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June 19, 1991

Meeting Minutes Transmittal/Approval
Meeting on 100-NR-1, -3 and 100-HR-3 Past Practice Work Plans
Washington Department of Ecology Offices
Olympia, WA
April 24, 1991

From/
Appvl.: Paul M. Pak Date: 6/26/91
Paul Pak, 100-NR-3 Operable Unit Coordinator, DOE-RL (A6-95)

Appvl.: L Goldstein Date 8/16/91
Larry Goldstein, CERCLA Unit Supervisor, Washington Dept. of Ecology

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The purpose of this meeting was to discuss the general concerns which the Department of Ecology had about the 100-NR-1, -3 and 100-HR-3 work plans.

Meeting Minutes are attached. Minutes are comprised of the following:

Attachment #1 - Meeting Summary/Summary of Commitments and Agreements
Attachment #2 - Agenda for the Meeting
Attachment #3 - Attendance List
Attachment #4 - Comments by Ecology on the 100-HR-3 Operable Unit Work Plan

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Prepared by: Doug Fassett Date: 6/21/91
SWEC GSSC

Concurrence by: AD Kruy Date: 6/20/91
WHC ER Programs

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Meeting Minutes Transmittal/Approval
Meeting on 100-NR-1, -3 and 100-HR-3 Past Practice Work Plans

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ADMINISTRATIVE RECORDS: 100-HR-3, 100-NR-1, 100-NR-3; Care of Susan Wray, WHC (H4-22)

Please inform Doug Fassett (SWEC) of deletions or additions to the distribution list.

Attachment #1

Summary of Meeting and Commitments and Agreements

Meeting Minutes Transmittal/Approval
Meeting on 100-NR-1, -3 and 100-HR-3 Past Practice Work Plans

1. Alan Krug (WHC) presented an overview of the scheduling of work and the prioritization of operable unit work plans. The work at operable units is divided into three groups for prioritization. The first group includes ten operable units where the work plans have been completed or have been started. These units are: 100-HR-1, -3, 100-BC-1, -5, 100-DR-1, 100-KR-1, -4, 100-NR-1, -3, and 100-FR-1. The second group includes 17 units where work plans will be started in FY 1993. These units have a priority similar to the first group of units. The third group of units includes the remaining units and they have a lower priority than the other two groups. *Larry Goldstein (Ecology) indicated the prioritization exercise cited by WHC was tentative and had not been finalized. Ecology cannot accept funding as justification for not beginning instrusive work in the 100-N area until mid-1993 as proposed. Ecology expects non-instrusive and instrusive work within these operable units to begin and be completed according to the schedules set forth in the final work plan.*

2. Larry Goldstein expressed concern about the certainty of funding. Alan Krug explained the planned schedule by saying that funding had not been procured in time to meet the original schedule, therefore a 400% ramp up was required in FY 1992. Another part of the problem was that not enough time was allowed to complete the work plans. Mr. Goldstein said a continuing question of funding was inappropriate. Progress should depend on clean up requirements not funding variations. He said it was unacceptable to delay sampling at NR-1 and NR-3 due to a lack of funding. Mr. Krug said that priorities must be set for funding of specific operable units.

3. Merl Lauterbach (WHC) said the completion of the NR-2 work plan and the combining of it with the NR-1 and -3 source operable unit work plans would take about four months. Chuck Cline (Ecology) said that the NR-2 work plan should be initiated soon so that work there could be coordinated with similar activities at NR-1 and -3. Alan Krug agreed that this should be done. Ecology expressed a desire to consolidate operable units in other areas into one source unit and one ground water unit. Mr. Cline said that, at EPA lead sites, the milestones for each operable unit may not be easily combined if the operable units are combined.

4. Larry Goldstein said one of the main problems with the 100-NR-1 and -3 work plans was that the data gaps were not identified. The information that is known, it's quality and the information that is needed should be identified. Due to the cost of data acquisition at the Hanford site, available data should be used to the maximum extent possible. Also, the

users of the data should be clarified. Chuck Cline said that if it was not practical to gather existing data, the problems with the cost and schedule that prevent this should be described in the work plan. Mr. Goldstein said both historical data and data from nonintrusive activities should be used in developing work plans. *Merl Lauterbach and Larry Goldstein agreed that these work plans would be completed and ready for regulatory review in 4 months (beginning July 1990) even though this would not allow time for scoping. Scoping activities would continue to be accomplished during the Phase I RFI/CMS. Mr. Lauterbach suggested that there are substantial limitations on the practicality and cost-effectiveness of collecting and analyzing historical data. Mr. Goldstein noted that Ecology has yet to see a thorough analysis of historical data. He also noted that the Past Practice Strategy emphasizes reliance on historical data to the extent that decision making is commensurate with the degree of confidence Ecology has in the data being used.*

5. Larry Goldstein said that Ecology had made an agreement with Tom Wintczak (WHC) to approve and implement the work plans through 200-UP-2. *The agreement on 200-UP-2 was with DOE and WHC and has been discussed at various meetings, including operable unit manager's meetings.* Additional work plans would be planned at some future date. Paul Pak (DOE) informed Ecology that 200-UP-2 would not be part of the Aggregate Area Management Study.

6. Paul Pak said DOE had 30 days to incorporate the comments by Ecology into the 100-NR-1 and -3 work plans; however, due to the large number of comments by Ecology (and EPA and USGS) DOE requested 60 additional days to respond to the comments. **Therefore, DOE has until June 19 to respond to the comments.** Merl Lauterbach said AT Kearney has about $200,000 to respond to the comments, but there would probably not be enough money left for AT Kearney to complete the NR-2 work plan and combine it with the NR-1 and -3 work plans. **WHC will start rewriting the NR work plans by July 1 and will complete the revised draft by Nov. 1. Larry Goldstein requested that a description of the changes from draft A to draft B of the NR-1 and -3 work plans be provided with draft B.**

<u>Specific Examples of Deficiencies in the NR-1 and -3 Work Plans (Items 7 - 11)</u>

7. Comment #113: Chuck Cline said the reasons for the installation of the monitoring wells, the applicable regulatory requirements, and the required data quality were needed. Alan Krug explained that some wells in the HR-3 area may be found to be acceptable through integrity assessments, some wells may be acceptable after remediation, and some may not be acceptable at all. Mr. Cline said the potential for use of existing wells should be identified. Also, criteria for use of existing wells should be included in the work plans.

8. Comment #61: Areas of remediation should be identified and sampling at areas that have been remediated should be described. The work plan should identify the data needed and the way it will be obtained for each

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waste disposal area. Alan Krug said non intrusive work will identify additional priority sites and allow the development of investigation plans for these areas.

9. Comment #185: Sampling may have to be based on individual waste disposal area conditions rather then just collecting the same number or type of samples at each waste disposal area. The extent and amount of contamination help to define the remediation method required.

10. Comment #151: Steve Cross (Ecology) said the determination of a lack of an imminent and substantial endangerment to human health, welfare or the environment was unfounded and that continued evaluation should take place. Jeff Surfus (AT Kearney) explained that it was meant that no imminent and substantial endangerment was, as yet, determined to be present at the NR area.

11. Comment #233: Steve Cross said parameters for analysis should be made consistent. Larry Goldstein said consistency was lacking in the 100-HR-3 and 100-DR-1 work plans. This procedure could be implemented for the UP-2 work plan when draft A is completed. *Ecology recommended that DOE review the work plans for external consistency during the time the plans were in publication. Any corrections would then be noted in an errata sheet that would come with the work plans for regulatory review.*

12. Chuck Cline suggested that a "boiler plate" work plan development process be considered. This would allow certain parts of the work plan to be transferred to new work plans or to be used as models for parts of new work plans. For example, the data management plan portion is very similar in most work plans and minimal changes would be required for it's incorporation into new work plans. Larry Goldstein said DOE had the responsibility for providing a realistic time frame for work plan preparation and review. Ecology suggested training of new subcontractors be considered as a method of ensuring greater consistency between different work plans. Mr. Goldstein suggested that a review by an "outside" technical reviewer would reduce internal work plan inconsistencies.

13. The draft comments by Ecology on the draft B of the HR-3 work plan were provided to DOE at this meeting (see Attachment #4). The HR-1 and DR-1 comments will be supplied to DOE in about two weeks. *Larry Goldstein said after comments on 100-HR-3 were resolved and incorporated, the work necessary to revise 100-HR-1 and 100-DR-1 would be minimal, since so many comments and issues apply to all three work plans.* He said revisions of the HR-3, HR-1 and DR-1 work plans were expected by the end of June. **Alan Krug agreed to shoot for July 1 to complete the revisions of these work plans.** Mr. Goldstein said consultation with Ecology on the HR and DR schedules was necessary. **Ecology requested an integrated schedule, in the form of an annotated outline, by May 22.** Larry Goldstein agreed with Alan Krug that the schedule should strive to support a sustained level of effort rather than extreme variations by year. **Merl Lauterbach proposed a meeting between Ecology and DOE on the**

HR-DR integrated schedule on July 1. Chuck Cline said work at the BC and KR areas depends on work being done at the HR and DR areas. Therefore combining operable units at the HR and DR areas is unlikely since delaying work at these areas would probably delay work at the BC and KR areas. AT Kearney's comments will be provided to Ecology on Monday, April 29. A meeting on AT Kaerney's responses to Ecology's comments is scheduled for May 7 and 8 at the Ecology offices in Olympia, WA.

14. The HR-3 data management plan will be applied as a model to all other work plans. There will be a small amount of variation (ex., tables) between data management plans in different work plans. A revised version of the HR-3 data management plan will be sent to Joy Denkers (Ecology) by the end of May.

15. Larry Goldstein said he will write a letter in response to the letter written to him which was dated April 19. His letter will include the agreement to review predecisional copies of chapters in work plans under development. It will also note the agreement that WHC will complete the revised and expanded NR area work plans by Nov. 1, and other agreements.

Attachment #2

Agenda

Meeting Minutes Transmittal/Approval
Meeting on 100-NR-1, -3 and 100-HR-3 Past Practice Work Plans

Topics for Discussion

- How to incorporate 100-NR-2 into the next draft of the work plans
- Schedule for next draft of 100-N Area work plans
- What level of detail is appropriate in the work plans?
- Status of WHC guidance document on writing Hanford Past Practice Work Plans
- What is the best means of addressing intra- and inter-work plan consistency problems?
- Data Management Plans - submittal of new Plan
- Schedule for 100-NR-1, -3 comments discussion

Attachment #3

Attendance List

Meeting Minutes Transmittal/Approval
Meeting on 100-NR-1, -3 and 100-HR-3 Past Practice Work Plans

Name	Org.	O.U. Role	Phone
Pak, Paul	DOE-RL	100-NR	(509) 376-4798
Shafer, David S.	DOE-RL		(509) 376-7167
Cline, Chuck	Ecology		(206) 438-7556
Cross, Steve	Ecology		(206) 459-6675
Goldstein, Larry	Ecology	Unit Manager	(206) 438-7018
Darabaris, John	AT Kearney		(415) 598-9390
Surfus, Jeff	AT Kearney		(415) 598-9390
Fassett, Doug	SWEC	GSSC to DOE-RL	(509) 376-3136
Krug, A.D.	WHC	OU Coordinator	(509) 376-5634

TECHNICAL REVIEW

of the

100-HR-3 OPERABLE UNIT

WORK PLAN

DRAFT B

DRAFT

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General Comments

1. Aggregate Area

Comment: There are substantial concerns centering on inadequate consideration of geological information by the groundwater investigations. This lack of geologic grounding and integration has three main aspects:

1) inadequate role of geology in planning and implementing the groundwater investigations

2) arbitrary southern boundary to 100-HR-3 that cuts across major groundwater flow paths and contaminant plumes

3) initial focus and major effort on source areas, prior to reconnaissance-level characterization of overall aggregate-area geohydrology

Additional, more specific discussions are presented in comments on subsections 2.2.1, 2.2.4, 3.1.1, 5.2.4 and 5.2.6.

2. Lack of Integration

Comment: The ground water operable unit investigation should provide a regional perspective within which source areas are screened, data gaps are identified, and remedial actions are prioritized and coordinated. This investigation should serve as the framework around which area-wide studies, e.g. modeling, are developed.

Recommendation: Sections 2.1, 3.1, 3.3 and 4.0 should be expanded to describe the general approach for integrating regional data collection and the decision-making process. For example, the work plan should specify how the analysis of existing data, and data generated during vadose and hydrogeologic investigations, will be integrated and assessed. Data quality objectives should be defined. The Hanford Site conceptual model should be developed.

The work plan should be up-dated to address how the 100-HR-3 Operable Unit investigation will serve as a mechanism to meet regional objectives. These objectives include providing data necessary to complete studies on river impacts, risk assessment, performance assessment and ground water modeling.

3. Aquatic Biota

Comment: With regard to the aquatic biota within the Columbia River adjoining 100-HR-3, there are two considerations which do not appear in this draft. The first consideration is the status of the aquatic biota for the pathway analyses; the second is the data to be gathered from these organisms.

In both this work plan and the one for 100-HR-1, mention is made of the presence of economically important anadromous salmonids within this section of the river. The fish are seen as a possible vector of contaminants (radiological and other) to humans (the ultimate receptors). However, the fish and other aquatic organisms are receptors in and of themselves. Exposure to radionuclides, heavy metals, and toxic organic compounds can have detrimental effects on these plants and animals which have indirect effects on humans. Considering the possibility that one anadromous salmonid species has been designated as endangered, and four other species are being considered for this status, more detail should be provided.

At this stage of the RFI/CMS planning process, concepts should be fully developed and consideration of all the biota should be comprehensive. It is probable that study of many pathways, or ecosystem components, will not provide insight into which remediation alternatives should be selected. However, data should be collected as base line for monitoring and as an adequate basis for determining whether or not additional remediation is required.

Recommendation: Decisions regarding the inclusion or exclusion of species or representative organisms should be based upon a solid knowledge base. There should be documentation within work plans which justify species and pathways selected for study. Citation for sampling techniques should be provided. For example, sampling sites for periphyton and benthic macroinvertebrates should be based upon flow characteristics of the river, seeps, and outfalls. Mixing zones should be delineated prior to locating sampling stations.

Life history characteristics of organisms should determine sampling times and methods. Numbers of organisms per unit area, their sizes, and distributions should be compared both spatially and temporally.

The US Fish and Wildlife Service's deliberations regarding endangered status for several anadromous salmonid runs in the Columbia River system should be provided. Use of the river within the 100-HR-3 aggregate area by these species provides the rationale for broad, inclusive consideration of several prey/food resources for migrating salmon as resident salmonid and non-salmonid species. Additional sampling for resident fish that do not feed on benthic invertebrates e.g, sturgeon, should be undertaken.

4. Biotic Investigations

Comment: A distinction in scope of biotic investigations is made between the 100-HR-3 Work Plan (riparian and aquatic realms), and the 100-HR-1 and 100-DR-1 Work Plans (terrestrial realm). Although it may be convenient to arbitrarily divide the RFI/CMS investigative approach in this manner, from an ecological and contaminant pathway perspective, terrestrial-riparian-aquatic components are often linked. Many of the wildlife species which characterize the Hanford site are multiple cover users which exploit the array of habitats available, particularly in upper trophic levels where significant biomagnification is likely to be

evident. For example, coyotes may utilize an old badger hole in upland habitat as a denning site, while hunting small and medium-sized mammals in both upland and riparian habitat, scavenging on spawned out salmon along the river shoreline when available, and drinking regularly from shoreline seeps. At some point, the terrestrial-riparian-aquatic components must be integrated to reflect the natural history of the species present.

Recommendation: Indicate points of linkage between the terrestrial-riparian-aquatic components at appropriate places within the documents. Outline potential pathways for bioaccumulation and biomagnification.

Specific Comments

5. WP-9, to 13, Section 2.1.1

Comment: Designation of the groundwater operable unit is intended to provide a method for characterizing groundwater conditions and groundwater contamination over an area defined by approximate hydrogeologic boundaries. Properly implemented, this strategy facilitates consideration at a hydrologic-unit scale of the physical conditions that could affect cleanup activities. It should provide: 1) a good understanding of the extent and severity of contamination, 2) a better sense of appropriate cleanup priorities across the aggregate area, and 3) a conceptual hydrogeologic framework within which source-area work plans are implemented and integrated.

Unfortunately, the southern boundary of the 100-HR-3 Area cuts arbitrarily across the logical hydrogeologic aggregate area. Much of the existing data that should be used to properly characterize the hydrogeology of the 100-HR-3 Area is from exploratory borings and monitoring wells south of the designated 100-HR-3 boundary.

A more logical southern aggregate area boundary, based on hydrogeologic factors, would coincide with the structural axis of the Umtanum Ridge-Gable Butte-Gable Mountain uplift. This axis, while not a complete barrier to groundwater flow (flow also moves through Gable Gap), is a partial barrier and is by far the strongest physical discontinuity separating the 100 areas from the 200 areas.

Regardless of the boundary used, planning and implementation of cleanup activities in the 100-HR-3 Area as presently defined will have to take into account the hydrogeologic conditions, contaminants, and cleanup activities of the 100 and 600 areas southward to the Umtanum Ridge-Gable Mountain axis. See comments on section 5.2.6.

Recommendation: Discuss the arbitrariness of the southern boundary for purposes of hydrogeologic assessment. Generally describe the enlargement of the 100-HR-3 Operable Unit to a more logical hydrogeologic unit, indicating the possible boundary modifications and cross-reference work plan sections that discuss these modifications, e.g. section 4.1. Describe how aggregate area studies such as ground

water modeling and risk assessment will be integrated with the 100-HR-3 investigation.

6. WP-13, Section 2.1.2

Comment: The history of operations of 100-IU-4 is not covered.

Recommendation: Write a paragraph covering the history of 100-IU-4 area.

7. WP-15, Section 2.1.4

Deficiency: The last sentence in paragraph one suggests that solid waste burial grounds are not primary sources of contamination because of "lack of sufficient moisture to leach buried materials through the unsaturated zone to the groundwater." This is not a proven statement and should be removed. Recent work on recharge rates at Hanford indicate that a significant portion of precipitation may become recharge (particularly over burial sites, with coarse backfill and no vegetation).

Recommendation: Remove this statement or rewrite.

8. WP-15,16, Section 2.1.6

Deficiency: Comment #9 from the review of draft A has only partially been fulfilled. Section 2.1.7 is greatly improved. However, specific recommendations for section 2.1.6 were not incorporated.

Recommendation: Further develop the integration text in section 2.1.6 using original comment suggestions.

9. WP-16, Section 2.1, Tables 1 and 2: WP-64, Section 3.1.3.2

Comment: In the 100-HR-1 Work Plan, (DOE/RL 88-35, Draft B, WP-81, Section 3.1.3 Groundwater), the results show that a plume containing gross beta and possibly chromium can be attributed to the 107-H Basin (116-H-7) and that the reactor complex (118-H-6 Area) is a major source of chromium contamination in the groundwater beneath the 100-HR-1 Operable Unit.

However, 116-H-7 is not listed on Tables 1 or 2, and is not discussed in section 3.1.3.2, Groundwater Contamination (last paragraph) as a potential source of contamination.

Recommendation: This discrepancy should be corrected.

10. WP-17, Section 2.1.7, 2nd paragraph, 2nd sentence.

Comment: Does "multilevel completions" mean nested or cluster wells?

Recommendation: This sentence should specify cluster wells to be more specific, and to reflect recent decisions on the limited use of nested wells.

11. WP-17, Section 2.1.7, 3rd paragraph, 1st sentence.

Comment: Reference Table 27 here and not Section 5.2.4.2.2.

12. WP-18, Section 2.1.7, 3rd paragraph, 7th sentence.

Comment: This sentence indicates that the basins leaked, but there is no statement to that effect.

Recommendation: It should be stated that the basins have leaked, resulting in certain constituents being detected in the ground water, notably nitrate, chromium, and technetium, and possibly uranium.

13. WP-19, Section 2.2.1

Comment: Several topographic features of the 100-HR-3 Operable Unit may have hydrogeologic significance. Within the 100-HR-3 area, the land surface slopes gently down to the Columbia River with only a minor bluff, with two exceptions. A moderate bluff, 15 to 20 feet high, is present in the vicinity of the 100-H area, and a bluff over 50 feet in height is present along the river from the 100-N area (southwest of 100-HR-3) extending northward through most of the 100-D area. The relatively high surface (elevation 460 to 470 feet) east of this bluff slopes gently northward and eastward from the 100-D area. The higher topography of the 100-D area may correlate at least in part to a zone in which Ringold Formation sediments project above the water table (see comment section 2.2.2.2.2).

East and north of the 100-D area, a number of indistinct swells and depressions mark the locations of glacial flood bars and channels, arranged in overlapping patterns roughly concentrically around the 100-D highland. The abandoned flood features occupy successively lower elevations, down to the present Columbia River channel. This results in a "corrugated" surface sloping gently northerly and easterly from the high ground in the 100-D vicinity in the southwest corner of the 100-HR-3 area. More complex flood-related landforms occupy the area immediately south of the 100-HR-3 boundary.

Recommendation: Add topographic details to this section, as discussed above. This discussion also relates to the next comment, and should be incorporated into a revised discussion of the Ringold Formation.

14. WP-19, Section 2.2.2.1.3

Comment: The stratigraphy and subcrop pattern of the Ringold Formation are important determinants of groundwater flow patterns in the 100-HR-3

area and in the 100 Area in general. Therefore, a more detailed regional perspective is appropriate. Furthermore, classification of the Ringold Formation north of Gable Mountain as all "section Type II" is probably incorrect.

Recommendation: Expand the discussion of the Ringold Formation to include its relation to the ancestral Columbia River and the distinction between main channel and overbank deposition in the 100 areas (see comments on Section 2.2.2.2.2 for details).

15. <u>WP-20, Section 2.2.2.2</u>

Comment: The geology section, including both regional and site specific subsections, is relatively cursory and relies heavily on recent hydrogeologic investigations for 116-H-6 (Liikala et al., 1988). The 116-H-6 investigation, while detailed and undoubtedly relevant to the HR-1 Area, has limited applicability to 100-HR-3 as a whole. The 100-HR-3 Work Plan omits reference to substantial amounts of specific information that have been generated in the 100 and 600 areas over the years.

In context of the overall hydrogeologic characterization, the existing geologic, chemical and groundwater-hydraulic data are extremely valuable. In many areas, geohydrologic changes have resulted from human activities, particularly the artificial recharge of immense quantities of wastewater. Older groundwater data may be the only and/or the best information available to document these changes, and the patterns of hydraulic response to human influences may be the best indication of subsurface conditions affecting contaminant transport in many areas.

Equally important, the amount of exploration necessary to replicate existing data is both expensive and time consuming. Good use can and should be made of existing data, particularly at the aggregate area (groundwater unit) scale. The 100-HR-3 Work Plan and succeeding documents for this groundwater aggregate area are the appropriate places to compile and evaluate this information, as a foundation for more detailed and site specific investigations.

Recommendation: At a minimum, this section of the work plan should reference the available sources of subsurface information on 100-HR-3 and the related area north of the Umtanum Ridge-Gable Mountain axis. Comparisons of 100-HR-3 as a whole to 116-H-6 should not be overdrawn. In addition to Liikala et al. (1988), relevant subsurface information is probably included or cited in the references listed below. Other sources of information are undoubtedly available and should also be cited.

See comments on section 5.2.3.1 for a discussion of the types of interpretive presentations that would be appropriate to develop using existing data.

Brown, R.E., 1979, ***A Review of Water Well Data from the Unconfined Aquifer in the Eastern and Southern Parts of the Pasco Basin***, RHO-BWI-C-56, Rockwell Hanford Operations, Richland, Washington, 63 p.

Crowley, W.H. and R.K. Ledgerwood, 1986, ***Borehole Status Chart and Location Map***, SD-BWI-DP-044, Rockwell Hanford Operations, Richland, Washington.

Dorian, J.J. and V.R. Richards, 1978, ***Radiological Characterization of the Retired 100 Areas***, UNI-946, United Nuclear Industries, Inc., Richland, Washington.

Fecht, K.R. and J.T. Lillie, 1982, ***A Catalog of Borehole Lithologic Logs from the 600 Area, Hanford Site***, RHO-LD-158, Rockwell Hanford Operations, Richland, Washington.

Gilmore, T.J., 1989, ***Ground-Water Quality Assessment Program for the 1324-N/NA Facilities***, WHC-SD-EN-AP-005, prepared by Pacific Northwest Laboratory for Westinghouse Hanford Company, Richland, Washington.

Hall, S.H., 1989, ***Evaluation of the Ground-Water Contaminant Plume Extending from the 183-H Solar Evaporation Basins***, PNL-7130, Pacific Northwest Laboratory, Richland, Washington.

Ledgerwood, R.K. and R.A. Deju, 1976, ***Hydrogeology of the Uppermost Confined Aquifers Underlying the Hanford Reservation***, ARH-SA-254, Atlantic Richfield Hanford Company, Richland, Washington.

McGhan, V.L., 1989, ***Hanford Wells***, PNL-6907, Pacific Northwest Laboratory, Richland, Washington.

Newcomb, R.C., 1958, ***Ringold Formation of Pleistocene age in type locality, The White Bluffs, Washington***, American Journal of Science, v. 256, p. 328-340.

Newcomb, R.C., J.R. Strand, and F.J. Frank, 1972, ***Geology and Ground-water Characterization of the Hanford Reservation on the U.S. Atomic Energy Commission, Washington***, U.S. Geological Survey Professional Paper 717.

Routson, R.C. and K.R. Fecht, 1979, ***Soil (Sediment) Properties of Twelve Hanford Wells***, RHO-LD-82, Rockwell Hanford Operations, Richland, Washington.

Summers, W.K., and G. Schwab, 1977, ***Drillers' Logs of Wells in the Hanford Reservation***, ARH-C-00016, Atlantic Richfield Hanford Company, Richland, Washington.

16. <u>WP-22, Section 2.2.2.2.2</u>

Deficiency: This section discusses the Ringold Formation almost entirely in the context of recent detailed explorations conducted in the 100-H Area (Liikala et al., 1988). Available information suggests that

the 100-H Area is not representative of conditions across 100-HR-3. A logical approach to the groundwater cleanup requires a more detailed evaluation of the Ringold Formation, especially where it comprises the unconfined aquifer, as in the 100-D and 100-N areas.

The Ringold Formation in the Pasco Basin represents mainly fluvial deposits of the ancestral Columbia River and its tributaries. Lower, middle, and upper stratigraphic subunits were originally defined by Newcomb (1958); these were expanded to five subunits by workers on the Hanford Reservation (Tallman et al., 1981), including a fanglomerate subunit (probably not present in the 100 areas) and a basal subunit.

Available subsurface information suggest that this vertical stratigraphic subdivision, observed in the Cold Creek Syncline to the south, may not be applicable to the 100 areas. Ringold sediments on the Hanford Reservation north of the Umtanum-Gable Mountain axis appear to have been deposited when the ancestral Columbia River flowed southeastward from the vicinity of China Bar, through the gap between Umtanum Ridge and Gable Butte and possibly between Gable Butte and Gable Mountain. This channel is identified by Fecht et al. (1987, figures 12, 13) and is reflected in the elevation of the base of the unconfined aquifer (Gephart et al., 1979, Plate III-3). These main channel deposits are represented by relatively coarse-grained gravel and sand in the Ringold, while finer-grained sediments to the east (100-H and 100-F areas) reflect overbank, floodplain-type deposits.

According to section 2.2.3.1.3 of the 100-DR-1 Operable Unit Work Plan, the water table in the 100-D and 100-N areas occurs within the Ringold Formation. Drillers' logs of 12 wells in the 100-N Area, completed for Westinghouse Hanford Company, indicate predominantly sands and gravel at and below the water table. This suggests that the transition between relatively permeable Ringold gravels and sands and less permeable silts, clays and sands occurs within the 100-HR-3 operable unit. This is contrary to the 100-HR-3 work plan statement suggesting that only the finer-grained Ringold deposits occur in the 100-HR-3 area.

References:

Fecht, K.R., S.P. Reidel, and A.M. Tallman, 1987, ***Paleodrainage of the Columbia River System on the Columbia Plateau of Washington State - A Summary***, Washington Division of Geology and Earth Resources, Bulletin 77, p. 219-248.

Gephart, R.E. and others, 1979, ***Hydrologic Studies within the Columbia Plateau, Washington - An Integration of Current Knowledge***, Rockwell International, Rockwell Hanford Operations Report RHO-BWI-ST-5, prepared for U.S. Department of Energy.

Recommendation: The occurrence and orientation of coarse, fluvial channel deposits in the Ringold Formation is critical to characterizing hydrogeology and contaminant transport of the 100-HR-3 operable unit and the other 100 areas. Numerous well logs and reports are available for this characterization. This work plan section should, at a minimum, address the basic character and variability of the Ringold Formation in

the 100-HR-3 area and closely related areas north of the Umtanum Ridge-Gable Mountain axis. References to available information should be cited.

17. <u>WP-22, 23, Section 2.2.2.2.3</u>

Deficiency: This section on the Hanford Formation says almost nothing about the basic geology of the formation. Clearly, the stratigraphy and distribution of the Pasco gravel member is a major aspect of characterizing the unconfined aquifer in the 100-H Area. It may be important in assessing potential interactions with the 100-F Area. The unconfined aquifer transition between the Hanford Formation and the Ringold Formation may occur somewhere between the 100-IU-4 unit and the 100-D/DR areas. Fecht et al. (1987, p. 243) indicate glacial-flood filling of an ancestral channel between Gable Mountain and Gable Butte. Gephart et al. (1979, Plate III-5) show this as a zone of unusually high hydraulic conductivity in the unconfined aquifer. Contaminant transport from the south and west will be influenced by these features.

Numerous flood channel and back-eddy features in the Hanford Formation are evidenced in topographic maps of the 100-HR-3 Area and adjacent areas to the south. These features will provide preferential groundwater flow paths and/or anisotropic hydraulic conductivities with maximums oriented subparallel to the Columbia River.

References:

Fecht, K.R., S.P. Reidel, and A.M. Tallman, 1987, ***Paleodrainage of the Columbia River System on the Columbia Plateau of Washington State - A Summary***, Washington Division of Geology and Earth Resources, Bulletin 77, p. 219-248.

Gephart, R.E. and others, 1979, ***Hydrologic Studies within the Columbia Plateau, Washington - An Integration of Current Knowledge***, Rockwell International, Rockwell Hanford Operations Report RHO-BWI-ST-5, prepared for U.S. Department of Energy.

Recommendation: The role of the Hanford Formation stratigraphy and occurrence in relation to the unconfined aquifer should be recognized and mentioned in this section. Numerous well logs and reports are available* from which the basic geology of the formation can be characterized in the 100-HR-3 and hydrogeologically related areas to the south. At a minimum, this section should reference these sources of information as a basis for more detailed geologic baseline studies.

*see comment on section 2.2.2.2

18. <u>WP-23 through WP-29, Section 2.2.3.2</u>

Deficiency: This section on the geohydrology specific to 100-HR-3 focuses on results of investigations in the 116-H-6 (HR-1) area. The statement is made in reference to the 100-D/DR area that "the

geohydrologic regime will be similar to the 100-H area". In fact, the geohydrologic regime of the 100-D/DR area may be quite dissimilar to the 100-H Area. Contrary to the work plan statements, a considerable amount of information is available for the 100-HR-3 area outside of 100-H and for the closely related area between 100-HR-3 and the Umtanum Ridge-Gable Mountain axis (see comments on sections 2.2.3 and 2.2.2.2).

As indicated in the comments on section 2.2.2.2.2, this information suggests that the Hanford Formation, which is the uppermost aquifer at 100-H, is unsaturated in the 100-D area. Also the Ringold Formation, which reportedly includes the unconfined aquifer in the 100-D/DR area, appears to be substantially more coarsely textured and permeable than in 100-H.

Other important features of the unconfined aquifer in the 100-HR-3 Area include: the location of the textural transition in the Ringold Formation, areas in which the top of the Ringold Formation is above the water table; preferential flow paths and/or anisotropic hydraulic conductivity due to the channel deposits and erosional surfaces in both the Ringold Formation and Pasco Gravels; changes in groundwater flow patterns over time due to effects of wastewater disposal; and the influence of bank storage and river-level fluctuations on contaminant dispersion and paths.

Information available for evaluating these factors, in addition to basic subsurface data cited in our comments on section 2.2.2.2, includes water table and contaminant concentration maps prepared for the Hanford Reservation at frequent intervals over the years. Patterns of contaminant plume development and migration may be particularly significant.

Recommendation: This section should be much more general in its coverage; geohydrologic aspects of the 100-H area should be kept in context, as representative of only one portion of the 100-HR-3 area. The major issues requiring characterization, discussed above, should be at least identified, if not addressed specifically. Sources of existing information should be cited, including but not limited to the references listed in the comments on section 2.2.2.2, plus the following:

Bierschenk, W.H., 1957, *Hydraulic Characteristics of Hanford Aquifers*, HW-48916, General Electric Company, Richland, Washington.

Bierschenk, W.H., 1959a, *Aquifer Characteristics and Ground-Water Movement at Hanford*, HW-60601, General Electric Company, Richland, Washington.

Bierschenk, W.H., 1959b, *Observational and Field Aspects of Ground-Water Flow at Hanford*, HW-SA-41, General Electric Company, Richland, Washington.

Eddy, P.A., D.A. Myers, and J.R. Raymond, 1978, *Vertical Contamination in the Unconfined Groundwater at the Hanford Site, Washington*, PNL-2724, Battelle Pacific Northwest Laboratory, Richland, Washington.

Evans, J.C., R.W. Bryce, D.R. Sherwood, M.L. Kemner, and D.R. Newcomer, 1989, ***Hanford Site Ground-Water Monitoring for July through December 1988***, PNL-7120, Pacific Northwest Laboratory, Richland, Washington [and others of this series].

Jacques, I.D., 1987, ***UNC Environmental Surveillance Report for the 100 Areas -- FY 1986***, UNI-4065, UNC Nuclear Industries, Richland, Washington, 59 p.

Jaquish, R.E. and R.W. Bryce (eds.), 1989, ***Hanford Site Environmental Report for Calendar Year 1988***, PNL-6825, Pacific Northwest Laboratory, Richland, Washington [and other reports of this series].

Jenkins, O., 1922, ***Underground Water Supply of the Region about White Bluffs and Hanford***, Washington State Department of Conservation and Development, Division of Geology, Bulletin 20.

Kipp, K.L., and R.D. Mudd, 1974, ***Selected Water Table Contour Maps and Well Hydrographs for the Hanford Reservation, 1944-1973***, BNWL-B-360, Battelle Pacific Northwest Laboratory, Richland, Washington.

Rockhold, M.L., M.J. Fayer, G.W. Gee, and M.J. Kanyid, 1990, ***Natural Groundwater Recharge and Water Balance at the Hanford Site***, PNL-7215, Pacific Northwest Laboratory, Richland, Washington.

Schatz, A.L., J.J. Ammerman, and J.A. Serkowski, 1987, ***Hanford Site Water Table Map, June 1987***, WHC-EP-0054, Westinghouse Hanford Company, Richland, Washington.

Zimmerman, D.A., A.E. Reisenauer, G.D. Black, and M.A. Young, 1986, ***Hanford Site Water Table Changes 1950 through 1980 - Data Observations and Evaluation***, PNL-5506, Pacific Northwest Laboratory, Richland, Washington.

19. <u>WP-25, Section 2.2.3.2, 1st paragraph, last 3 sentences.</u>

Comment: The discussion in these sentences is of the regional geohydrology and should be in Section 2.2.3.1. The discussion in Section 2.2.3.2 should be HR-3 Unit specific.

Recommendation: Place these sentences in the correct section or rewrite.

20. <u>WP-30, WP-33, Section 2.2.4.2</u>

Comment: The seepage from the operable unit which discharge along the Columbia River shoreline are an extremely important pathway of potential contamination and therefore warrants careful evaluation and investigation. The most current information available should be cited to insure field investigations will compliment existing data. See, for example, Dirkes 1990 (PNL 7500) for data from upgradient seeps. Is there no comparable recent data for the 100-HR-3 Operable Unit?

Section 2.2.4.2 references McCormack and Carlisle (1984) in describing the locations and discharge quantities of seepages from the 100-HR-3 area. This study was conducted after the river had been artificially lowered. As a result, observations may have included seepage from relieved bank storage. Thus, to the extent that seepage observations and samples included releases from bank storage, seepage discharge could be overestimated and concentrations of potential contaminants underestimated.

Recommendation: Provide current information, including reference to the pending River Impact Study that will better define ground water and surface water relationships. Provisions should be made in planning seepage investigations to compensate for bank storage effects. It is suggested that sampling take place after a period of time determined by monitoring the water temperature and conductivity of wells immediately adjacent to seeps. This can be done through continuously-monitoring pressure transducers placed in the wells.

21. Sections 2.2.4 and 5.2.4

Comment: Section 2.2.4.1 of the 100-HR-3 Work Plan discusses surface water drainage patterns, but does not describe the drainage and discharge of stormwaters from roadways, roof tops, parking lots, etc. Although this environmental pathway is probably of grater concern in eeither areas, e.g. 300 Area, it should be quantified in the 100 Area. In section 5.2.4 of the work plan, no surface runoff investigations are proposed. Storm-runoff potential and disposition needs to be better understood and described.

Localized storm-water runoff will be generated from storm events e.g., thunder storm cloud bursts off roadways, parking lots, maintenance areas, roof tops, etc. This runoff can be contaminated, as data from industrial areas studies have indicated. Even if runoff is relatively clean, concentrated discharges could affect recharge. It should be straightforward to calculate how much runoff would be generated under expected rainfall durations and intensities, and to generally describe how and to where runoff collects and drains. From this analysis, sufficient information would be available to decide whether further investigations are warranted. Alternatively, since runoff could be easily controlled and treated, if necessary, a plan for source control, or treatment of runoff could potentially alleviate the need for further investigations.

Recommendation: Generally, describe the collection and disposition of storm-water drainage from site facilities (e.g., roadways, roof tops, etc.). Additional data may be needed to describe how much runoff occurs from a given precipitation event and where it goes. Describe any plans for control and treatment of storm-water runoff during remediation activities. Describe how or if the survey studies will be used to obtain some of this information.

22. WP-50, Section 3.1.1

Comment: The "Hanford Past Practices Investigation Strategy" (October 1990), states that the aggregate area

"...delineates the geographic area necessary to define and understand the local hydrological regime, the distribution and migration of contaminants emanating from the target source terms, the interaction of those source terms and the area necessary to provide defensibility for both conceptual and numerical models. In many areas the aggregate area is the groundwater operable unit."

Since 100-B, 100-K, and 100-N Area contaminants may have migrated into the existing boundary of 100-HR-3 via the local hydrological regime, the aggregate area boundaries and the 100-HR-3 groundwater operable unit should include these sources.

Using the proposed approximate natural hydrologic boundary along the Umtanum Ridge-Gable Butte-Gable Mountain axis as the southern boundary for 100-HR-3 aggregate area is also supported by past contaminant source studies of the Gable Mountain-Gable Butte area. The Gephart et al. (1976) study of the West Lake Basin suggested (p. 23) that the source of the higher tritium levels northwest of West Lake in the Gable Mountain-Gable Butte gap were from B Reactor which maintained a 5 meter waste water recharge mound during its operation into the late 1960's. This is supported by the groundwater monitoring data from 1971 (Kipp, 1972) and 1983 and 1984 (Cline et al., 1985). The tritium contour maps from these reports clearly show a tritium plume migrating eastward from the 100-B area. This plume extends eastward along the north side of Gable Butte and Gable Mountain with a southward lobe projecting into the Gable Mountain-Gable Butte gap.

Recommendation: Data generated during phase 1 of the RFI should include information from selected wells in the 100-B, 100-K, and 100-N Areas under an expanded 100-HR-3 aggregate area. New wells needed in contiguous areas should also be identified. See also recommendations under section 2.2.2 an 2.2.3 comments.

References:

Kipp, K.L., 1972, *Radiological Status of the Groundwater Beneath the Hanford Project January-June 1971*, Battelle Pacific Northwest Laboratories Report BNWL-1649.

Gephart, R.E., P.A. Eddy, R.C. Arnett, and G.A. Robinson, 1976, *Geohydrologic Study of the West Lake Basin*, Atlantic Richfield Hanford Company Report ARH-CD-775.

Cline, C.S., J.T. Rieger, J.R. Raymond, and P.A. Eddy, 1985, *Ground-Water Monitoring at the Hanford Site, January-December 1984*, Pacific Northwest Laboratories Report PNL-5408/UC-41,11, prepared for the U.S. Department of Energy.

23. <u>WP-53, Section 3.1.3.1</u>

Comment: Table 5, which lists estimated background levels, does not list either nitrate or tritium which are the main contaminants associated with Hanford operations used to delineate source area plumes. Other contaminants associated with Hanford operations not listed include ^{129}I and ^{99}Tc.

Various methods have been used in the past to measure nitrate in the groundwater at Hanford. The ion-specific electrode and ion chromatography methods have high detection limits and are not suitable to measure background levels on the order of 100 p/b or less as nitrate. Only existing data based on wet chemical analyses with lower detection limits should be used.

Giving method detection limit values as background when other methods are available would not meet DQOs for the purpose of determining background.

This section would be a good place to describe recent WHC activities concerning background determinations.

Recommendation: List background values for nitrate, tritium, ^{129}I and ^{99}Tc. Use only the wet chemical analyses from past surveys for nitrate. Update the section by describing the recent work by WHC.

24. <u>WP-53, Section 3.1.3.1</u>

Comment: Using the overall Hanford Site groundwater quality background as the background for 100-HR-3 may be inappropriate. The background for ground water within some parts of the operable unit may more closely resemble Columbia River water as this may be the major source of recharge.

Recommendation: Rewrite this section; include a discussion of Columbia River water as possible background ground water quality near the river. Reference the upcoming River Impact Study and how it will be used to help define background in this operable unit.

25. <u>WP-55, Section 3.1.3.1</u>

Comment: How were "typical" background wells selected from the 600 area wells? What criteria were used to make the judgement that a particular well was or was not "anomalous"?

Concentrations of many constituents in the unconfined aquifer may change seasonally due to recharge or river stage depending on where they occur on the site. How were these other environmental factors taken into account in determining background levels?

Recommendations: Clearly state the criteria used to select background wells. Indicate the locations of the background wells on a map of the Hanford site, and include it in the work plan. Determine if seasonal

variations occur regionally for the listed background constituents. If they do, state so and indicate the region and seasonal range.

26. WP-55, Section 3.1.3.1

Comment: Although this section has been improved, there is still disagreement on how groundwater in the Hanford Site can be considered background.

Recommendation: Background should be established from wells upgradient (northwest and southwest) of the Hanford Site such that significant values of elements in on-site wells can be established relative to background. It may be appropriate to differentiate between "upgradient" concentrations, and "background" water quality, depending on point of compliance.

Reference the pending review of the draft "Characterizations and Use of Soil and Groundwater Background for the Hanford Site" by Ecology and EPA, and the final report due in July 1992.

27. WP-55, Section 3.1.3.2, 1st paragraph, last sentence.

Deficiency: It is stated that, in general, herbicides, pesticides, and volatile and semivolatile organics have not been detected in ground water in the 100-HR-3 Operable Unit (with references given to Liikala, 1988 and Evans, 1988). It is not entirely clear from these reports how many samples have been analyzed for these constituents. Also, the data given in these reports indicate rather common occurrences of several volatile organics (chloroform in 22 of 23 wells and methylene chloride in 13 of 23 wells tested).

Recommendation: Indicate how much testing has been done, which constituents were analyzed for, and indicate which constituents were detected.

28. WP-58, Section 3.1.3.2, last sentence

Comment: We still insist that it is misleading to assert that the nearest public community drinking water source where drinking water standards would apply is at Richland. It has not been determined that drinking water standards would not apply to ground water at the Hanford Site. Hanford on-site wells currently provide drinking water, and are regulated under WAC 248.54. That these wells are not within the 100-HR-3 Operable Unit is immaterial. Potential beneficial uses of ground water have not been determined, and should not be precluded. Drinking water standards may also be RCRA corrective action standards or CERCLA ARARs or TBCs. Eg., MCLs can be action levels under proposed 40 CFR 264.521(a), 55 FR 30876, and media cleanup standards under proposed 40 CFR 254.525(d)(iv), 55 FR 30876.

Recommendation: Explain the possible application of drinking water standards to the ground water on the Hanford Site.

29. WP-63, Section 3.1.3.2

Comment: The Hanford Site background concentrations for nitrate listed in Table 8 and referenced on page WP-60 are incorrect. This table actually comes from Table 17 in Liikala, et. al. (1988, p. 124) and not Jaquish and Mitchell (1988) as referenced on Table 8 and in the text on page 60. Table 17 in Liikala et al lists the background nitrate as a range of 500-2,000 p/b without the ± precision estimate. This is probably a result of the ion chromatography method used in analyzing groundwater nitrate in the original data source, Jaquish and Mitchell. This method gave a range of detection limits of from 500 to 2,500 p/b depending on the dilution used in the analysis (see Jaquish and Mitchell, 1988 for details).

Recommendations: Correct the error in Table 8. Determine if the range of values in Liikala et al. (1988) are actual values or a method detection limit range. Show it as <500 p/b if the latter is true. Correct the citation.

30. WP-72, Section 3.1.4.2

Comment: The last full sentence in the last paragraph which states that "data indicating no measurable effect from the Hanford operations at these locations." is contradictory. The next sentence identifies significant increases in the measured concentration for tritium and ^{129}I at the Richland Pumphouse which indicate an influence from Hanford operations.

Recommendation: Strike the last part of the last full sentence in the bottom paragraph starting with... "indicating no measurable effect."

31. WP-75, Section 3.1.4.2

Comment: The Student's t-test of the radionuclides does show a significant difference for particulate $^{239,240}Pu$ at between the 20% and 50% significance level. The statement that "No other statistically significant differences were noted between concentrations of radionuclides.." needs to be amended.

Recommendation: Amend the sentence to read: "No other statistically significant differences were noted at the 5% significance level ..."

32. WP-75, Section 3.1.4.2

Comment: There is a significant difference in the nonradiologic river-water data between the Priest Rapids Dam and the Richland Pumphouse for nitrate. Nitrate showed a statistically significant increase at the

99.8% confidence level (0.2% significance level). Since nitrate is one of the best indicators of the influence of Hanford operations, it should be included in the discussion.

Recommendation: Add a new third sentence to paragraph two: "Nitrate levels were significantly higher at the Richland Pumphouse than at the Priest Rapids Dam, again indicating the influence of Hanford operations on river-water quality."

33. WP-75, Section 3.1.4.2

Comment: Very little data exists to characterize existing water quality and contamination of the seepages from the 100-HR-3 area which discharge along the Columbia River shoreline. See Comment #20.

34. WP-75, Section 3.1.4.3, 1st paragraph, last sentence.

Comment: It is stated that the Columbia River bed is scoured to bedrock (or has a thin layer of gravel over bedrock) for most of the river reach between reservoirs. Almost everywhere along this reach, there are at least several hundred feet of sediment between the riverbed and the basalt bedrock.

Recommendation: Remove this statement.

35. WP-75, Section 3.1.4.3, 2nd paragraph, last sentence

Comment: Supply data to support the statement that radionuclides are present because of worldwide dispersion from atmospheric testing of nuclear weapons.

36. WP-76, Section 3.1.4.2

Comment: Table 13 shows maximum and minimum chromium values at <10 and <1 ug/L with an annual average of <7. We don't know of any way to take a range of detection limits and determine an average value.

Recommendation: To be conservative, state the annual average as <10 ug/L.

37. WP-80, Section 3.1.6.2, 1st paragraph, 6th sentence

Comment: This sentence is speculative and unclear as to purpose. It should be deleted.

38. WP-81, Section 3.1.6.3

Comment: This section should include information about the removal of mulberry bushes in August 1990. The text should describe why they were removed, and what data were generated from this removal activity.

39. WP-82, Section 3.2., 1st paragraph

Deficiency: In the first paragraph, cleanup standards are referenced. The Washington State Model Toxics Control Act cleanup standards were adopted in April, 1990, and should be discussed as potential applicable standards. (WAC 173-340)

40. WP-83, Section 3.2.1.2, 1st and 2nd paragraphs.

Comment: Please specify the sources used for background concentrations. If sources used were on-site, an evaluation of constituents based on off-site sources would lead to a greater range of compounds considered for corrective action and risk assessment.

41. WP-83 and WP-84, Section 3.2.1.2

Deficiency: It was suggested in the original comments (#33) that the applicability of WAC 173-290 be examined and incorporated into the work plan. The reason for not doing so was that these regulations were not promulgated. Since that time, the ground-water quality standards have been promulgated as WAC 173-200.

Recommendation: This section should be further developed by citing WAC 173-200. The constituent list should be expanded based on this regulation to include nitrate.

42. WP-83, Section 3.2.1.2

Deficiency: The MTCA regulation, specifically WAC 173-340-720, are not introduced as corrective action requirements.

Recommendation: Explain the applicability of the MTCA regulations.

43. WP-84, Section 3.2.1.3, last paragraph, last two sentences.

Deficiency: MTCA regulations have been promulgated that contain ground water quality standards, specifically WAC 173-340-720.

Recommendation: Delete these two sentences. Reference the MTCA regulations in section 3.2.1.2.

44. WP-85, Section 3.2.2, 1st bullet

Comment: Reference the "Strategy for Handling and Disposing of Purgewater at the Hanford Site". This is more relevant to Hanford, and what is actually occurring in the field, than general citations of federal regulations.

45. Section 3.3

Deficiency: The preliminary risk assessment used to identify contaminants of concern (WP-93) is a more objective process than that used to identify contaminants of concern in 100-DR-1. However, there are some problems with the approach. Instantaneous dilution of groundwater inputs in the Columbia River is incorrectly assumed. At a minimum this is not a conservative assumption, particularly if protection of the sensitive riparian zone is desired. As indicated elsewhere in the document (WP-125), discharge to the river tends to hug the shoreline. It is not obvious that complete mixing would be achieved as far downstream as the hatchery, 300 Area, or Richland water intakes. Therefore, exposures could be higher than predicted. They will certainly be higher if riparian biota are included as receptors in risk assessment.

The preliminary risk assessment does not include riparian biota specifically, either as receptors or as food pathways for exposure of human receptors. If riparian biota is not considered a pathway to human exposure, why were mulberry bushes that were contaminated with radionuclides cut down in August 1990? While preliminary risk assessment may be useful in identifying contaminants of concern for intensive data collection effort, it should not be used to eliminate known source contaminants from baseline risk assessment. If it is used for this purpose, the assessment at this stage should be conservative (i.e., based on worst-case assumptions involving plant and animal exposure in riparian mixing zones).

Recommendation: Rewrite this section, considering that instantaneous mixing does not occur in the Columbia River, and that riparian resources play a more important exposure pathway to humans than is outlined.

46. WP-86, Section 3.2.1

Comment: The context of this section is not clear.

Recommendation: Explain the relation between this section and section 5.2.11, Task 11--Baseline Risk Assessment.

47. WP-86, Section 3.3.1.1, 2nd paragraph.

Deficiency: There is no discussion of pathways from release to vadose zone to reception exposure via ingestion of vegetation or soil.

Recommendation: Discuss pathways from release to vadose zone to reception via ingestion of vegetation or soil.

48. WP-87, Section 3.3.1.1, first paragraph, first sentence.

Deficiency: We cannot accept the characterization of an exposure route as not important without quantification upon which to accept or deny that characterization. We cannot conceive of a groundwater exposure route being characterized as unimportant for the reason the aquifer is not currently being used. Although section 3.3 is entitled "POTENTIAL IMPACTS...," this sentence restricts consideration of exposure routes based on current usage. Alternate future land uses must be considered, unless the probability of the site supporting those uses is "exceedingly small," as specified in section 6.2.2 of "*Risk Assessment Guidance for Superfund*,Volume I, EPA/540/1-89/002 (December, 1989). WAC 173-340-708(3) specifies that risk be assessed in terms of "the highest exposure that is reasonably expected to occur at a site under current and potential future site use," for example, ground water used as drinking water.

Recommendation: Delete the first sentence. Explain that groundwater may be an exposure route in future residential and agricultural land use alternatives. Correct Figure 26 to reflect this exposure route.

49. WP-86, Section 3.3.1

Comment: The second and third paragraphs are identical.

Recommendation: Delete one of the paragraphs.

50. WP-87, Figure 26

Deficiency: An arrow should be drawn from the "transport to unconfined aquifer" box to the right-hand vector. Groundwater consumption should also be included in the bottom right-hand box. Consumptive-use wells exist east of the river and transport of site contaminants in the unconfined zone has not been documented to the extent that this mechanism can be excluded as a viable pathway.

Recommendation: Please make changes to figure 26 as indicated.

51. WP-87, Section 3.3.1.1, 4th paragraph.
WP-88, Section 3.3.1.1, 9th paragraph.

Comment: Although water-table elevations are probably much greater across the Columbia River from the HR-3 operable unit, data would need to be gathered to verify this, unless sufficient information is already available. Transport of on-site contaminants to wells east of the Columbia River using this unconfined aquifer and upper confined aquifer should be included as a viable pathway and should not be excluded based solely on the notion of the Columbia as a base level hydraulic boundary. Evaluation of this pathway based on hard data and perhaps flow modeling during different river stage levels would aid in risk assessment

considerations and provide useful data beyond operable unit boundaries. See the comment on Section 5.2.6.2.1.3.

Recommendations: Appropriate methods, e.g. cluster well installation, should be enacted to evaluate groundwater conditions east of the Columbia River. More useful data may be obtained by drilling the wells on Locke Island or one of the other islands rather than across the river, and this should be considered.

52. WP-89, Section 3.3.2, 3rd sentence.

Comment: Significant concentrations (3X background), in the toxicity assessment, should be based on a mean true background value obtained from several Hanford and off-site upgradient sources. This section should include text that indicates Hanford "background" has yet to be determined.

53. WP-93, Section 3.3.4

Deficiency: The stated dilution factor given in the text as the annual average flow rate of 1.2×10^5 (cfs) for the Columbia does not make complete sense. A dilution factor must use two volumetric parameters, in this case volumetric flow rates, to determine dilution ratio (factor) of one into the other. The implicit assumption as stated would be that the groundwater was discharged at a flow rate of 1 cfs so that it was diluted 1 part in $1.2 \times 10^5 + 1$ total parts of volume. Ignoring the insignificant "+ 1" part from the groundwater discharge yields the dilution factor of 120,000.

However, as far as can be determined, there is no justification for the assumption of a groundwater discharge of 1 cfs. There is a statement in the work plan (WP-31) that estimates of contaminant discharge were "as low as 3 cfs" downstream from operable unit.

Recommendation: Revise the dilution factors to include a reasonable estimated range of groundwater discharge values and typical Columbia River discharge values. For example, given a groundwater discharge range of from 3 to 10 cfs and a river discharge range of 36,000 to 250,000 cfs, would yield a maximum range of dilution factors of from 3,600 to 83,000.

54. WP-95 to 99, Section 3.4

Comment: The work plan does not adequately establish remedial action objectives, a key step in the DQO process. In order to focus the investigations and better define data needs, it is important to know before hand the objectives of data collection and evaluation. Lacking a clear definition of these objectives, the work plan should clearly define the process for establishing remedial action objectives, including a statement defining who will make these determinations and when.

Recommendation: Provide additional text describing the process for establishing remedial action objectives. Include specific language that indicates how these decisions will affect data collection in subsequent phases of the RFI/CMS.

55. WP-97, Table 23

Comment: Evaluation of potential remedial alternatives is one of the most important "data uses". The work plan should develop specific concepts of how potential technologies might be applied, and how data collection and analysis will follow those concepts.

At this stage, specific technologies under each general response action should be identified so that we know what technologies will be included in the screening process. There is no need to wait until implementation of the CMS, since preliminary contaminants of concern have been identified (WP-122), and thus a list of technologies capable of treating them could be generated. Presenting a preliminary list would help ensure that it is complete.

Recommendation: Identify specific technologies most likely to be used within the operable unit, and describe data needs associated with those technologies.

56. WP-101, Section 4.1

Deficiency: The identified data uses do not seem to include environmental risk assessment with consideration of plant or animal receptors.

Recommendation: Include plant and animal receptors in the environmental risk assessments.

57. WP-101, Section 4.1.1

Comment: Data Quality Objectives should include low-level analytical methods, when available, for the determination of background values. As mentioned in the comments to section 3.1.3.1, presenting method detection limit values as background when other methods are available would not meet DQOs for the purpose of determining background under the category of site characterization.

Recommendation: Add a sentence to the end of the site characterization paragraph stating that, "determination of measurable background values using low-level analytical methods, when available, is also an integral part of site characterization."

58. Sections 4.1.2 and 5.2.4.2

Deficiency: Section 4.1.2 states: "(g)iven the current data, it does not appear that riverbank springs, the Columbia River and sediments, and aquatic biota within 100-HR-3 exhibit significant contamination; thus, they will not be extensively sampled to delineate the existing areas of contamination". In this context, how is "significant" defined? It is possible that for some media (e.g., aquatic biota) relatively low concentrations of contaminants may be significant depending on several factors (e.g., potential bioaccumulation). For the riverbank springs, the current data appears to include only single samples taken at certain sites during 1982-83 (Table 14, WP-77). These data do not seem to be of sufficient quantity or spatial/temporal coverage to conclude that contamination is insignificant.

Despite the above conclusion, sampling of riverbank springs is proposed (section 5.2.4.2.2, WP-119). It is unclear as to whether the total maximum number of samples to be collected at the riverbank springs (i.e., 10) as listed in Table 28 (WP-129) are the total per site or across all sites. If the latter, the number of samples appear insufficient and should be justified. The proposed River Impact Study should also be noted.

The standard velocity area measurement techniques or "best estimates" as proposed (WP-123) are not appropriate. Rather, much greater accuracy would be attained using a portable flume or conservative tracer techniques.

Caution should be exercised when sampling during low-river flow (WP-124) to assure that sampling is not influenced by release of bank storage. To the extent samples include bank storage, spring discharges could be overestimated and concentrations of potential contaminants underestimated.

Recommendation: It is recommended that pressure transducers with the capability of measuring water temperature and specific conductivity be placed in wells adjacent to springs or seeps of interest and that these be monitored continuously after river levels have been lowered to determine the end of bank storage effects. Samples from springs can be obtained and discharge measurements through flume and tracer techniques can be conducted after bank storage effects end.

Add text describing the River Impact Study, and how it will be used to help characterize this operable unit.

59. <u>WP-101, Section 4.1.2, 1st paragraph, last sentence</u>

Comment: It is stated that, "The data are summarized every 6 months in status reports for the site-wide groundwater monitoring project, but are not purposefully reviewed to identify the extent of plumes within the 100-HR-3 operable unit." It isn't clear in this sentence how these status reports (or the data bases from which they are written) will be used.

OSWER Directive 9355.3-01 states: "Before the activities necessary to conduct an RI/FS can be planned, it is important to compile the available data that have previously been collected for a site. These data can be used to determine the additional work that needs to be conducted both in the field and within the community. A thorough search of existing data should help avoid duplication of previous efforts and lead to a remedial investigation that is more focused and, therefore, more efficient in its expenditure of resources.

The results from any previous sampling events should be summarized in terms of physical and chemical characteristics, contaminants identified, and their respective concentrations. Results of environmental sampling at the site should be summarized, and evidence of soil, ground water, surface water, sediment, air or biotic contamination should be documented. If available, information on the precision and accuracy of the data should be included."

Recommendation: The work plan should show how these requirements will be fulfilled.

60. WP-103, Section 4.1.2, 3rd paragraph, 4th sentence.

Comment: This section states that selected samples will be completely characterized and that chemical analyses will be conducted on indicator species. This is contrary to Table 4 of SAP/FSP-29 and section 5.2.6.3 (WP-146) that states that initial groundwater samples will be analyzed for a variety of contaminant constituents. Section 4.1.4 states that detailed chemical analyses of these samples will occur for the first two sampling periods, then are to be trimmed. Section 4.3 of SAP/QAPP (SAP/QAPP-15) states that procedures required for Phase 1 are listed in Table 1 of the SAP\QAPP. Table 1 shows the analytical requirements to be CLP level.

Recommendation: Specify how many samples will be analyzed and at what level.

61. WP-104, Section 4.1.3, 1st paragraph, 6th sentence.

Comment: This section states that levels I, II, and III (Table 26) will be used for initial survey. However, Section 3.0 of SAP/FSP Table 1 shows CLP (level IV) as standard validated method. Section 2.5.1.6.6 and Table 1 (SAP/FSP) refers to analytical references in Table 2 Contract Laboratory Program, Organic Target Compounds. Section 5.2.3.3 WP-116 states that soil samples will be analyzed for organic and inorganic constituents using CLP protocols.

Recommendation: Specify which level of analysis will be used for samples.

62. WP-109, Section 4.2

Deficiency: The aquatic investigation methodology should include surface water plume delineation by means of dye or drogue studies. It must also include measurement or quantitative estimation of seep discharge and concentration. Without this information, no credible aquatic dispersion model can be developed and risk assessment will not adequately address the riparian zone. A numerical model that includes sedimentation may be needed to predict impacts on benthic communities. Grain size information will be an essential sediment parameter if sedimentation is to be considered.

Recommendation: Include plume delineation study in the aquatic investigation methodologies.

63. WP-115, Section 5.2.2.4

Comment: Source unit screening needs to consider not only the characteristics of the source units themselves, but also the hydrogeologic setting of each source unit and the relation between these sources and the known contaminant plumes and pathways.

Recommendation: This subsection should reference the other investigations to be conducted for the aggregate groundwater area and describe the integration of source unit screening with aggregate-area wide characterization.

64. WP-115, Section 5.2.3

Comment: Geologic deficiencies in the work plan were discussed in the comments on several subsections, particularly under 2.2.2.2. A major requirement for correcting these deficiencies is to evaluate and integrate information over a larger area, the boundaries of which are defined hydrogeologically. The work plan should facilitate integration of effort between the geologic, ground water and vasose zone investigations.

The existing geologic information on the 100-HR-3 area and adjacent, related areas to the south have not been sufficiently evaluated or utilized in preparing section 2 of this work plan. Discussion of geologic investigations in section 5.2.3 should clarify how these deficiencies will be addressed in the geologic investigations under the RFI/CMS.

Recommendation: Expand this section to address geologic data needs for 100-HR-3 as a whole, and integration of 100-HR-3 with the hydrogeologically related areas adjoining to the south.

Specify how geologic, vadose zone and groundwater investigations will be coordinated and integrated for each operable unit. Specify how these investigations for each source area operable unit will be integrated with the groundwater aggregate area investigations.

These discussions may be referenced to the Project Management Plan (Attachment 3); however, that plan does not presently provide any specific guidelines for these integrations. It is insufficient to simply indicate (as on page PMP-1) that the technical leader will "see that the RFI/CMS project managers interact and cooperate ..." A specific plan of coordination, using the groundwater aggregate area as a basis for the master plan, is recommended.

65. WP-115, Section 5.2.3.1

Comment: Data compilation is an important, fundamental step in the geologic investigation that will have to be done either as part of the 100-HR-3 work plan revision or as the initial stage of RFI studies. As discussed in comments on section 2, much existing, basic information is missing in the work plan descriptions of the geologic setting. This information needs to be compiled and evaluated in order to proceed logically and efficiently with source unit screening and with the more detailed source area investigations.

The regional setting of the 100-HR-3 operable unit has been described only in the most general terms. The existing work plan descriptions (sections 2.2.2 and 2.2.3) leave a large gap between Pasco Basin scale and source unit scale. As discussed in the section 2 comments, characterization is required at the intermediate (aggregate area) scale. The logical aggregate hydrogeologic area would include not only 100-HR-3 as presently designated, but all the 100 and 600 areas between the Columbia River and the Umtanum Ridge-Gable Butte-Gable Mountain structural axis.

Recommendation: The available geologic information (see comment on section 2.2.2.2) should be compiled and, at a minimum, the following working maps should be prepared for the aggregate area:

- Elevation of top of basalt/Ellensburg
- Elevation of top of Ringold
- Thickness of Ringold sands and gravels*
  *If an ancestral Columbia River channel facies can be identified in the Ringold, working maps of the elevations of the top and bottom should be attempted.
- Facies descriptions and areal definitions within the Hanford Formation (e.g., main flood channel, point bar, back eddy...)

66. WP-127, Section 5.2.4.2.3.2

Comment: The fixed interval transect approach to sampling water and sediment in the seep plumes on the Columbia River may well miss the peak concentrations of the plume. The plume extent can be defined by dye studies prior to sampling, and the sampling intervals adjusted to approximate dilution contours. This would ensure adequate characterization of the plume.

If Stage I samples are to control initiation of such detailed Stage II plume characterization, they must be collected as close as possible to the discharge or at the discharge point.

The text states that Stage II sampling will occur only if Stage I sampling indicates levels abouve background. If should be noted in this section that Hanford background levels have not be determined, and are the subject of a seperate study.

Recommendation: Consider alternative methods for assessing the seep plume in the Columbia River. Add text describing the scope, design and schedules for the River Impact Study. Describe how this study will be used to augment the RFI/CMS activities in the 100-HR-3 operable unit.

Add text describing the Hanford Site background study and how data or determinations made in that study will be used in the 100-HR-3 operable unit.

67. <u>WP-116, Section 5.2.3.2</u>

Comment: Siting of the four geologic "control" boreholes should consider the data compilation and evaluations discussed and recommended in the comment on section 5.2.3.1.

The last paragraph of this section is unclear as to where the borings will terminate. It is stated that the "control" boreholes will "terminate" in the basal Ringold but may be drilled through the Elephant Mountain Basalt. If borings are drilled into the basalt/interbed, will they be backfilled to the basal Ringold Formation? The word "terminate" is unclear.

Recommendation: The work plan should address the results of the compilation and evaluation of existing data (section 5.2.3.1) in siting the geologic control boreholes.

Rephrase the last paragraph on "control" wells.

68. <u>WP-117, Figure 27 and WP-24, Figure 6.</u>

Comment: In Figure 27, the Ringold Formation is subdivided into "upper", "middle", "lower" and "basal" units. In Figure 6, the Ringold is subdivided into units with lithologic descriptions.

Recommendation: Be consistent with subdivision terminology.

69. <u>WP-118, Section 5.2.3.4</u>

Comment: See section 5.2.3.1 for maps cited.

Recommendation: Geohydrologic fence diagrams may be useful and appropriate; however, they should not be a substitute for the more general maps cited in the comment/recommendation for section 5.2.3.1.

70. WP-119, Section 5.2.4.2.2, 2nd paragraph, 4th sentence

Comment: Special sampling techniques are mentioned, with no explanation of why they are necessary, or what they are.

Recommendation: Specify what special sampling, handling and preservation procedures and techniques will be used, or provide a cross-reference to the appropriate section in the Sampling and Analysis/Field Sampling Plan.

71. WP-123, Table 27.

Comment: The citation in footnote a) is still incomplete.

Recommendation: Please cite the complete reference to the American Chemical Society publication.

72. WP-124, Section 5.2.4.2.2.1

Comment: It is stated that: "(s)ampling will be conducted during periods of low-river flow to maximize the potential for the seeps to be actively flowing and to maximize the impact of the contaminated groundwater entering the river along the 100-HR-3 operable unit." Caution should be exercised to ensure that low-river flow sampling is not influenced by release of bank storage waters. If low-river flow seepage samples contain waters that are actually from bank storage, then concentrations of potential contaminants could be underestimated.

Recommendation: Provisions should be made in the sampling of seepage to avoid or compensate for any bank storage effects as recommended in previous sections.

73. WP-131, Section 5.2.5.2, 3rd paragraph, 6th sentence.

Comment: Samples should be screened in the field for metals and known major contamination (3.2.1.1) using X-ray fluorescence (see Table 26) and for volatile organic compounds and radionuclides.

Recommendation: Include X-ray fluorescence as a screening method.

74. WP-132 Section 5.2.5.3, 1st paragraph, last sentence

Comment: This section states that total organic and inorganic analysis will be performed. However, in Section 5.2.5.2, it is specified that

organic compounds would be analyzed if field screening or visual inspection indicated presence of volatile organic compounds.

Recommendation: State that total organic and inorganic analysis will be performed, and be consistent.

75. <u>WP-132 through WP-147, Section 5.2.6</u>

General Comments: The "aggregate area" is a key concept for groundwater cleanup at Hanford. Under this concept, groundwater operable units are designated over a geographic area and usually encompass two or more source units. The purpose of the groundwater unit-aggregate area is to provide a regional perspective within which source areas are screened and remedial actions are prioritized and coordinated. This approach is an integral part of the draft "Hanford Past Practice Investigation Strategy", and has been agreed upon by the parties (see Operable Unit Manager's Meeting Minutes, 2/90).

Designation of the groundwater operable unit is intended to provide a method for characterizing groundwater conditions and groundwater contamination over an area defined by natural hydrogeologic boundaries, rather than by arbitrary administrative or source unit boundaries. Properly implemented, this strategy facilitates consideration at a hydrologic-unit scale of the physical conditions that affect the cleanup activities. It should provide both a "big picture" of contamination levels and cleanup priorities at the aggregate area scale, and a conceptual hydrogeologic framework within which source-area work plans are developed and integrated. This approach should also integrate risk and performance assessments for source and groundwater operable units.

With respect to groundwater characterization and cleanup, there are three main problems in the implementation of the aggregate area concept to the 100-HR-3, 100-DR-1, and 100-HR-1 Operable Units.

A. Boundaries of the groundwater aggregate area.

The southern boundary of the 100-HR-3 Operable Unit follows land survey section lines and cuts arbitrarily across the logical hydrogeologic aggregate area. This boundary is inappropriate for the following reasons. First, contaminated groundwater may enter the 100-HR-3 area from the south and west, particularly from the 100-N area. For example the detection of significant concentrations of chromium at well 699-83-47, just south of the 100-HR-3 boundary, suggests the possibilities of other contamination sources to the south or of southward contaminant transport from the 100-IU-4 Operable Unit.

Second, much of the existing data that should be used to properly characterize the hydrogeologic units of the 100-HR-3 area is from exploratory borings and monitoring wells south of the designated 100-HR-3 boundary.

A more logical southern aggregate area boundary would be based on hydrogeologic factors, and would coincide with the structural axis of the Umtanum Ridge-Gable Mountain uplift. This axis, while not a complete barrier to groundwater flow, is a partial barrier and is by far the strongest physical discontinuity separating the 100 areas from the 200 areas.

In summary, a comprehensive aggregate area approach requires that planning and implementation of cleanup activities in the 100-HR-3 operable unit take into account the hydrogeologic conditions, contaminants, and cleanup activities beyond the existing boundary.

B. Inadequate hydrogeologic characterization of the groundwater aggregate area.

Despite the considerable amount of information available, there has been no meaningful hydrogeologic conceptual framework developed at the groundwater aggregate area scale. This deficiency notwithstanding, a major monitoring well program is proposed in the 100-HR-3 Work Plan with most of the well locations, including all Stage I wells, pre-designated. In short, the available hydrogeologic information appears to have been largely ignored in the planning of a major drilling, monitoring, and analytical program. There is no specific program for integrating data compiled in the groundwater investigation with existing information to guide development of the monitoring well program. Siting of monitoring wells under the 100-HR-3 work plan should not be attempted prior to 100 area sloping activities, and compilation and evaluation of existing hydrogeologic data.

C. Source-area focus.

It appears that the groundwater investigations proposed in the 100-HR-3 Work Plan contradict the "aggregate area" approach, in which the overall hydrogeologic framework is developed and within which source area investigations are implemented. The groundwater investigations outlined in the work plan reverse this sequence, starting at the source areas and moving outward.

It would follow that if additional monitoring wells or other activities are required near existing waste disposal facilities, these activities should be implemented under the source-area operable unit work plans, not under the groundwater operable unit work plan. This is particularly true for expedited cleanup actions <u>specific to these facilities.</u> The groundwater operable unit work plan should serve to coordinate with and integrate data from the source unit activities.

Recommendation: The following points should be considered in focusing the ground water investigation:

1) Siting of monitoring wells should not be attempted prior to completing compilation and evaluation of existing hydrogeologic data, as outlined in sections 5.2.3.1, 5.2.4.1, and 5.2.6.1.

2) The 100-HR-3 Operable Unit investigation should be carried out using an aggregate area approach. This will result in data being gathered in a focused manner over a larger area, and will serve regional studies such as risk assessment and groundwater modeling. In other words, data compilation and intrusive activities should occur as necessary to comprise all the 100 and 600 areas between the Columbia River and the Umtanum Ridge-Gable Butte-Gable Mountain axis. The emphasis should be on eliminating data gaps and meeting remedial action objectives.

3) The groundwater operable unit work plan needs to coordinate with and integrate data from the source unit activities.

76. WP-132, Section 5.2.6, 1st paragraph, 3rd sentence.

Comment: Objective (1) should be written as compile and validate existing data ...

77. WP-133, Section 5.2.6, 2nd paragraph, 3rd sentence.

Comment: This section states that Stage II wells will be located at considerable distances from the waste disposal sites and will serve for both groundwater contamination zone definition and geohydrologic characterization. Figures 29 and 30 show the wells adjacent to waste sites.

Recommendation: Revise the figures or the text to approximate the actual case.

78. WP-133, Section 5.2.6, 4th paragraph, last sentence.

Comment: Change "between DOE and the appropriate lead regulatory agency." to "between DOE and the regulatory agencies."

79. WP-135, Section 5.2.6.1

Comment: Two compilations of existing data that have been regularly included in annual or semi-annual Hanford reports are water-table maps and maps showing the evolution of various groundwater contaminant plumes. These maps provide extremely useful information on geohydrologic features, particularly pathways of preferential groundwater flow. The water table maps show the pattern of propagation of changes in the water table over time due to artificial recharge of groundwater. The contaminant maps show graphically the major contaminant pathways.

Recommendation: The work plan should specifically provide for compilation of previous water table and groundwater contaminant maps. Current data should be compiled on working maps at the same scale as the geologic data maps recommended in the comments on section 5.2.3.1.

80. WP-136, 137, Section 5.2.6.2.1

Comment:

1. The proposed Stage I and most of the Stage II and III monitoring wells are sited in relation to specific waste disposal facilities. To the extent that these wells can be immediately justified, it is premature to designate specific monitoring well sites for the groundwater operable unit. See the comments and recommendations under section 5.2.6 on this subject.

2. The first full paragraph on page WP-137 addresses investigation of vertical hydraulic gradients. For the 100-HR-3 Area and the hydrogeologically related area to the south, it is believed that upward gradients generally prevail between the basalt aquifers and the Ringold Formation aquifers, and between the confined aquifer in the lower Ringold Formation and the unconfined aquifer in the Ringold Formation and/or Hanford Formation. With many of the existing monitoring wells open throughout the suprabasalt section, it is possible that water from the confined aquifer is being continually transferred via some of the well bores from the confined to the unconfined aquifers. This could have the result of flushing shallow contaminants out of the monitoring wells, producing an apparent contaminant concentration lower than would be monitored in a well open only to the uppermost aquifer. Consistent delineation of vertical gradients is necessary to evaluate this possibility, as well as to more accurately characterize groundwater flow conditions in general.

Recommendation:

1) See recommendations under section 5.2.6 for well-siting considerations.

2) Static water level should be obtained and/or a piezometer installed in any deeper aquifer zone penetrated by new wells within the basalt or Ellensburg. A deep piezometer should definitely be installed if indications are found of a basalt/Ellensburg static level close to or below the basal Ringold static level. Intermediate level piezometers may be appropriate in discrete water-bearing zones between the first confined aquifer and the phreatic surface of the unconfined aquifer.

81. WP-137, Section 5.2.6.2, last paragraph.

Comment: The geophysical logging of the boreholes may have to wait until a decision is made as to the type of logs that can provide reliable data with existing equipment and those that will require equipment not presently onsite.

Recommendation: Evaluate which downhole geophysical logs can be utilized onsite presently and those that may require subcontractors or additional equipment purchases. Calibrated equipment will be required, as will good referable procedures.

82. WP-140, Figure 30

Comment: Location of 116-H-6 referenced on pages WP-16 and WP-141 is not shown own or referred to on building list.

Recommendation: Show and reference location of 116-H-6.

83. WP-145, Section 5.2.6.2.1.3.

Comment: It is suggested that a well cluster across the Columbia River wil resolve questions regarding possible ground-water flow from the Hanford Site beneath the Columbia River to the other side (Franklin County). Available water level maps indicate much greater heads across the Columbia River than on the Hanford Site (both in the water table aquifer and in the deeper basalt aquifers). Drilling a well or a well cluster across the river may be a needless exercise. However, if documentation is required in this area to verify or add to the water table maps presently available for the area across the river, then the cluster wells may need to be drilled. Perhaps more information could be obtained if the wells were drilled on Locke Island or one of the other islands north of the HR-3 operable unit.

Recommendation: Consider the possibility of drilling a cluster well system on one of the islands north of the HR-3 ground-water operable unit. Drilling a cluster system across the river may still be required for documentation purposes if presently available information is not sufficient.

84. WP-145, Section 5.2.6.2.1.3

Comment: This paragraph raises more questions than it provides information. It makes the definitive statement that ground water "cannot" cross from the unconifined aquifer on the Hanford Site to Grant County. It then describes "confusion" among the "lay and technical communities" concerning this issue, and suggests further study. The basic physical properties guiding the assumptionn are clear, but the lack of agrement by technical people is not. It would be better to qualify the assumption in order to justify the additional study. It would also be better to use "controversy" rather than "confusion".

In addition, this paragraph suggests a "cursory examination" of groundwater quality across the Columbia River from the 100-HR-3 Operable Unit. In 1987, the Intercontractor Working Group (Westinghouse Hanford Company, 1987, Data Compilation - Iodine-129 in Hanford Groundwater: WHC-EP-0037) reported anomalous levels of iodine-129 in confined aquifers across the Columbia River from the southern part of the Hanford

Site. Although attracting considerable attention at the time, further study was abandoned (to our knowledge) when the BWIP program was terminated in early 1988. These iodine-129 concentrations are still unexplained other than general perhaps erroneous, acceptance that the contamination must have originated at Hanford.

Recommendation: A more thorough investigation of groundwater contamination across the Columbia River from the Hanford Site, should be prepared to deal with complex and apparently contradictory data. A "cursory" study may raise more questions than answers.

Qualify the assumption, and substitute "controversy" for "confusion".

85. <u>WP-146, Section 5.2.6.3.</u>

Comment: Sampling of the monitoring network on a quarterly basis may be insufficient close to the Columbia River. Effects of bank storage may result in changes over much shorter durations (perhaps daily).

Recommendation: Selected wells near the river might be instrumented for measurement of some basic water-quality parameters (e.g., specific conductance and temperature) on a schedule of at least several times a day. These measurements should be taken early in the investigation to help determine the needed frequency of sampling for the overall water-quality network and to help in interpreting the representativeness of the samples that are taken.

86. <u>WP-146, 147, Section 5.2.6.4.2</u>

Comment: This section on geohydrologic characterization deals only generally with the types of evaluations that will result from the 100-HR-3 groundwater investigations.

Recommendation: Specifically designate, as products of the geohydrologic characterization, periodically updated versions of the working maps recommended in the comments on sections 5.2.3.1 and 5.2.6.1. In addition, as sufficient data become available, working maps should be prepared showing contours of equal transmissivity in the unconfined aquifer.

87. <u>WP-147, Section 5.2.6.4.2</u>

Comment: It is stated that the cyclic evaluation technique will be used to provide additional information on transmissivity. It would be clearer to state that this technique will provide diffusivity values (from which transmissivity can be calculated). Some discussion of possible techniques for obtaining the needed storage numbers would be appropriate. Also, it may be necessary to install a well close to the river and equip it with a stage recorder (this would act in place of river stage in the cyclic evaluation technique and would improve the

evaluation by reducing the effects of partial penetration of the river and "skin" effects of the riverbed).

Recommendation: Restate, indicating "diffusivity" values are the result of applying the technique. Add discussion of method(s) planned for obtaining storage values. Consider adding well(s) for stage measurements for applying technique.

88. WP-147, Section 5.2.6.4.2.

Comment: It is stated that the cluster wells will be used to assess whether there is communication between the upper unconfined aquifer in the Hanford formation and the aquifers in the Ringold Formation and the Saddle Mountains Basalt. It should be stated that the "degree" of communication will be assessed (communication exists unless there is a zero permeability confining bed or a zero vertical gradient).

Recommendation: State that the degree of communication will be assessed.

89. WP-147, Section 5.2.6.4.3

Comment: Laboratory studies to correctly determine equilibrium adsorption constants (K_d), which are required by the transport models, are difficult and require a significant investment of resources.

Obviously contaminants which exist as negatively charged ionic species in near-neutral oxidizing environments like nitrate, chromate, and pertechnetate ions show essentially no adsorption by most geologic materials. These could be given a K_d of 0. Other contaminants such as uranium, plutonium, americium, cobalt, and strontium may exist as negatively charged or neutral complexes with naturally occurring and/or contaminant-related ligands such as carbonates, phosphates, acetate, EDTA, and HEDTA. These could also have very low K_d values depending on the geochemical environment.

Recommendation: Rather than initially conducting laboratory studies, the following actions are suggested:

1) Review the existing literature available on adsorption studies for Hanford soils from the BWIP, PNL and defense waste environmental studies to determine applicability to the 100-HR-3 soils, geochemical environment, and model requirements for equilibrium.

2) For those contaminants which have applicable literature values, run sensitivity tests using the selected transport model(s) and site hydraulic parameters to determine the range of sensitivity to the retardation factors (from the equilibrium adsorption constant K_d) selected from the literature survey.

3) If the literature values are appropriate or marginal but insensitive, further studies may not be required. If the values

are marginal and sensitive further studies would be required. If the values are appropriate and sensitive, then further studies may be required.

WP-151, Section 5.2.8

Deficiency: The phased approach to biological sampling (lower trophic levels first, and higher trophic levels only if contaminant elevation is evident at lower trophic levels) fails to recognize the biomagnification potential of many contaminants. Elevation could be detectable at higher trophic levels, but not at lower trophic levels. Moreover, at least some samples at all trophic levels will be needed for pathways model calibration purposes. These samples should encompass all pathways to receptors of concern. For example, in addition to man, raptors, fish and waterfowl are valued resources, and may be considered as receptors.

Recommendation: Specify sampling higher trophic levels to assess biomagnification.

WP-162, Section 5.2.11.1

Comment: The selection of contaminants for risk assessment in this section is based on unspecified toxicological properties. However, earlier in the work plan (WP-93), it is based on preliminary risk assessment. The process seems unclear.

Recommendation: Clarify how toxicological properties for selection of contaminants will be assessed. Clarify the criteria to be used in defining the contaminants to be used in the risk assessment.

90. WP-162 to 165, Section 5.2.11.1

Comment: The goal for acceptable lifetime cancer risk is stated to be from 10^{-7} to 10^{-4}, a very wide range. The reasons for this range should be explained, as these criteria influence selection of contaminants of concern and the alternatives selection process.

The various receptor populations for risk analysis (WP-164) should be reasonably well defined prior to data collection so as to ensure that all relevant exposure pathways are adequately calibrated.

Risks for alternate corrective actions may be beyond the scope of the baseline risk assessment (WP-166). However, they should not be beyond the scope of the RFI/CMS. Both conceptual models and field data collections for calibration purposes should be broad enough to permit later screening of alternatives based on risk.

Recommendation: Provide clarification on the goal for acceptable lifetime cancer risk.

Useing conserative assumptions, define the various receptor populations for risk analyses.

Add text that defines how risks will be considered both for current exposure and for possible exposure during remediation efforts.

Sampling and Analysis Plan/Field Sampling Plan

91. **General Comment:** The Field Sampling Plan (FSP) should be written so that a field sampling team unfamiliar with the site could gather the samples and field information required. Reference to Westinghouse Hanford Company Environmental Investigations Instructions (EIIs) that are and will be written to reference specific procedures do not give the information needed to conduct the FSP.

    Recommendation: Discuss field procedure in the SAP/FSP.

92. SAP/FSP-2, Section 2.1.1.1, 3rd paragraph, 5th sentence

    Comment: What does "...and only chosen among all locations..." mean?

93. SAP/FSP-2, Section 2.1.1.1, 3rd paragraph, 6th sentence.

    Comment: Is there any statistical evidence to support the choice of 5% for alpha and beta measurements at transect locations?

94. SAP/FSP-8, Section 2.3.1.3 and Figure 2

    Comment: Surface water, riverbank springs, and near-shore sediment samples should be sampled from an offshore to onshore, downcurrent to upcurrent direction to minimize potential sampling interferences due to sediment re-suspension and airborne particulates.

95. SAP/FSP-12, Table 2.

    Comment: The citation American Chemical Society is not complete.

    Recommendation: Cite the complete reference here or include it in the references in the back.

96. SAP/FSP-17, Section 2.3.1.3.

    Comment: The timing of spring sampling is not clearly stated. When will the samples be collected after river levels are lowered by operation of the Priest Rapids Dam? If samples are collected too soon after the river stages fall, the samples will be strongly affected by bank storage of river water. Also, will samples be a single "grab", or

will field parameters such as specific conductance, temperature, etc. be measured to determine trends prior to sampling?

Recommendation: After river stage is dropped (by control at Priest Rapids Dam), springflows should be monitored (field parameters) to see if any trends exist before final samples are collected.

97. SAP/FSP-17, Section 2.3.1.6, 3rd paragraph, 2nd sentence

Comment: This section states that samples will be transported in accordance with Chapter 5.0 of the QAPP. Chapter 5.0 of the QAPP discusses chain of custody procedures and sample flow process. Chapter 5.0 does not outline sample transportation requirements.

Recommendation: Discuss transportation requirements in the appropriate section.

98. SAP/FSP-18, Section 2.4.1.1, 2nd sentence.

Deficiency: Please state how organic compounds will be determined in vadose zone soils.

99. SAP/FSP 18, Section 2.4.1.3, 1st paragraph, 3rd sentence.

Deficiency: Please state how the need for "more detailed chemical characterization" will be determined. What are the criteria for collection of additional soil samples at the "site geohydrologists discretion?"

100. SAP/FSP-18, Section 2.4.1.3, 2nd paragraph, 3rd sentence

Comment: If 25-foot samples are intended to detect releases below waste disposal sites, why would this interval be sampled from all locations that are not situated near such sites?

Recommendation: This sentence should be rephrased to discuss an evaluation of contamination below the general level of waste disposal sites in each Operable Unit Area. For example, the sentence should read "below the level of waste disposal sites in the Operable Unit Area."

101. SAP/FSP 18, Section 2.4.1.3, 2nd paragraph, 4th sentence.

Comment: Given the natural variability of geologic materials (Section 2.4.1.4, 3rd sentence) and presumably the depth to static groundwater, how will the static water level (during drilling) be determined prior to the collection of the lowest vadose zone sample (collected from 5 feet above the water table.)

Recommendation: Please state reasoning.

102. SAP/FSP-22, Section 2.4.1.5, 1st paragraph, 1st sentence.

Comment: Only organic and radioactive screening is discussed in this section. On table 27 of the workplan, X-ray fluorescence and atomic absorption are discussed as viable options since chromium is a contaminant of concern.

Recommendation: Incorporate X-ray fluorescence or atomic absorption as a screen option.

103. SAP/FSP-24, Section 2.5.1.2.1.

Comment: The cluster well designations are stated as "P, Q, R, S, and T, respectively)." This is, primarily, the nomenclature for piezometers or nested wells within a single borehole. Cluster wells are normally designated as A,B,C etc.

Recommendation: Determine the correct designation and so state.

104. SAP/FSP-24, Section 2.5.1.2.2.

Comment: The wells designated for aquifer testing are scheduled to have a single piezometer. Two piezometers (at varying distances) would greatly enhance the test results.

Recommendation: Consider the cost/benefit of installing a second piezometer at each of the aquifer test wells.

105. SAP/FSP-24, Section 2.5.1.2.2

Comment: Cluster wells should also be located across the river from, or on one of the islands adjacent to the 100-H Area to evaluate chemical groundwater conditions with respect to on-site contaminants, potential confining layer discontinuities and possible recharge/discharge relationships in the upper unconfined and upper confined aquifers as a result of river stage changes. In addition, such information would support risk assessment and corrective measures actions. See comment on 5.2.6.2.1.3 regarding this issue.

106. SAP/FSP-24, Section 2.5.1.2.2; 1st, 2nd and 3rd paragraphs

Comment: It is stated that gravel pack will be used around the well screen in each phase. Gravel pack would be inappropriate for units completed in the Ringold, which is predominantly composed of silty sand, and perhaps the Hanford Formation which also consists of gravely silty sand.

Annular packing materials should ideally consist of particle size perhaps one order of magnitude larger than the finest formational

fractions and appropriate well screen size. A sand pack of #8 Monterey would function to transmit formation water and minimize potential screen clogging effects and the transfer fine sand and silt.

Recommendation: Please state reasoning for using gravel in light of the above comment and comply with the suggested change.

107. SAP/FSP-27, Figure 10.

Comment: It should be determined, in advance, that before specifying the well construction requirements that those doing the drilling have the capabilities and are using equipment with the capacity to do that which is described. It could be that drilling may need to be subcontracted to other companies than those presently onsite.

108. SAP/FSP-28, Section 2.5.1.4, 1st paragraph, last sentence.

Comment: Since water displacement using compressed air for slug tests is an uncommon method, a discussion and reference would be appropriate.

Recommendation: Include a discussion of compressed air slug tests.

109. SAP/FSP-28, Section 2.5.1.6.

Comment: As mentioned previously, quarterly sampling of wells immediately adjacent to the Columbia River may not be adequate because of bank storage effects. This can be determined by monitoring temperature and specific conductance to determine the end of bank storage effects.

110. SAP/FSP-31, Section 2.6.1.2, 1st paragraph, last sentence.

Comment: No criteria is referenced to determine if the present air-monitoring network is satisfactory or unsatisfactory.

Recommendation: State criteria.

Sampling and Analysis Plan/Quality Assurance Project Plan

111. **Comment:** Field Duplicate Sample. A field triplicate rather than a field duplicate gives a much better (more powerful) estimation of the combined sampling and analytical error. This is one area that you can gain considerable "bang for the buck" by adding an additional QA sample.

Recommendation: Consider adding a field triplicate protocol rather than a field duplicate protocol to the QAPP. These should also preferably be blind samples.

112. SAP/QAPP 3.0, SAP/QAPP-6.7

Comment: Table 1 should include low-level analytical methods to determine background concentrations. According to EPA (1986), method 7196 is to be used for Cr (VI) concentrations in the range of 0.5 to 50 mg/L. The table lists it as 10 ug/L (0.01 mg/L). Figures 20 and 25 shows most wells in 100-HR-3 are below 0.5 mg/L, therefore this method would not be recommended according to EPA (1986). Method 7197 is recommended for levels of Cr (VI) between 1 and 25 ug/L and should be used for determining low-level background levels.

Method 353.2 for nitrate can routinely reach less than 50 p/b as nitrate. Ion-specific nitrate electrode could be used for field-screening nitrate samples.

Recommendations: List methods 7197 and 7195 in addition to 7196 for Cr (VI). List other available low-level analytical methods in Table 1 for use in background determination.

113. SAP/QAPP-8, Table 1.

Comment: ^{129}Sr should be ^{90}Sr.

114. SAP/QAPP-14, Section 4.2.2, 1st sentence.

Comment: EII 5.8 is available as of August 10, 1990 and is therefore not "in preparation".

115. SAP/QAPP-15, Section 4.2.2, 2nd paragraph

Deficiency: This section states that sampling requirements are defined in Part 1 of Field Sampling plan. Part 1, Section 2.3.1.6 references Section 4.2 of the QAPP. Neither of these sections describe the sampling requirements.

Recommendation: Section 4.2 of the QAPP should state the sample handling requirements.

116. SAP/QAPP-17, Section 5.2

Comment: This section states that "Samples with detectable levels of radioactivity using standard field survey equipment, will be routed to a Westinghouse Hanford or Hanford Site participant contractor laboratory equipped and qualified to analyze radioactive samples. Samples having no detectable radioactivity, obtained using standard field survey equipment, may be sent to onsite analytical laboratories. Samples showing detectable levels of radioactivity, measured with standard field equipment, will not be released to an offsite laboratory based on field measurements. These samples must be measured with laboratory radio-analytical equipment and released in accordance with Westinghouse

Hanford procedures. Alternate offsite subcontractor laboratories may be used for radioactive sample analysis at the Westinghouse Hanford technical lead's direction if onsite laboratory capabilities are inadequate."

Recommendation: It is not clear when samples will be sent to an offsite laboratory. Please clarify.

Health & Safety Plan

General Comment: Inadequate documentation of subsections under Sections 2,5,6, and 8 exists. The reader is consistently referred to either the "Hazardous Waste Operations Permit," "Radiation 'Work Permit'" or the respective WHC EII's. These documents or descriptions contained therein should either be included in the respective HSP subsections or in an appendix to this document. Review of the information is essential in determining costs associated with field labor and ODC's, schedule evaluation and evaluating appropriateness of personnel protection equipment, documentation procedures, physical hazards, and environmental monitoring equipment with respect to the tasks performed during work plan implementation. Proper evaluation of the 100-HR-3 HSP is contingent upon receipt of the documents.

117. HSP-8, Section 2.1.2, 5th bullet.

Comment: Should this bullet read "limitations in mobility, dexterity and visual impairment inherent in the use or level A, level B and level C personal protective equipment", or, the use of level A and level B?

118. HSP-19, Section 4.2.

Comment: What happened to Table 4 from the previous workplan version listing the potential radiation hazards? Does this mean that RPTs and radiation training is not necessary?

Recommendation: Find Table 4 and discuss radiation hazards.