.

14. **Section 4.0, Page 30, Recommendations: DOE's recommendation of creating a compliance evaluation should have been part of this document.**

Response: A site-specific compliance evaluation is beyond the scope of this report. Such an evaluation is within the responsibility of the affected project and/or program. This will be clarified in the text.