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**Department of Energy**
Richland Operations Office
P.O. Box 550
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MAY 0 5 1994

94-ERB-114

Mr. Dave C. Nylander
Nuclear Waste Program
State of Washington
Department of Ecology
7601 W. Clearwater, Suite 102
Kennewick, Washington 99336

Mr. Douglas R. Sherwood
Hanford Project Manager
U.S. Environmental Protection Agency
712 Swift Boulevard, Suite 5
Richland, Washington 99352

MAY 1994 RECEIVED EPIC

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Dear Messrs. Nylander and Sherwood:

FINAL RESPONSES TO REGULATOR AND PUBLIC COMMENTS ON DOE/RL 92-28, COLUMBIA RIVER IMPACT EVALUATION PLAN, REVISION 0 AND TRANSMITTAL OF DOE/RL 92-28, COLUMBIA RIVER IMPACT EVALUATION PLAN, REVISION 1.

Enclosed please find 10 copies of the final responses to the regulator and public comments on DOE/RL 92-28, Columbia River Impact Evaluation Plan, Revision 0 (enlcosure 1). The comments are those compiled and forwarded by the U.S. Environmental Protection Agency (EPA) and included supplemental comments sent to the U.S. Department of Energy, Richland Operations Office (RL), from the Nez Perce Tribe. A majority of the attached comments concern Chapters 1 through 4 and are of less significance to the document. However, the comments may still be applicable for the Columbia River Comprehensive Impact Assessment (Milestone M-13-80).

On February 15, 1994, RL, EPA, and the State of Washington Department of Ecology agreed to issue Chapter 5 from the subject document as Revision 1. In accordance with that agreement, also provided as enclosure 2, are 10 copies of DOE/RL 92-28 Columbia River Impact Evaluation Plan, Revision 1.

If you have any questions regarding the comments, please contact Mr. B. L. Foley on (509) 376-7087.

Sincerely,

Patrick W. Willison
Acting Hanford Project Manager

END:BLF

Enclosures: As stated

cc w/encls:
B. A. Austin, WHC
S. N. Balone, EM-442
P. W. Eslinger, PNL
K. Parrett, MACTEC

cc w/o encls:
R. F. Stanley, Ecology
S. G. Weiss, WHC
T. M. Wintczak, WHC

HANFORD PROJECT OFFICE
MAY 1 0 1994
ENVIRONMENTAL PROTECTION AGENCY

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# REVISED (FINAL) RESPONSES TO REGULATOR AND PUBLIC COMMENTS ON THE COLUMBIA RIVER IMPACT EVALUATION PLAN (CRIEP)

## I. GENERAL RESPONSE

Comments numbered 1 through 7 were received from four individuals: residents of Portland, OR (1); Seattle, WA (2); and Vancouver, WA (1). The following agencies/interest groups have also provided comments (and their comment numbers are noted):

Agency for Toxic Substances and Disease Registry (110-119)
Columbia River United (128-136)
Confederated Tribes of the Umatilla Indian Reservation (202-265)
Heart of America Northwest (120-127)
National Park Service (200-201)
Nez Perce Tribe (266-427)
Oregon Department of Energy (137-193)
Sierra Club, Hazardous Materials Committee (194-199)
U.S. Fish and Wildlife Service (8-62)
Washington State Department of Health (63-80)
Washington State Department of Wildlife (81-92)
Yakima Indian Nation (93-109)

Recent (January 25, 1994) changes to the Tri-Party Agreement include a milestone to study the effects to the Columbia River from past Hanford operations on a larger scale than just the 100 areas, which was the geographic limitation of milestone M-30-02. This new milestone, M-13-80A, is to make a comprehensive Columbia River impact assessment. Milestone M-13-80A, in effect, makes milestone M-30-02 obsolete. Through February 15, 1994, discussions among the DOE, EPA, and Ecology, it was agreed to publish just chapter five of the Columbia River Impact Evaluation Plan (DOE/RL-92-28), and refer the initial data analysis Chapters 1 through 4, and public comments and responses, to the full river study for greater public input. While most of the tasks identified in this plan have been initiated or completed, those that have not yet been started (Tasks 1A-3, 1B-1, 1B-2, 2-2, and 3-1b) will also be referred to the full river study so they can be integrated with public input, data needs for other areas, and results from other areas.

The final public comment and response package for Milestone M-30-02, with some wording changes suggested by EPA, are being transmitted to the organizations developing Milestone M-13-80A for inclusion, and to the individuals and organizations who commented so they may monitor the progress and integration of their concerns.

A number of public comments were essentially notes about the content of the document. These comments did not invite a response nor suggest any change to the document. Responses were not prepared for these comments, and the comments that were omitted from the package were done in consultation with the EPA.

The major theme that is common to most of the public comments is that the CRIEP offers premature conclusions and that the relationship between the preliminary evaluation and the recommended investigation tasks is confusing. The preliminary evaluation was never offered as a baseline risk assessment. On the contrary, it was conducted to identify data needs for such an assessment and to develop hypotheses that can be tested by such an assessment. The National Research Council and other scientific bodies have long endorsed an experimental approach such as this to impact assessment. In addition, EPA CERCLA guidance requires that existing

information be evaluated and a conceptual model be developed to facilitate investigation planning.

In summary, the results of this impact evaluation are 1) preliminary, 2) include only the contaminants with the most apparent potential for effects, 3) include limited data on river sediment, and 4) include only several of the exposure pathways. The results of this assessment are intended only to indicate additional data needs to support a full river study and risk assessment. This plan covers only the section of the Hanford Reach through the 100 areas; the entire reach and areas downstream will be addressed in a more complete risk assessment and river study just now beginning. All public comments to the CRIEP that address this larger scope have been provided to the organizations conducting the study.

The complete river study will use a more complete data set from historical reports, research from other agencies (e.g., Washington Department of Health), studies resulting from this plan, and on-going characterization studies. In addition, input will be included from the EPA, Ecology, and the public in establishing measurement endpoints (e.g., species to measure to determine possible effects) and exposure pathways. When all pathways and endpoints are agreed on, additional data needs may become apparent. At that time, work to fill those data gaps may begin.

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## II. EPA and ECOLOGY COMMENTS

Comment 1. As we have stated in comments on the previous draft of this document, we do not endorse the first four chapters of this document. We request that the document be revised in reference to the concerns expressed by the public. We also request that the document be split into two parts. Part A will be the Tri-Party primary document containing the "Columbia River Impact Evaluation Plan" as called for by milestone M-30-02. This would essentially be a revised chapter 5 of the current document. Part B would be a DOE-only document containing the modeling, risk assessment, and any determinations of impact conclusions that comprise the first four chapters of the current document. Even though we would not share ownership with the part B document, we strongly recommend that DOE incorporate public comments, as appropriate, into a revision of that document.

Response: Reject. The need for specific activities identified in Chapter 5 must originate from an identified data need. The review of available data and the preliminary impact evaluation contained in the first four chapters provide the needed rationalization to conduct the activities in the plan. There is no need to split the document into two separate pieces.

Comment 2. Many of the public comments call for an expansion of the technical scope and approach of the river assessment. We fully support this identified need, and is the basis for the comprehensive Columbia River assessment now in its formative stages. We recommend that DOE identify those comments that pertain to the current scope and approach of the CRIEP as opposed to those that call for an expanded scope. Specific responses should be provided, when appropriate, to those that pertain to the current scope and approach of the CRIEP. Those that call for an expanded scope should be flagged for scoping into the comprehensive river assessment.

Response: Accepted. Those comments that do not pertain to the current scope of the CRIEP are denoted by †. Such comments and any responses to them will be provided to those planning further investigation and assessment of the Hanford Reach.

## III. PUBLIC COMMENTS - NUMBERED

Comment 1†. The preliminary evaluation is faulty in groundwater discharge into the Columbia River. I am concerned with the unknown chemicals and tailings that have not been of concern or recorded through the years and needs more review by independent consultants -- scientific.

The agencies involved at Hanford need to involve the citizens of the state with summaries quarterly by newspaper (locals) because most of the documentation and time involved will lose most ordinary citizen response.

Response: Acknowledged. The preliminary evaluation used in the CRIEP is a simplified approach to evaluate information that is currently available for the 100 Area. Operable units are currently being investigated and complete lists of potential contaminants in both the soil and groundwater are being compiled. Future impact evaluations and risk assessments of the river will have this information available and will be able to do further evaluation.

With respect to notifying the public, the Department of Energy and the Department of Ecology publish periodicals (e.g., Hanford Update) that provide updates on cleanup activities at the Hanford Site. These periodicals should be available at your local library, or by calling 1-800-321-2008.

Comment 2†. This initial evaluation focused upon previous studies and data collections. It continued to suggest what future plans might be considered in collecting information around and in the Columbia River.

I was impressed, along with the writers, at not being able to find any significant amounts of uranium around the study area. I question also the inability to find any plutonium. It seems to me if the primary purpose of the facility for over forty years was to produce weapon-grade plutonium, there should be significant amounts of plutonium waste as well.

It seems to me also if we are studying the effects on the human population an in depth study of the Native American tribes in the area is most important. For it is and has been the Native Americans that have most used the river for their uses, especially in catching and eating fish. And, if I remember correctly, very little time and effort is being focused upon Native Americans in the current study being conducted by the Department of Social and Health Services. But it is good that finally you are considering and writing about the human factor in these events of waste and cleanup at Hanford.

Response: Acknowledged. Comments will be considered in planning further investigations and assessments of the Hanford Reach.

Comment 3. In dealing with dangerous environmental contaminants, assessment of long-term effects is essential. However, the CRIEP barely begins to address this issue (pages 90 and 91). Levels of radioactive waste and other contaminants are discussed in CRIEP but it is critical to investigate actual toxicological effects (Gilbertson 1990).

Response: Acknowledged. The CRIEP identifies the compilation of ecotoxicological data as a specific activity. This activity will identify acute (short-term) and chronic (long-term) effects due to contaminant exposure. These effects will be used in conjunction with contaminant concentrations in the future comprehensive river assessment to identify the likelihood of acute or chronic environmental effects.

Comment 4.† Bald Eagles and Ospreys are two proven indicators of water quality (Gilbertson 1990). Eagles are mentioned as possible subjects for investigation by the CRIEP. If Osprey are also residents of Hanford Reach they should be monitored as well.

Response: Acknowledged. Ospreys migrate through the site, and eagles are common winter residents. The comment will be considered in planning further investigations and assessments of the Hanford Reach.

Comment 5.† Anthony et al. (1993) used non-lethal techniques (i.e. sampling blood, eggs, and carcasses) to determine that contaminants in the Columbia River Delta are affecting Bald Eagle productivity. Determining prey species and prey species levels of contamination of Hanford Reach Bald Eagles (and Ospreys if present) is also important because contaminants in prey species accumulate in predators. Knight et al. (1990) found that much of the contamination of inland Bald Eagles was due to ingestion of Glaucous-winged Gulls, which are also high up on the food chain.

Response: Acknowledged. The selection of indicator species for an environmental risk assessment will likely include bald eagles and contaminant transport through the food chain will be an important component of that process.

Comment 6.† Despite the fact that radiation levels are low in groundwater plumes entering the river from the 100 Area storage, these contaminants are undoubtedly being bioaccumulated. Further, low (not immediately lethal) levels of radiation over long periods have been shown to be harmful (Kneale et al, 1983). Specifically, low levels of tritium (which is now leaking into the Hanford Reach according to the CRIEP) have been found to cause an irreversible loss of germ cells in mammals (Dobson 1979). The productivity of Hanford Reach Eagles (and Ospreys) should therefore be compared with uncontaminated areas.

Response: Acknowledged. The preliminary evaluation contained in the CRIEP does contain a human fish-ingestion pathway that is influenced by bioaccumulation. Other pathways, to both human and ecological receptors, in which bioaccumulation must be addressed will be considered in future assessments.

Comment 7. I am appalled at the ponderous pace of the CRIEP in addressing the long-term effects of Hanford waste. I encourage you to contact researchers who

have done this sort of work (i.e. Knight et al and Anthony et al.) instead of attempting to "reinvent the wheel".

Response: Acknowledged. The CRIEP was not intended to evaluate long-term effects, rather the intent is to identify data needs for determining cumulative impacts to the Columbia River. We are uncertain as to the meaning of "reinventing the wheel". There is abundant experience on site for conducting the type of investigations necessary for evaluating impacts to the Columbia River.

U. S. Fish and Wildlife Service

Comment 8.† The USFWS is not familiar with the referenced source literature included in Sections 2.2.2 Surface Water Contamination, 2.2.3 River Sediment Contamination and 2.2.4 Ecological Contamination and, therefore, can not agree with the conclusion referenced to Robeck et al. 1954, (that the levels of radioactivity found in the river during the study "had no apparent immediate effect on aquatic populations"). Consequently the decision made in Section 3.0 Contaminant Fate and Transport under 3.1.3 River Sediment Pathways, that impacts due to river sediments will not be evaluated in the report appears to minimize a major source of contamination in this reach of the river. The USFWS is aware of Hyallela bioassays conducted by Ecology in 1992 to test toxicity of sediment from the Columbia River near the McNary National Wildlife Refuge. Mortality in these tests ranged from 60 to 71 percent. Standard chemical analyses of the sediments for metals, volatiles, dioxins, furans, organochlorines, phenolics, resins, and fatty acids, resulted in either non-detect levels or levels usually not associated with toxicity. Based upon these tests we recommend that Hyallela and Microtox bioassays be included in the data collection activities in Section 5.2 for this reach of the river.

Response: Accepted in part.

All literature cited in the CRIEP is available to the public.

The text of the CRIEP will be clarified to indicate that impacts due to river sediments are not assessed in the preliminary impact evaluation contained within Chapter 4. The preliminary evaluation was conducted to develop an hypothesis that will be tested in future assessments conducted with the data collected under the plan as presented in Chapter 5.

The report referenced by the commentor is Johnson, A., and M. Heffner, 1993, Class II Inspection of the Boise Cascade Pulp & Paper Mill, Wallula, Washington - April 1992, Washington Department of Ecology, Olympia. Not enough of the details of the Ecology-conducted bulk sediment toxicity study results for the McNary National Wildlife Refuge are included in Johnson and Heffner (1993) to adequately evaluate the methodology or results, such as the appropriateness of Hyallela azteca for the sandy media tested. H. azteca may also not be a suitable organism for bioassays on the toxicity of radionuclides (many invertebrates and other lower-trophic level organisms are fairly resistant to the effects of radioactivity).

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Recent (1992) river sediment sampling does not indicate significant radionuclide contamination. An evaluation of the results of Activity 3-1 in Chapter 5 of the CRIEP (conduct more complete river sediment sampling throughout the 100 areas) will help determine if the levels of radionuclide contaminants are high enough to warrant bioassays.

Comment 9.† The list of contaminants of concern provided in the report was found to be deficient and vague. Specifically, information on analysis of non-radionuclide chemicals was unclear, with references limited to such terms as "chemical constituents" in groundwater (page 12), "comprehensive list of potential contaminants" in surface water (page 32), and "chemical parameters" in springs (page 33). At a minimum, complete lists of these chemicals, including detection limits, should be provided in the appendices. Appendices containing means and ranges of concentrations in the different sample types would be preferable. In addition, as no information was provided on the depths at which wells were screened, it is not possible to evaluate the completeness nor adequacy of the groundwater testing.

Response: Accept in part. The list of contaminants in the CRIEP was not intended to be a comprehensive list of contaminants of potential concern, because the CRIEP is not a risk assessment. This is specifically acknowledged in the report. Rather, a specific list of chemicals, known to be present in groundwater, were used to aid the development of a conceptual model of contaminant transport for the river. This limited set of contaminants was used to evaluate specific pathways of the model (which were chosen using best professional judgement) and identify data needs for those pathways. All materials used to develop the conceptual model are publicly-available. The inclusion of a groundwater database in the CRIEP is beyond its scope.

Comment 10. The USFWS is concerned with the conclusion presented on page 24, second bullet, that most contaminants of concern in surface water are not significantly different between upstream and downstream collection points. This conclusion was based upon an inappropriate statistical test. Without having access to raw data, we suggest the possibility that differences in contaminant concentrations between upstream and downstream sites for any one monthly sampling period were masked by the variability between sampling periods, when statistical comparisons were based on yearly means. We strongly recommend that these data be analyzed using a paired comparisons t-test, using upstream and downstream concentrations for any one sampling period as pairs. Also, the following statement, "Thus, except for tritium, these data do not show any significant adverse impact on overall river-water quality that can be attributed to Hanford Site operations at this time", is overstated and inappropriate, as the downstream sampling site is 30 miles downstream of the contaminant sources.

Response: Accepted. The text will be modified to note the technical limitations of the river water monitoring scheme and the statistical methods used. It will be changed to "This conclusion is only preliminary, given the limitations of the river water monitoring scheme and the statistical method used to evaluate the data". For the limited purposes of the CRIEP, the one-sided T-test was appropriate. The appropriateness of a paired t-test can be considered under the comprehensive river study.

Comment 11. In several places, the report states that significant adverse impacts have not occurred to the Hanford Reach ecosystem (page 38, last sentence; page 41, paragraph 6, 3rd sentence; page 81, paragraphs 5 and 6; and others). However, the review of ecological studies did not include review of any impact studies. The USFWS interpret impacts to refer to measures of biological effects such as toxicity in bioassays, chromosome aberrations, changes in fish populations or age class structure, elevated incidence of lesions, disruption of enzyme systems, and other measures. Measuring concentrations of contaminants in tissues alone does not allow for the interpretation of impacts unless laboratory exposure studies are available to assist in interpretation. The report did not indicate that these types of comparisons had been made. Unless the above mentioned types of studies have been conducted, statements to the effect that impacts have not occurred are incorrect.

Response: Accepted in part. The definition of impacts is not limited to the interpretation by the Fish and Wildlife Service. The text on pages 38, 41, and 81 will be modified to "However, other interpretations of ecological impacts (e.g. measurements of specific endpoint effects) may need to be considered in future baseline risk assessments". However, for evaluating the contaminant transport, concentrations in tissue may indeed be the most appropriate measure.

Comment 12. With the exception of NO3, the contaminants of concern will tend to partition to sediment, yet discussions of contaminant fate and transport and risk assessments, at most, only touched on the subject of sediment as a component of contaminant ecology. This subject should be given stronger emphasis throughout the document. It is likely that aquatic biota are receiving greater contaminant exposure from sediment than surface water for the following reasons: 1) contaminants are partitioning into sediment, 2) contaminant concentrations in sediment are much higher than in surface water, and 3) because the high water flow rates do not allow development of a major plankton food base, the Hanford Reach food chain is based upon substrate-associated productivity.

Response: Acknowledged. Sediments are not quantitatively evaluated in Chapter 4 due to insufficient information. For reasons similar to those noted in the comment, the data collection plan in Chapter 5 emphasizes sediment sampling and analysis.

Comment 13.† In Section 3.3.3 Biological Transport, the report focuses on the transport of groundwater contaminants of concern, namely hexavalent chromium, nitrate, tritium, strontium-90, technetium-99, and total uranium to the river water column where fish can ingest the contaminants. The bioconcentration factor developed is assumed to be directly proportional to the concentration of the contaminant in the water column. The assumption that the bioconcentration factor is directly proportional to contaminant concentrations in the water column does not take into account the effect of food chain interactions from sediments or the water column through benthic organisms, plankton, aquatic plants, aquatic invertebrates, and forage fish up to predatory fish species. The USFWS recommends that the bioconcentration factor be reevaluated based upon the Columbia River food chain. Any subsequent impact evaluations in the report are flawed either for Human Health Evaluation, Section 4.1 or Environmental Evaluation, Section 4.2.

Response: Acknowledged. A risk assessment of the river will evaluate contaminant transport in more detail than is possible in this plan.

Comment 14. The USFWS strongly disagrees with the assertion on pages 41 and 79 that sediment contaminant assessment methodologies do not exist, and find it interesting that a reference to Adams et al. (1992) is used to support this point. Adams et al. (1992) reviewed the available assessment methodologies and discussed the extent to which the methods have been validated. The USFWS endorses the proposed investigations designed to examine sediment issues in more detail.

Response: Accepted in part. The sentence in question on p. 41 accurately states that "a consensus impact assessment methodology does not exist at this time (Adams et al. 1992)." The word "consensus" will be inserted into the sentence in question on p. 79 to denote the lack of one standard method that has been agreed to by all parties. Until agreement has been reached on which method to use, the use of any one method by any one of the Tri-Party Agreement signatories will almost certainly be open to dispute.

Comment 15. The USFWS contends that the conclusions draw from Section 4.2 Environmental Evaluation, are not valid and recommends that they should be removed from the document. The environmental evaluation was based only on exposure of biota to surface water contaminants. Among the potential exposure pathways, which include surface water, sediment, interstitial water, and food chain, the surface water pathway probably has the lowest and most dilute contaminant concentrations and the least impact to Hanford Reach aquatic biota.

Response: Accepted. Any conclusions in the document will be identified as preliminary and limited given the limited scope of the document.

Comment 16.† The additional activities outlined on page 84 will provide much needed information for future impact assessment. The following recommendations are provided for additional activities to further define biological impacts and include sediment toxicity methodologies. The recommendations are provided without knowing whether these types of studies have been conducted previously at Hanford.

Activity 1A-3. Suspended sediment is an important contaminant transport mechanism. It is not clear from descriptions of previous surface water studies whether contaminants were dissolved or partitioned to suspended sediment, or whether any distinction was made. If partitioning of contaminants to suspended sediment has not been previously addressed, it should be included in this activity. Bioassays to determine impacts of ambient sediment conditions should be conducted on whole sediment and interstitial water in conjunction with chemical analysis. Bioassays should include a variety of organisms and both lethal and sublethal endpoints. Chemical concentrations should be compared to appropriate criteria. The USFWS strongly recommends that additional sampling be conducted on salmon spawning areas. Development of a specific bioassay to assess effects to eggs and fry may be appropriate.

Activity 4-1. Information on uptake and elimination rates will be very useful in determining potential impacts to nonresident species such as those which migrate through the Hanford Reach or are only present during overwintering or nesting periods.

Activity 4-2. The USFWS recommends the objectives be expanded to include determination of potential impacts to benthic invertebrate communities by comparing community characteristics such as abundance, diversity, and species composition with upstream reference sites. The bioassays and invertebrate community structure studies will assist in defining biological impacts associated with contaminant exposure. Because carcinogenicity is a concern with these contaminants, an additional biological impact study based on histopathological examination of fish is recommended to determine potential chronic impacts to fish health. For all studies, care needs to be taken in identifying reference sites.

Activity 4-3. The USFWS recommends that the short-faced lanx (Fisherola nuttalli) and Columbia pebble snail (Fluminicola columbianus) be included in this activity.

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Response: Acknowledged.

Activity 1A-3. River monitoring samples are not filtered. If the findings of the investigation so warrant, we agree that partitioning may be needed in future investigations. Existing data, however, suggest that contamination is difficult to detect in whole water samples. With respect to incorporation of bioassays, we agree that this may be appropriate for future investigations. Given the obvious favorable environment provided for salmon spawning, it is difficult to justify the need for extensive bulk sediment toxicity testing at this time. The primary rationale for these positions is that existing data are of low spatial resolution (e.g., river monitoring data available for upstream and downstream of a 94-km Reach). The preliminary evaluation seems to indicate that there are few significant adverse impacts on this scale; however, localized impacts cannot be precluded (see Section 5.1 and Task 1A-3). The planned investigation activities are meant to find such localized impacts by focusing in the most likely areas of the Reach. If such areas are found, future actions, including efforts such as those recommended in this comment, can be even more focused and thus more effective.

Activity 4-1. Uptake and elimination rate data fall into the category of exposure assessment. Baseline risk assessments generally rely on data published in the literature for these types of parameters. The specific type of data needed will be dependent upon assessment and measurement endpoints identified for the ecological portion of the baseline risk assessment.

Activity 4-2. Benthic community studies are generally not very informative unless either the monitoring design includes a very large number of samples or there is an obvious impact. As the preliminary evaluation indicates the absence of an obvious impact at the low level of spatial resolution for which data are currently available, we believe it is appropriate to defer a decision until results of the sediment sampling project have been evaluated. At

that time, if localized significant adversely impacted areas are identified, a benthic community study can be proposed.

Activity 4-3. The HSBRAM allows for consideration of non-listed species under the guise of sensitive habitat. Our opinion is that the entire Reach is regarded as sensitive habitat.

Comment 17. Page 5, paragraph 4, 1st sentence. The term "shrub-steppe grassland community" should be changed to "shrub-steppe community."

Response: Text will be revised to "shrub-steppe community".

Comment 18. Page 8, paragraph 2, 2nd sentence. The character of Hanford Reach is unaltered in that it is still free-flowing, however, it has been altered greatly by control of flows by the Priest Rapids Dam and other dams upstream. For example, riparian vegetation is much more extensive relative to pre-dam conditions. You may wish to mention in this paragraph that although adjacent shrub-steppe habitats are not considered, diversity is enhanced by proximity to the river.

Response: The sentence in question accurately refers to "largely unaltered ... habitats," and the topic of shrub-steppe habitat diversity is outside of the scope of the CRIEP.

Comment 19. Page 8, Section 2.1.4.1. This section or Section 2.1.4.2 needs to include information on the extensive use of the river by waterfowl for migration stopover and overwintering and by a variety of piscivorous birds. The islands are used for nesting of waterfowl and several species of colonial nesters. Consider adding information on zooplankton to complete this section.

Response: Text will be added to section 2.1.4.2 to include nesting as a habitat usage for the riparian zone. The additional sentences will be added to the text of section 2.1.4.2, pg. 10, para. 4, sentences 4 and 5, as follows: "Waterfowl nest along the shoreline and on islands in the Hanford Reach. Species include resident and migratory Great Basin Canada Geese (Branta canadersis) and mallard ducks (Anas platyrhynchos) (Weiss and Mitchell, 1992)." A new paragraph under Section 2.1.4.1 will read: "The zooplankton populations are generally sparse, with densities ranging from 4500 organisms/$m^3$ in summer to less than 50 organisms/$m^3$ in winter. Dominant genera are Bosmina, Diaptomus, and Cyclops (Neitzel et al 1982b)."

Comment 20. Page 8, paragraph 5, 3rd sentence. Recommend changing the term "immature aquatic insects" to "invertebrates" as non-insect invertebrates such as snails and crayfish may be important components of the aquatic system.

Response: Accepted. "[I]mmature aquatic insects" will be changed to "[benthic] invertebrates."

Comment 21. Page 9, paragraph 3, last sentence. Change panfish to "sunfish", as it is a more biologically correct term.

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Response: Accepted. Panfish will be changed to sunfish.

Comment 22. Page 9, paragraph 4, 3rd sentence. This sentence is misleading, since the extensive tracts are irrigated by water from the Grand Coulee Dam rather than the Hanford Reach.

Response: Accepted. "[E]xtensive" will be deleted.

Comment 23. Page 10, paragraph 5, 3rd sentence. The pelican is properly referred to as the American white pelican. This paragraph is misleading as several other State and Federal threatened and endangered listed species not mentioned here, also occur. Inclusion of a full list of State and Federal threatened and endangered species in an appendix is recommended.

Response: Accept in part. The pelican will be changed to American white pelican, and a reference to a list of endangered and threatened species will be provided.

Comment 24. Page 12, paragraph 2. In addition to skyshine, other sources of environmental contamination should be listed, including deposition of contaminated dust, former atmospheric releases from Hanford, and erosion of bank soils likely to be contaminated by association with contaminated groundwater.

Response: Accepted. The other pathways mentioned in the comment will be given as examples of pathways regarded as minor for the purposes of the preliminary evaluation. The following additional text will be incorporated in the text of pg. 12, para 1, after sentence 3, as follows: "Additional exposure pathways include past atmospheric releases from Hanford site operations, fugitive dust deposition, and erosion of Columbia River banks. However, for purposes of this preliminary investigation, these are considered minor in comparison with the groundwater pathway. The identification of these and other pathways are recommended in Section 5.2.2, Proposed Collection Activities.

Comment 25. Page 12, paragraph 3, last two sentences. The terms "eventually" and "have the potential" are misleading since the contaminants have clearly reached the river.

Response: Accept in part. The text will be edited to indicate that contaminants other than those specifically considered in this evaluation may also be present in the river. An additional sentence will be added to the end of pg. 12, para 2, as follows: "Additionally, contaminants other than those considered in this preliminary evaluation are also present in the river".

Comment 26. Page 12, paragraph 4, 1st sentence. The term "ambient water quality criteria" should be changed to "freshwater chronic criteria" since this is what is used in the rest of the document.

Response: Freshwater chronic criteria are a subset of ambient water quality criteria; the broader reference is appropriate in para. 3.

Comment 27. Page 12, paragraph 6, 1st sentence. Table 2-1 as described here, was not included in the document.

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Response: Accept. The table will be revised to include the information specified in the text.

Comment 28. Page 24, 3rd paragraph. Include the location of the U.S. Geological Survey monitoring station.

Response: Accepted. The locations of the USGS monitoring stations will be added. Sentence will be added to the text of pg. 24, para 2, after sentence 4, as follows: "The USGS surface water gaging stations for the Hanford Reach include the station below Priest Raps Dam at the Vernita Bridge and at Richland (Miles et al., 1992).

Comment 29. Page 34, Table 2-7. This information would be more valuable and easier to evaluate if data on sample size, sediment grain size, and total organic carbon were included.

Response: Acknowledged. The authors agree that the information requested would be beneficial for data interpretation. The original source, however, did not include this information. Our recommendation for future sediment monitoring (Activity 3-1, page 91) included measurement of total organic carbon and sediment particle size. (While sediment size was measured, TOC was not included when activity 3-1 was conducted because determination of the availability of contaminants would be efficient only if sufficient contaminants were found. However, as a generalization, TOCs are associated with the clay fraction of river sediment, and are usually a small percentage of the clay. The grain size analyses completed in 1992 showed only small amounts of silt and clay in the sediments. Thus, a likely conclusion is that TOCs are a very small part of the sediment.)

Comment 30. Page 35, paragraph 2, last sentence. Reference site information may be available from other state or federal studies conducted upstream of Hanford. There are abundant available data in the current scientific literature, toxic chemical databases and from the Environmental Protection Agency and state environmental quality divisions and departments to evaluate if the metals measured are elevated above background. At a minimum, metal concentrations can be compared to those of western soils compiled by USGS (Shacklette and Boerngen, 1984).

Response: The investigation referenced in para. 1 also did not conduct any comparisons to any available state or national data. The comprehensive river assessment will be better situated to evaluate upriver and downriver sediment studies with Hanford Reach concentrations.

Comment 31. Page 35, paragraph 4, 4th sentence. "...low concentrations of radionuclides". This is low relative to what reference?

Response: Acknowledged. The characterization was made in the referenced paper, but was intended to show that the concentrations were almost undetectable at the time of measurement.

Comment 32. Page 35, paragraph 4, last sentence. Include bank erosion as another source of uncontaminated sediment.

Response: Accepted. A reference to erosion along the Reach will be added in the final sentence of para. 3. The sentence will read "Because of the continued influx of uncontaminated sediments from upstream sources, erosion along the banks of the Hanford Reach, and export of contaminated sediments downstream. . . ".

Comment 33. Page 36, last sentence. Reword the sentence as follows: "Thus, the processes associated with food chains appear to result in a biodilution of radionuclide concentrations in animals at higher trophic levels."

Response: Accept. The sentence will be reworded as suggested.

Comment 34. Page 37, paragraph 1, 2nd sentence. "Results showed that the measurable body burden...". Is there an unmeasurable fraction of fission-produced radionuclides?

Response: Accepted. "[M]easurable" will be deleted.

Comment 35. Page 37, paragraph 3, 2nd sentence. Is it known whether the geese were resident year-round or only on the Hanford Reach during the nesting season?

Response: There are geese in the Columbia Basin that are year-round residents and some are migratory.

Comment 36. Page 37, paragraph 3, last sentence. Include the mallard tissue type analyzed.

Response: While the referenced report indicated muscle tissue was examined from B-Pond ducks, the muscle tissue was not specified for Hanford Reach ducks. We assume it was also muscle, but cannot be certain.

Comment 37. Page 37, paragraph 4, 4th sentence. Include the great blue heron tissue type analyzed.

Response: Accepted. The tissue samples included eggs, liver, and whole body samples of hatchlings. This information will be included in the referenced sentence.

Comment 38. Page 37, paragraph 5, 3rd sentence. Were metals concentrations in whitefish elevated relative to nationwide monitoring programs (Schmitt and Brumbaugh, 1990)?

Response: Cushing (1979) is a food web study, not a contaminant study. Cushing, however, compared his results with metals concentrations in other fish species from Illinois. The levels in the Columbia tended to be lower, but other factors in the Illinois river, and the species studied, may have influenced the results.

Comment 39. Page 39, Section 3.1. Include an additional pathway of "interstitial-water". The interstitial water is the habitat of a significant percentage of the biomass in aquatic systems. The contaminant concentrations in interstitial water are likely to be higher than in surface water and, unlike sediment, can be

compared to established water quality criteria. Also consider adding a "suspended sediment" pathway.

Response: Accept in part. The following sentence will be inserted after sentence 1, para 4, on page 41: "In addition, interstitial water in sediments may have contaminant concentrations greater than surface water and should be considered a part of the sediment/surface water interface".

Comment 40. Page 41, paragraph 2, first and last sentences. Consider replacing "Subsurface seeps and springs..." with "Subsurface groundwater discharge...".

Response: Accepted in part. The recommended change will be made in the final sentence of para. 2.

Comment 41. Page 41, paragraph 5, last sentence. Consider replacing the last phrase of the sentence with "...and aquatic organism exposure through dermal, respiratory, and dietary pathways".

Response: Accept. The recommended change will be made to the last sentence of paragraph 5.

Comment 42. Page 42, paragraph 4, 5th sentence. It is not clear what is meant by "...no measurable influence on fish from radionuclides". The specific endpoints measured in these studies should be identified.

Response: Accepted. Sentence 5, pg. 42, para 4 will be changed as follows: ". . . surveillance reports show no measurable influence on fish muscle tissue and carcasses from radionuclides released. . ."

Comment 43. Page 50, paragraph 3, 1st sentence. Other large departures of the model from the natural system include: 1) the lack of a variable which represents partitioning of contaminants from water into sediment; and, 2) large variability in measured hydraulic conductivity, which ranged approximately an order of magnitude on either side of the mean (page B-8, paragraph 1, second sentence).

Response: Acknowledged. The additional deviations from natural systems will be noted.

Comment 44. Page 50, paragraph 5. The information in Figure 3-5 and the text do not match.

Response: Accepted. The reference to Figure 3-5 will be corrected to Figure 3.6. All of the parameters mentioned in the paragraph are included on Fig. 3-6.

Comment 45. Page 57, paragraph 2, 1st sentence. Change the text to "...where fish are exposed to contaminants...", as other exposure routes in addition to ingestion can occur.

Response: Accepted. The text will be changed as recommended.

Comment 46. Page 59, paragraph 3, last sentence. Only four radioactive contaminants were listed below.



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Response: Accepted. There are only four radiological contaminants of potential concern mentioned; the text will be modified.

Comment 47. Page 64, paragraph 2. Information on the location of the upstream collection site for fish was not included. If the collection site was downstream of Priest Rapids Dam, subtraction of upstream concentration from downstream concentrations does not seem appropriate. The second sentence is confusing and needs clarification.

Response: The text in question refers to the modeling of contaminant concentrations in fish and not the actual collection of fish. Contaminant monitoring in fish is covered in Section 2.2.4.

Comment 48. Page 70, paragraph 2, last sentence. After reviewing the wide variety of carcinogenic and noncarcinogenic impacts associated with chromium exposure to mammals presented by Eisler (1986), we feel that this sentence needs to be documented.

Response: Accepted. The sentence will be modified to "According to the U.S. EPA integrated risk information system (IRIS) database on February 17,1994, there is no evidence that the chemical contaminants of potential concern (i.e., Cr and $NO_3$) are carcinogenic when ingested. However, there are no long-term studies of ingested Cr VI."

Comment 49. Page 71, paragraph 5, last sentence. This seems to be a rather circular argument.

Response: Accepted. The sentence will be clarified to remove ambiguity, as follows: "It demonstrates that even though a conservative model for groundwater was used to estimate contaminant concentrations at the receptor sites, the majority of the risk will only be associated with two contaminants. Therefore, future efforts can focus on the critical few contaminants, rather than the many contaminants which are not critical due to their low concentrations."

Comment 50. Page 74, paragraph 2, 1st sentence. The USFWS strongly disagree with this statement and contend that the sediment and interstitial water pathways are the most significant exposure pathways to Hanford Reach biota.

Response: Accepted. The statement will be modified to indicate that the choice was made under the constraint that existing data did not allow for a meaningful preliminary quantitative evaluation of the sediment pathway (and that Chapter 5 provides a plan to change this situation).

Comment 51.† Page 74, paragraph 4. The implicit assumption is that the primary environmental receptors are fish. Aquatic plants and invertebrates have limited or no mobility and, as part of the food web, should be included in the environmental evaluation.

Response: Acknowledged. Fish were explicitly chosen as a primary receptor for this preliminary evaluation because they are readily identifiable as an important component of both human and ecological food chains. It is expected that a

baseline risk assessment of the Columbia River will evaluate additional environmental receptors.

Comment 52. Page 75, paragraph 4, paragraph 3. These acronyms are not defined.

Response: Accepted. A global editorial review will be conducted to ensure that all acronyms within the document are defined the first time they are used.

Comment 53. Page 76, paragraph 4, last sentence; page 81, last paragraph. As this ecotoxicity assessment included only exposure of nonhuman receptors from surface water and did not include possible exposure to contaminated sediment or food sources, this conclusion is not appropriate and should be removed from the document.

Response: Accept in part. The limitations of this conclusion (e.g., limited contaminant list, limited exposure pathways, limited receptors) will be explicitly addressed to qualify the conclusions. The text will be modified to indicate that the conclusions are not intended to suggest that no further study is required, but to identify where further information is needed to conduct a baseline risk assessment.

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Comment 54. Page 81, paragraph 2, last sentence. Include the short-faced lanx and Columbia pebble snail in this section. Although they are candidate species, their aquatic/benthic habitat puts them at greater risk of exposure than the species listed here.

Response: The species mentioned are not endangered or threatened, and the phrase "many important ecological functions" encompasses mollusc habitat. DOE policy is to consider federal candidate species with the same consideration as threatened or endangered species.

Comment 55. Page 84, 3rd bullet. As written, this item focuses on the extent to which contaminants will end up in the water column. It should be revised to give equal emphasis to groundwater contaminant partitioning into sediment, interstitial water, and surface water as described in the text of Activity 1A-3. The sentence will be changed as follows: ". . . their associated interstitial waters <u>and the mechanisms of groundwater contaminant partitioning into sediment, interstitial water, and surface water</u>".

Response: Accept. The text (3rd bullet, page 84) will be rewritten as suggested to specify the partitioning between water and sediments.

Comment 56.† Page 84, 5th bullet. A reconnaissance level contaminant/water quality study was conducted in 1992 on the Columbia Basin Project irrigation drainwater. This study was conducted by the U.S. Geological Survey and U.S. Fish and Wildlife Service under the U.S. Department of Interior, National Irrigation Water Quality Program. The draft report, titled <u>Reconnaissance Investigation of Water Quality, Bottom Sediment, and Biota Associated with Irrigation Drainage in the Columbia Basin Irrigation Project, Washington 1991-93</u> (Embrey et al. in preparation) is currently in review. Contact Sandra Embrey, USGS, Tacoma, at 206-593-6510 for further information.

Response: Acknowledged. The cited draft report will be obtained upon finalization and the information provided will be used, as appropriate, in the impact evaluation, and will be considered for use in the planning and implementation of future investigations and assessments.

Comment 57.† Page 84, Surface water pathway objectives. Gas supersaturation of water is a problem at some dams on the Columbia River. Evaluation of this potential impact at the Priest Rapids Dam should be addressed.

Response: The impact associated with gas supersaturation is not attributable to activities at the Hanford Site and therefore is beyond the scope of the CRIEP.

Comment 58. Page 87, paragraph 1, last sentence. A specific statement the "water quality standards applied to interstitial water will be protective of the environment" needs to be made.

Response: The last sentence will be enlarged to add "... will adequately protect both human health and the environment, and that water quality standards applied to interstitial water will be protective of the environment".

Comment 59. Page 88, paragraph 6, last sentence. Please add "permitted and nonpermitted point sources" to this list.

Response: Accept. The sentence will be changed as follows: ". . . irrigation return water, permitted and non-permitted point sources, and contributions. . .".

Comment 60. Appendix B. The information presented here was difficult to interpret due to inconsistent presentation of ground water elevations. For example, some figures showed ground water elevation relative to sea level, text information provided ground water elevation relative to surface level, and Figure B-1 did not include elevations at all. A table with data on well screen depths, the number of times wells were tested, and the constituents analyzed should be included.

Response: Accepted in part. All water table maps are plotted relative to mean sea level. Figure B-1 is a generalized stratigraphic column for the entire Hanford Site; therefore, elevations are not provided as the column does not apply to any specific location. General information specific to a given location of interest is provided in the text of the appendix.

Appendix B was not prepared specifically for the CRIEP, but rather as part of a conceptual feasibility study to evaluate macroengineering options for groundwater remediation at the Hanford Site. The appendix was excerpted from the macroengineering study as the study is currently in draft form and not approved for public release. The original source for data presented in Appendix B was Evans et al. (1990), which provides details and results of the ground-water surveillance program

Comment 61. Page B-8, paragraph 1, 2nd sentence. Using a mean hydraulic conductivity based on such large variability will result in discharge estimates with large confidence intervals. Please note this source of error where mean hydraulic conductivity is used in other equations or models.

Response: Accept.

Comment 62. The inclusion of four areas of the Hanford Site on the EPA's National Priorities List under CERCLA indicates the importance of the CRIEP to cleanup actions in this reach of the Columbia River. The limited time frame initially provided for public comment, did not allow the USFWS sufficient opportunity to provide this plan to USFWS research and development staff with expertise in hazardous materials. The USFWS recommends that the Tri-Party Agencies prepare an environmental impact statement for this plan and submit it for public review in accordance with the provisions of the NEPA as provided in Section 1502.18.(d) for circulation of environmental statements.

Response: The studies being conducted under the Columbia River Impact Evaluation Plan are in support of CERCLA activities at the Hanford Site. It is EPA Region X's policy that CERCLA is the functional equivalent of NEPA. Therefore, no additional NEPA procedures to supplement the CERCLA process are warranted. Currently, however, it is DOE's policy to integrate CERCLA actions with NEPA. DOE has, therefore, prepared a site-wide Categorical Exclusion under NEPA for CERCLA remedial investigation activities, including the Columbia River. Furthermore, DOE is still planning a comprehensive Environmental Impact Statement for Hanford Remedial Actions (HRA-EIS) that will include the Columbia River Study area and the public review requested.

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Washington Department of Health

Comment 63.† Many issues of the CRIEP involve radiological contamination and health effects. Because the DOH is the state radiation regulatory agency, including environmental radioactivity, DOH involvement in these plans is essential. Appropriate participation includes developing cleanup plans, measuring environmental radioactivity, interpreting data, evaluating radiation risk, and assessing cleanup effectiveness.

Response: Acknowledged. DOH will be considered in the planning of future investigations

Comment 64.† The Environmental Radiation Section of the DOH is responsible for environmental radiation monitoring and protection statewide. For more than two decades the Section has been monitoring environmental radioactivity in the vicinity of the Hanford reservation. Since 1985 the Section's Hanford Environmental Oversight Program has participated with DOE in the collection of environmental media on or near the Hanford Reservation. This participation has included side-by-side monitoring, split sampling and/or independent monitoring for all facilities and projects having a potential environmental or public health impact. This program can be easily extended to satisfy quality assurance aspects of the monitoring needs of CRIEP.

Response: Acknowledged. This offer will be taken into consideration in the planning of future investigations.

Comment 65.† The DOH concurs that sampling proposed by the CRIEP should be conducted by existing site monitoring programs within "that segment of the

river bounded by Priest Rapids Dam down to the head of Lake Wallula". This area, in its current configuration, does not pose any immediate threat to the public or the environment. This conclusion is supported by our monitoring data and by the "impact evaluation" (Chapter 4) presented in the CRIEP.

Response: Acknowledged.

Comment 66.† While it may be justifiable to extend the downstream boundary to include McNary pool, in our opinion further extension of the downstream boundary cannot be justified on radiological grounds. Results from numerous special investigations and state and federal monitoring programs have conclusively shown that levels of Hanford-origin radioactivity in Columbia River sediments downstream from McNary are barely measurable and well below levels that would be a cause of concern for human or ecological health. These results will be summarized in a new DOH report to be publicly released in September, 1993: "Columbia River Sediment Study: Past, Present and Future". (Note: Because the authors are including additional information, this document has not been released as of February, 1994)

Response: Acknowledged.

Comment 67. Page 4, "1.3 Relevant Environmental Statutes...". R.C.W. 70.98 authorizing the DOH as the state radiation regulatory agency, including environmental radiation, is clearly "applicable, relevant and appropriate".

Response: Acknowledged. Section 1.3 was not meant to be a comprehensive list of potential ARARs. A sentence will be added to the paragraph as follows: "These are only four of the many potential ARARs for the Hanford Site."

Comment 68. Page 12, paragraph 2. "Shine" is a phenomena resulting from nuclear and electron Compton scattering of high energy photons (approximately 1 MeV). Reflection/refraction from dust and clouds results from scattering low energy photons (approximately 1 eV) from molecular lattices. These two phenomena are physically distinct. However, this comment only affects the technical accuracy of the document and not its impact or conclusions.

Response: Acknowledged.

Comment 69. Page 36, 4th paragraph. Discrete particles of radioactivity, including machine components swept downstream, is a very difficult form of contamination to locate or monitor and therefore difficult to remediate. Nevertheless, these issues do not seem to be addressed in the CRIEP. It is essential to address this issue before, in the "recreational scenario", a beachcomber picks up highly radioactive material.

Response: Acknowledged. Current radiation monitoring and protection programs are actively seeking the types of particles that the reviewer describes.

Comment 70. Pages 62,63 and 73. The DOH agrees that most of the assumptions of the CRIEP are conservative and probably result in conservative risk assessments. However, several assumptions in the CRIEP appear to be non-conservative that are not so recognized. For example, the assertion on page 62



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that "sediments tend to wash off" is directly contradicted by the common experience that beach sand (sediments) sticks to clothing, shoes, towels and sporting goods. Similarly, the recreational scenario of 1 day/year on page 63 seems more of an average number, rather than representing the boater who loves to fish every weekend. Finally, the argument on page 73 that "EPA radionuclides slope factors are likely to represent an upper bound estimate of the carcinogenic potential..." is extremely weak. In fact, as noted in that paragraph, the worlds data is also consistent with the risk being three times higher than current EPA slope factors.

Response: Accepted. The point is arguable, but the authors would regard beach sand as "soil" rather than sediment. Sediment, unconsolidated material that is overlain by water, does tend to wash off during water activities. The text will be modified to indicate the distinction between sediment and soil and will indicate that there are occasions where river users do not wash off sediments. The following will be added to the last sentence of paragraph 2, pg. 62. ". . . water activities, But, if they are not involved in water activities the probability of washing off contaminated sediments decreases and the likelihood of dermal absorption increases. The 1 d/yr exposure frequency used in the recreational scenario does not represent the frequency of fishing or of undertaking any other particular river activity, it is used to conservatively estimate the frequency at which a river recreator consumes 1 L of raw river water. The usage of this exposure frequency will be clarified. "[U]pper bound" will be replaced with "conservative" in regard to EPA slope factors for radiologicals.

Comment 71.† Page 86, Activity 1A-1 - Identification of Contaminants of Potential Concern. The DOH is concerned that radiological contaminants are being identified without the DOH's participation. In particular, the DOH would like to see included in this report an evaluation of the human health impact of radiological contaminants in sediments. Contaminants of potential concern include, but are not limited to, the isotopes already considered in the CRIEP as well as isotopes of plutonium, europium, cesium-137 and cobalt-60.

Response: Acknowledged. The list of contaminants for the evaluation within the CRIEP was acknowledged to be a limited set, but were judged sufficient to evaluate existing data collection and monitoring plans. The selection of contaminants and exposure pathways for a risk assessment of the river will be done in accordance with the Hanford Site Baseline Risk Assessment Methodology.

Comment 72.† Page 86, Activity 1A-2 - Characterization of Contaminant Fluxes. The DOH maintains great interest in these groundwater investigations planned for 100 Area Operable Units. The DOH should receive a summary report of the information collected under this activity.

Response: Acknowledged. The individuals conducting the studies will be given this request.

Comment 73.† Page 86, Activity 1A-3 - Characterization of Contaminant Mixing in Discharge Zones. The DOH believes that understanding contaminant mixing is essential for realistic risk calculations. Thus, the result of this study are of

great interest to the DOH and the DOH should be kept apprised of results of these investigations.

Response: Acknowledged. The individuals conducting the studies will be given this request.

Comment 74.† Page 88, Activity 1B-1 - Identification of Other Contaminant Input Sources. Should compilation of existing information prove inadequate to characterize other contaminant sources of radioactivity, thereby initiating a new sampling program, the DOH proposes some split sampling activities for quality assurance purposes. The DOH should receive a summary report of the information compiled under the activity.

Response: Acknowledged. See the response to Comment 64.

Comment 75.† Page 89, Activity 2-1 - Surface Water Monitoring. Active participation in the radiological portion of this sampling activity by the DOH would lend greater credibility to the final conclusions as well as partially satisfy the DOH's statutory requirements for environmental radiological monitoring of the Hanford site.

Response: Acknowledged. See the response to Comment 64.

Comment 76.† Page 91, Activity 3-1 - River Sediment Monitoring. The DOH should actively participate in the radiological part of this activity. DOH participation could include split samples, joint planning and execution of sampling activities, and comparison of results.

The DOH should be consulted regarding the process of developing sediment quality criteria for the investigation of radiological contaminants.

Response: Acknowledged. See the response to Comment 64.

Comment 77.† Page 92, Activity 4-1 - Compilation of Ecotoxicological Data. The DOH maintains a keen interest in the radiological aspects of this activity and should receive a summary report of this information.

Response: Acknowledged. See the response to Comment 64.

Comment 78.† Page 92, Activity 4-2 - Compilation of Biocontaminant Monitoring Data. The DOH is potentially interested in splitting samples with this program and monitoring the progress of these activities. The DOH should receive a summary report of this data and actively participate with assessing environmental and human impacts.

Response: Acknowledged. See the response to Comment 64.

Comment 79.† Page 92, Activity 4-3 - Compilation of Sensitive and Critical Habitat Information. The DOH should be kept informed of these activities as they progress and receive a summary report of this information.

Response: Acknowledged. See the response to Comment 64.

Comment 80.† Page 93, Activity 4-4 - Data Evaluation

The DOH should actively participate with the evaluation of all radiological data and those decisions made regarding project changes. Data quality issues will be partially addressed by intercomparisons between the DOH's data and DOE contractor data. An active participation of the DOH regarding quality assurance and statistical protocols would enhance the quality of the final product.

Response: Acknowledged. See the response to Comment 64.

Washington Department of Wildlife

Comment 81. The selection of environmental endpoints is heavily biased towards receptors that traditionally have been selected either because they have a potential impact on human health (i.e., they are part of a biotic pathway for human exposure) or because they have created localized problems by their ability to intrude into waste sites. Thus, Section 3.1.4 of the CRIEP states that fish will be used as a measurement endpoint, not only to evaluate human exposure but also to evaluate environmental impacts.

Response: Acknowledged. Fish were also selected because they are an important resource of the State of Washington.

Comment 82.† We acknowledge that Hanford has added additional species to evaluate impacts to environmental receptors independent of the human pathway (Steve Friant, personal communication with John Hall of the Washington Department of Wildlife). Moreover, it only makes sense to start with existing data bases to evaluate potential environmental indicators or receptors of concern. Our concern, however, is that by relying too heavily on existing data bases and biases for selection criteria we will ignore those groups of organisms that are sensitive to environmental contaminants and for which we have a poor knowledge of their distribution and abundance.

Response: Acknowledged. We agree that sensitivity to contamination should be one criterion considered in the selection of ecological assessment endpoints for future assessments. General criteria for this process are laid out in the Hanford Site Baseline Risk Assessment Methodology (HSBRAM).

Comment 83. In relation to the CRIEP it is insufficient to only assess the impact to fish. Ecology's earlier comments on a draft of this document have already pointed out the shortcomings of relying on a mobile indicator species (see comment number 89 on Section 4.2 of the CRIEP). Moreover, reliance on only fish as an environmental endpoint ignores the impact to the riparian zone species that are independent of food webs involving fish. Within the context of a Qualitative Risk Assessment (QRA) evaluating fish may be sufficient; however, this narrow focus should be viewed as insufficient for a baseline risk assessment. In their disposition of Ecology's comments to the draft CRIEP (Goller 1992) DOE/RL indicated that the CRIEP represents a plan for gathering the necessary additional information necessary to construct a baseline risk assessment for the 100 Area. (We understand that the scope of this effort may have changed to something even broader by now.) Thus, the proposed



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data collection plan (Section 5.0) should identify data gaps and propose possible additional environmental endpoints. This section of the CRIEP is insufficient on both accounts.

Response: Acknowledged. In relation to a preliminary scoping effort for developing a conceptual model and evaluating current monitoring and data collection programs, it is not possible to evaluate every potential receptor. Fish were selected because they are an easily identified receptor and will surely be included in a baseline risk assessment. The inclusion of other receptors will be done in accordance with HSBRAM. The CRIEP has included activities (Activity 4-2) to identify contaminant monitoring data in other potential receptors. The authors do not see any shortcoming in the plan with regards to considering other receptors. It should be noted that the CRIEP noted that the use of mobile species may be insufficient to detect impacts (page 37, paragraph 2, last sentence).

Comment 84.† Because my staff has some experience with amphibians, I will use them as an example of a riparian zone indicator species to illustrate our argument. Other groups of organisms, such as butterflies and lizards, may be important in other contexts (unrelated to the Columbia River) because of sensitivity to environmental perturbations or place in the food chain; however, we mention them here only to illustrate there may be other groups of organisms that have been ignored because they have not been the focus of past data collection. Besides the rationale I mentioned previously for environmental endpoints, past data collection efforts on species' distribution, abundance, and ecological tolerance may have been skewed toward those organisms considered of interest to humans and not necessarily toward those species (and habitats) that may be the most ecologically sensitive.

Response: Acknowledged. See the response to Comment 82.

Comment 85.† The HSBRAM provides guidance on identification of habitats of potential concern and the identification of environmental assessment and measurement endpoints. The use of indicator species is described as a means to support the assessment process. Only in the broadest sense has the habitat necessary for the maintenance of amphibian populations on Hanford been identified (for now this refers only to riparian habitat where reproduction and larval development take place), yet amphibians qualify as both detector and bioassay species (HSBRAM, page 69).

Response: Acknowledged. See the response to Comment 82.

Comment 86. Amphibians can be important monitors of environmental quality and are of current worldwide concern because of seemingly widespread declines in numbers (Blaustein and Wake 1990). Because of their biphasic life-cycle (aquatic larvae and terrestrial adult) amphibians are exposed to contaminants from all three media. Moreover, their highly permeable skin is highly susceptible to skin absorption of contaminants. Each stage of their lives: egg, larval, juvenile, and adult is useful in bioassays (Devillers and Exbrayat 1992).

As pointed out by Fitzner and Gray (1991) the distribution and abundance of amphibians (and reptiles) on the Hanford Site is poorly understood (though the manuscript identified three amphibians as common in riparian areas). Current literature even indicates a lack of agreement on definitive species lists for the Site (e.g., Gray and Rickard 1989; Fitzner and Gray 1991). From a position of relative ignorance it is hard to reconcile statements such as: "No studies have been conducted on the abundance and distribution of reptiles and amphibians on the Hanford Site, and no specific data exist for the peninsula between the 100-D and 100-H Areas." (DOE-RL 1992, page 2-24) with statements such as: "Because of their low numbers [reptiles and amphibians] and because they are not in a direct pathway to humans, they are not considered further here." (Weiss and Mitchell 1992, page 25). Both of these latter documents provide support information for the CRIEP. In summary, and using only amphibians as an example, the Washington State Department of Wildlife conclude that the proposed data collection plan of the CRIEP inadequately evaluates ecological data gaps and may fail to identify additional and appropriate environmental endpoints and bioassay data.

Response: Acknowledged. Future, more detailed ecological evaluations will require detailed identification of assessment and measurement endpoints as generally laid out in the HSBRAM. However, a worldwide decline in amphibian numbers seems to lie well outside the scope of any investigations and assessments conducted to comply with the Tri-Party Agreement. Furthermore, the "biphasic life-cycle" referred to is shared by other taxa, such as most aquatic insects, that may well be better suited to environmental impact analysis due to relative ease of sampling, relative importance in the food chain, and benthic (i.e., relatively non-motile) habits.

Comment 87. Section 2.1.4.2 Riparian Zone, page 10, last paragraph of section: The great blue heron is not a candidate species for listing. It is currently identified as a state monitor species. (As an example of bias note that in the preceding paragraph in which it is mentioned that many invertebrates, birds, reptiles, amphibians, and mammals use the riparian zone, only birds and mammals are listed as examples.)

Response: Accepted. The correct status of the great blue heron will be noted and the bias against reptiles, amphibians, and invertebrates will be removed. The last sentence of pg. 10, para 4 will be changed to "The Common Loon (Gavia immer) is another riparian species which is a candidate for listing, and the Great Blue Heron is a Washington State monitor species". Additionally, macrophytes, molluscs, and the painted turtle (Chrysemys picta) will be added to the species list in paragraph 3, pg. 10.

Comment 88. Section 3.1.4 Biotic Pathways, last paragraph: This paragraph, in essence, only evaluates the potential impact to critical habitats necessary for endangered or threatened species and does not the evaluate the full range of sensitive habitats identified by 40 CFR Part 300, Appendix A, Table 4-23. The second sentence of this paragraph should clarify that bald eagles are federally and state listed as threatened; whereas, the American white pelican is only state listed as endangered. Finally, the assessment of impact to the white pelican is incomplete. First, chemical contaminants are not assessed. Second,

can Becker's (1990; referenced in the last paragraph on page 36 of the CRIEP) generic statement related to a dilution of radionuclide concentrations at the higher trophic levels be used to assume bioaccumulation of contaminants does not occur in the white pelican?

Response: Accepted in part. The final paragraph of Section 3.1.4 addresses both sensitive and critical non-aquatic habitats; however, the authors do agree that critical habitats are, we believe appropriately, the focus of the paragraph.

The second sentence notes the threatened status of the bald eagle and the endangered status of the white pelican. The text will be modified to ". . . endangered white pelican (the most stringent of either the Federal or State designations are applied).

The penultimate sentence of the paragraph in question will be clarified to better support the interim conclusion presented in the final sentence. The following sentence will be inserted after the subject sentence: "This corresponds with the findings of Becker (1990) which concludes that radionuclide contaminants are lowest at higher trophic levels.

Comment 89.† Section 4.2 Environmental Evaluation, 2nd paragraph: As pointed out by Ecology's earlier comments on a draft of this document, the use of a mobile receptor species may inadequately serve to assess impacts to sensitive members of the biotic community. Amphibians breed in the sloughs and slack-water areas of the Hanford Reach and the larvae tend to remain near the area in which they hatched. Thus, they are inadequately modeled by a mobile organism. They are potentially exposed to much higher concentration of contaminants than a free-swimming fish.

Response: Acknowledged. A baseline risk assessment will consider the inclusion of additional sensitive species and will evaluate in greater detail contaminant exposure pathways.

Comment 90.† Section 5.1 Columbia River Impact Evaluation Summary, 3rd paragraph, 2nd bullet: The statement: "Threatened and endangered species continue to use the Reach for Habitat." is meaningless. The bald eagle and American white pelican are insufficient monitors of the functional integrity of the Hanford Reach ecosystem. Eagles are dependent on a human supplied resource (i.e., planted trees) and neither species has an established breeding population on the reach. Although listed species are of concern, they do not necessarily reflect the integrity of an ecosystem. Other factors may play a role in their decline. The status of year-round resident species that were at one point common may provide a better assessment of ecosystem health. Again, the bias in data gathering may have prevented us from observing whether certain groups of organisms have been adversely impacted by contaminant releases.

Response: Acknowledged. See the response to Comment 82. The authors agree that resident species should be considered in developing assessment endpoints for future detailed assessments.

The authors believe that the bullet in question has meaning. As piscivores, the eagles and pelicans are at the top of the Reach's food chain and

are thus vulnerable to any potential bioaccumulation effects. While eagles are dependent upon the presence of planted trees, they are also dependent upon naturally occurring salmon. While neither eagles nor pelicans breed on the Reach, it is significant to note that they inhabit the Reach seasonally and survive to breed elsewhere. We do agree that a decline in the local eagle or pelican populations could have nothing whatsoever to do with conditions in the Reach, but ecologists know that the presence of a species conveys far more information than an absence. It should be noted, however, that both populations are significantly higher than two decades ago, probably for a variety of reasons. We acknowledge that eagles and pelicans may not be the most effective or reliable indicators of ecosystem integrity, but believe that they are worth noting for not only the reasons specified above, but also because of social relevancy.

Comment 91. Section 5.2.2.4 Task 4 - Characterization of Biological Pathways:

- 1st paragraph on page 91: The statement that, "...there are relatively few data needs required to allow for a cumulative impact assessment." is not correct for the many reasons stated.

- Activity 4-1 - Compilation of Ecotoxicological Data: No mention is made of the need for additional bioassay data should there be a determination that adding indicator species is necessary; i.e., there seems to be no intent to go beyond the mobile fish model as an indicator species even for the baseline risk assessment.

- Activities 4-2 and 4-3 (Compilation of Biocontaminant Monitoring Data and Compilation of Sensitive and Critical Habitat Information, respectively): These two activities exemplify the bias in relying strictly on historical data and emphasizing those organisms that could be part of the human food chain. These activities should evaluate whether organisms that have been poorly studied require an evaluation of their population status and their susceptibility to contaminants.

Response: Acknowledged. The data compilation activities (4-1, 4-2, and 4-3) in task 4 of the plan are not limited to any particular species, but instead are intended to be comprehensive. If shortcomings are noted during the review, activity 4-4 provides for additional investigation or sampling programs.

Comment 92. Although the CRIEP may suffice as a QRA for evaluating the impacts of the 100 Area on the Columbia River it does not adequately address the ecological data required to construct a baseline risk assessment. It seems to rely on the unsupported supposition that almost all ecological data needs have already been met. This assumption must be critically analyzed.

Response: Acknowledged. The authors acknowledge the parallels between a QRA and Chapter 4 of the CRIEP. We do believe, however, that Chapter 5 establishes an effective framework for further investigation that will allow for the implementation of a baseline risk assessment that will comply with the requirements of the Tri-Party Agreement. If it seems that many ecological data needs have been met, one must remember that the Hanford Site as a whole has been subjected to extensive investigation for five decades; as a result, the Site

was far better characterized ecologically prior to the enactment of the Tri-Party Agreement than most NPL sites are after a record of decision is developed. The public review process established by the Tri-Party Agreement will ensure that there is continued opportunity to identify data gaps.

Yakima Indian Nation

Comment 93.† The scope of the impact evaluation should include consideration of all sources of pollution to the Columbia River, not just those that result from past and present 100 Area operation as suggested in Section 1.2 of the proposed plan. Contaminants from other operations at Hanford have and continue to contaminate the river and should be considered in a comprehensive plan.

Response: Acknowledged. An evaluation for the entire Hanford Reach is being developed and these concerns will be given to the organizations involved.

Comment 94. The scope of planning should include the effects on sediments downstream from sources on contamination, including sediments behind dams.

Response: Acknowledged. See Paragraph 5.2.2.3, p. 90, "Task 3 – Characterization of River Sediment Pathways."

Comment 95. The CRIEP seems to disregard the presence on iodine-129 as a potential contaminant. In general if technetium-99 is observed or monitoring planned, investigation for iodine-129 should also be accomplished, since these two isotopes are highly soluble fission products and are usually found together in ground water, unless there is a specific reason they did not exist together in the source of the contamination.

Iodine is also concentrated in fish by about a factor of 1000 over the concentration in the water in which they live. This concentration effect should be considered in the subject monitoring plan with specific evaluation of fish. Fresh water clams and mussels may also concentrate iodine. Thus, they also should be considered in the CRIEP.

Response: Acknowledged. The CRIEP does not ignore any potential contaminant. The choice of contaminants for preliminary evaluation was explicitly made using available groundwater monitoring data for the 100 Area. None of the reports reviewed showed any presence of iodine-129. Iodine-129 has been reported in groundwater in the 200 Area, but this is not currently impacting the Columbia River and was beyond the scope of this document.

Comment 96. Neptunium-237 and Neptunium-239 are particularly mobile and troublesome isotopes. The CRIEP should explain why these isotopes are not being monitored at Hanford. For example, see Tables 2-3 and 2-4 for omission of consideration of Neptunium-239 or Neptunium-237.

Response: Neptunium isotopes are immobile relative to, for example, tritium which is present in far greater concentrations. Neptunium-239 also has a very short half-life of 2.4 days. While neptunium-237 is long-lived, one would expect to find it occurring with a wide variety of transuranic isotopes, including the plutonium isotopes reported in the tables in question.

Comment 97. A Hanford Reach Contaminant Transport Model is described in Section 3.3.2 of the CRIEP. Validation for this model should also be presented in the CRIEP. Data collected by Hanford in the early days of operations should be utilized to accomplish this validation. In particular, values of contamination in fish compared to the river water and sediment contamination should be considered as well as the measured dilution of isotopes with distance from source during these early operations.

It would appear that a model that more properly considers the gradual slopping of the river bottom from the shore with the lower water velocities near the shore line and in back water locations should be assessed to provide a basis for contamination transport. It would appear that the model described can not assess the limiting conditions in the river where contaminants could accumulate from particulate transport. Bottom feeding fish such as sturgeon should be assessed relative to the accumulation of contaminants distributed by particulate transport.

Response: Acknowledged. The model presented was intended to be a conservative rather than comprehensive estimate of likely river concentrations. The text will be modified to indicate the limitations with regards to concentrations in sloughs.

Comment 98. The CRIEP states that eight (8) reactors were constructed to allow direct contact between the reactor cores and the cooling water of the river up until 1986. And within the same paragraph, it states that direct-contact, single-pass reactors ceased operations in 1971. The plan is vague about when the direct contact between the cores and once through river water ceased.

Response: In para. 1 on p. 7, it is noted that nine plutonium-production reactors were constructed and operated from 1944 - 1986. The same paragraph notes that eight of these reactors were cooled by direct contact with river water and that these eight ceased operations in 1971. The ninth, N-Reactor, did not use flow-through river water for cooling, and ceased operation in 1986, as noted on p. 7, para. 1.

Comment 99. Figures 2-4 indicates that tritium is not a factor in the "100 K" area. Yet the statistics on the "Estimated Contaminant Fluxes and Concentrations" show otherwise. Tritium may be originating from the 100K area. This source of tritium should be reconsidered in the plan.

Response: Acknowledged. Contaminant sources are being evaluated in remedial investigations at the operable units. That information will be available for a baseline risk assessment to select contaminants of potential concern.

Comment 100. The HSBRAM should not be used. This risk assessment does not properly consider cultural foods and habits of the Yakima Nation people.

Response: The HSBRAM, although used as a reference for some exposure parameters, was not followed exactly in the development of the preliminary impact evaluation presented in Chapter 4. The exposure assumptions used in the preliminary evaluation are not reflective of any particular culture, but are regarded as generally conservative representations of the behavior of the

majority of the inhabitants in the region. Note that the purpose of the preliminary evaluation is not to quantify risk, but to evaluate some of the major exposure pathways to allow for the identification of those areas of the Reach that could be significantly adversely impacted and those contaminants that are of likely concern for such impacts. In this manner, the preliminary evaluation allows for the development of an hypothesis that will be tested in a detailed baseline risk assessment after additional data collection.

Comment 101. The CRIEP should state how charts 2-6 and 2-7 came up with the figures of contamination. Any source of contamination upstream would originate from the 100 area. Unless the nitrate, tritium, uranium, technetium and other contaminants are coming from independent sources other than Hanford. Otherwise the model should use the Snake River for comparison where there is more control. In particular, the source of tritium and technetium in the Columbia above Hanford should be identified and compared with other surface water not associated with Hanford to validate assumptions about the "background" levels of these contaminants.

Response: Acknowledged. The 100 Area of Hanford is not the only source of contaminant input to the Columbia River. There are indeed other sources of contamination that are independent of Hanford. Uranium is a naturally occurring radionuclide that exists in the soils and geology of Washington. Uranium ore is found in the northeast portion of the state. Nitrate is a common contaminant of agricultural production and can be abundant in irrigation return flows. Tritium is another naturally occurring radionuclide and also is a product of atmospheric testing of nuclear weapons. Its distribution is worldwide.

There is no evidence that discharges to the river from Hanford are moving upstream and affecting water quality at the upstream sampling sites. In addition, it is inappropriate to use the Snake River as a reference area because the geology of its basin is completely different from that of the Columbia River. Thus, differences in water quality could not be ascribed to activities at Hanford.

Comment 102. The CRIEP states that there is no evidence of past or present significant ecological impacts associated with contaminated sediments; but yet, in the same paragraph states river sediments are known to be contaminated. This should be clarified.

Response: The first paragraph of Section 1.2, p. 2, defines significant adverse impact to mean a threat to human health or the environment that could be regarded as unacceptable under the NCP (i.e., an incremental lifetime cancer risk above $10^{-6}$, a hazard index above 1.0, or an environmental hazard index above 1.0). Contamination is regarded as the presence of a chemical or radiological substance in excess of background (or control or reference) concentrations. Therefore, it is possible to have contamination without a significant adverse human or ecological health impact.

Comment 103. The CRIEP states that human ingestion is the most significant biotic pathway. The CRIEP should consider the cumulative effects of fish consumption by the indigenous people whose main staple is fish. Indigenous

people along the Columbia River may consume up to 40 time as much fish as the average non-indigenous person.

Response: Acknowledged. The CRIEP used average exposure parameters to conduct the preliminary evaluation. A baseline risk assessment will determine the need to include additional exposure parameters to evaluate sensitive populations.

Comment 104. Maximum contaminant levels as proposed in 56 FR 33050 should not be used if it has not been made a binding regulation of clean up. 40 CFR 300.430(e)(2)(i)(A)(2) should continue to be used as the baseline until superseded.

Response: Acknowledged. Whether or not MCLs will be used as remediation objectives is a matter to be decided during the development of records of decision. However, MCLs were used, merely as screening benchmarks, to help identify contaminant of potential concern for the preliminary evaluation presented in Chapter 4.

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Comment 105. The CRIEP states ..."upstream concentrations of carcinogenic contaminants (i.e. radionuclides) are subtracted from the average river concentrations or concentrations at the City of Richland water intake prior to calculating intake values". This would reduce the total content of contaminants. It should not matter whether the contaminants are coming from the Hanford area or not, the total amount of contaminants and their effects are the critical factors to be considered. If the total effects were unacceptable, then the impacts of the Hanford contaminants would be significant in any case.

Response: Acknowledged. If the objective is to determine if contaminant inputs from Hanford are having an impact, then the increase in risk due to those operations relative to background must be determined. If the incremental increase in risk due to Hanford inputs was less than 1E-04 to 1E-06, then Hanford inputs would not be a significant impact. The management of risks associated with background is beyond the scope of this document.

Comment 106. The CRIEP mentions Yttrium-90 and Barium-137 but does not describe the source of these isotopes nor their undesirability. The CRIEP should state the effects of those elements on the ecosystem and biota.

Response: The authors could find no reference to barium-137, but the information requested on yttrium-90 is provided on p. 68, para. 6.

Comment 107. The CRIEP states that the drinking water of Richland is "treated" and therefore, concentrations of many contaminants would decrease. But the CRIEP does not state whether the water is treated for tritium, uranium, nitrates, etc. Contaminants for which treatment is effective should be identified.

Response: Acknowledged. Since this is a qualitative evaluation which uses conservative assumptions, the model assumes no removal of any of the contaminants of potential concern. However, little, if any, nitrate removal

would be anticipated and no tritium removal would occur but the flocculation treatment would remove most metals.

Comment 108.† Integrated surveys should be used to determine the cumulative effect on human exposure to contamination and not limit it to inhalation, ingestion of fish, and water. For example, irrigation using river water, pasturing of livestock, consumption of wild waterfowl, gathering of roots, plants and berries, hunting of wild game, etc., should be considered as potential pathways. Note that irrigation water from a point near the 300 area is currently being accomplished.

Response: Acknowledged. The pathways mentioned were not considered as the majors pathways for purposes of the preliminary evaluation. However, the recommended pathways will be reconsidered for inclusion in the baseline risk assessment.

Comment 109. The characterization of contaminant mixing in discharge zones should in addition to the use of 100-D-1 as an example, use the 100K-1 and 100-N-1 sources based upon the content and volume of contamination seeping into the Columbia River.

Response: Acknowledged. The assumption was that it is not necessary to characterize contaminant mixing at every operable unit. Rather it is expected, given similar river bank characteristics, that one site could be used as an analog for all sites in the 100 Area.

U. S. Agency for Toxic Substances and Disease Registry

Comment 110. It will be useful to see an emphasis on nonradiological contamination present in the Columbia River, resulting from Hanford activities. The literature to date is underdeveloped in this aspect of potential contamination of the Columbia River.

Response: Acknowledged. Much of the historical data is focused on radiological substances due to the obvious concern associated with the operation of nuclear reactors. The Tri-Party Agreement, however, requires that hazardous substances, whether chemical or radiological, be addressed, and the efforts being conducted under the Agreement are doing this. Note that the chemical data in the existing literature is sufficiently well developed at this time to include two non-radiological substances—chromium and nitrate—as 100 Area contaminants of likely concern for the Reach.

Comment 111.† More information is needed regarding the surface water model which is being used. However, it appears from the discussion that the model selected is too simplistic to provide meaningful and reliable results. It is understood that the surface water model is theoretical and in the formative stage, but it might be necessary to refine it to account for the complexities of the actual, natural river system. In order to be a valid predictive tool, the model must be verified using actual data.

Response: Acknowledged. The model used in the CRIEP is preliminary in nature. The CRIEP specifies an activity to develop a groundwater-surface water dispersion model.

Comment 112.† The emphasis of the CRIEP is the impact of the 100 Area on the river. However, it should be stated early and distinctly in the plan that the other NPL areas, most importantly the 200 and 300 Areas, have the potential to significantly impact the river. The study should be conducted to account for the possible effects of contaminants released from these areas.

Response: Acknowledged. The scope of the CRIEP is defined in Section 1.1, p. 1, and DOE has initiated efforts to evaluate the Site's impacts on the Reach on a programmatic basis.

Comment 113. It is imperative that the public be brought into the process to the greatest extent possible so that concerns can be addressed early on and so that the public is given the greatest opportunity to "buy-in" to the project.

Response: Acknowledged. As the Tri-Party Agreement requires ongoing public review, opportunities for involvement in river characterization activities are ensured.

Comment 114. Identification of the groundwater contaminant sources and specific contaminants emanating from each will be valuable in assessing the potential public health impacts on the river.

Response: See Table 3-1 on p. 49 and Appendix B. Identification of specific source facilities responsible for groundwater contamination will be carried out in the implementation of RIs for terrestrial operable units.

Comment 115. An evaluation of the speciation of chromium is necessary in that there is a significant difference in public health effects of trivalent and hexavalent chromium. The primary difference between the two species is that hexavalent chromium has been classified as a known human carcinogen (EPA class A) through inhalation, while the trivalent species has not been so designated.

Response: Acknowledged. Chromium speciation is specifically identified as an activity for further study in the plan (Activity 1A-4).

Comment 116. An evaluation of the public health effects of contaminants present in the corrosion products within the reactor outfall lines must be made, particularly the introduction of scales or pipeline "sediment" into the river during decommissioning and/or removal.

Response: Chapter 5 contains a river sediment characterization task, and sediment contamination will be evaluated in the baseline risk assessment. Suspension or redistribution of pipeline contaminants resulting from removal or remedial actions will be addressed as part of the cleanup decision process.

Comment 117.† Specific evaluation is necessary concerning the public health effect of crops irrigated with river water. Results in the DOE annual environmental reports suggest that no significant impact have occurred or are occurring.

Nevertheless, a specific evaluation is necessary for the public health effect of human consumption of irrigated crops, relative to the reported contaminant concentrations in the river water. This evaluation would be useful in informing the public on the specifics in this issue.

Response: The suggested pathway would be considered in a future baseline risk assessment.

Comment 118. Specific evaluation must be made of the human health effects of contamination entering the river environment from seeps, particularly the "N-springs" and "Hanford Reach Mile (HRM) 28" springs/seeps. These areas both have elevated levels of radionuclide contamination. Definitive statements need to be made addressing the level of threat and the remedial requirements for these areas.

Response: Further investigations to obtain data to allow for a detailed assessment of the effects associated with the discharge of contaminated groundwater into the Reach are proposed in Chapter 5. The effects of contaminated seeps associated with terrestrial exposures along the river bank will be assessed as part of terrestrial operable unit RIs.

Comment 119. In the evaluation on the effect on the biota, care should be taken to address the concerns of Native Americans. The wider use of the living natural resources by Native Americans could result in exposure to biological pathways not a consideration in Non-Native American cultures.

Response: Baseline risk assessment conducted using HSBRAM would allow consideration of concerns of Native Americans.

Heart of America Northwest

Comment 120. The Columbia River and the health of the public using it are in serious jeopardy from past and present Hanford operations. The threat is not only from the flow on contaminated groundwater into the River, but, from: radioactive "shine" exposing users of the Columbia River and shoreline near reactors, cribs and basins; leaching of contaminants, including mercury, from old reactor discharge and pipes and other facilities; contaminated shoreline and island sediments/beaches, including flakes of radioactive material from old reactor piping and "chips" of irradiated reactor fuel and fuel cladding washed into the River when the "once through reactors" operated. (It was known 30 years ago to cause "significant" public radiation exposures to users of the Columbia River islands and beaches. But, the documents were classified while the public was encouraged to use the Hanford Reach of the Columbia River.)

The CRIEP does not address the threats in comment 119. In fact, this document fails to address the known contamination, from numerous operations and contaminants, of the groundwater. Despite numerous reports and existing data required to be collected by federal and state law (i.e., RCRA and RCW 70.105) on contaminants known to either be impacting the River, or threatening the River, the CRIEP ignores all data except that regarding six contaminants of concern. In this regard, one can only reach the conclusion that this document was prepared solely with a public relations goal in mind; and, either



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incompetently, or as part of a willful cover-up, failed to even include known contaminant data; estimates of health risks to children utilizing the Hanford Reach for recreation; data on potential for irrigated crop contamination; information of a definitive health risk to Hanford Reach users from radioactive "shine" -- to name just a few of the shortfalls of this study.

Response: See the response to Comment 100. The contaminants of potential concern were identified on the basis of an extensive study, part of which is included as Appendix B, that was performed to evaluate the feasibility of large-scale groundwater remediation options for the Hanford Site. All existing groundwater data were used in the development of the study. Child exposure parameters were not used in the preliminary impact evaluation presented in Chapter 4 for the sake of model simplification. (All models, even the most detailed baseline risk assessments, are simplified representations of reality.) Focusing the model in this manner was appropriate given the purposes of the preliminary evaluation:

- To develop an hypothesis that can be tested with a subsequent detailed baseline risk assessment; and,
- To identify data needs for the baseline risk assessment.

The results of the preliminary evaluation are offered as preliminary order-of-magnitude estimates. If child exposure parameters would have been included, one could have expected the results to have increased by less than 20%, which is well within the noise range of an order-of-magnitude estimate (± 900%).

Comment 121. Amazingly, the CRIEP failed to disclose and discuss known contamination and exposure threats which have been ranked by regulators as serious enough to warrant listing as CERCLA Expedited Response Action sites. E.G.: The CRIEP fails to disclose or discuss mercury as a "contaminant of concern" despite listing it in document WHC-SD-EN-TI-037 as a "contaminant of concern" due to known spills and disposal via 100-D/DR area pipelines to the River, with the likelihood of continuing releases to the environment.

Response: The document referenced in the comment was reviewed by the authors. The document in question was a geology report of the 200-BP-1 operable unit. No reference in the document to disposal of mercury in the 100-D/DR area was found. Also, see response to Comment 9.

Comment 122. Perhaps the most incredible aspect of DOE's CRIEP is the use of a model to assess and quantify health risks to River users which deliberately excluded ALL CHILDREN and teenagers from its recreational exposure scenario:

> "the recreational scenario assumes that adults are the only receptor population and that young children do not need to be evaluated for this scenario" CRIEP, page 72.

Response: See the final portion of the response to Comment 120.



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Comment 123. The CRIEP's usefulness is further destroyed (beyond the selective use of data and use of a model that excluded children) by being based upon four year old data ["Hanford Site Groundwater Monitoring for 1989"] which is known to exclude RCRA Groundwater Monitoring Reports that include monitoring data on far more contaminants, and which reveal far greater concentrations of contaminants moving more quickly to the River.

Response: See the first paragraph of the response to Comment 120.

Comment 124. The CRIEP, therefore, must be rejected by EPA and Ecology as totally inadequate and deliberately misleading. Thus, because the production of this plan was an important milestone of the Tri-Party Agreement (and frequently proffered to concerned citizens as the future basis for decisions on protection/usage of the Columbia River) the DOE (and its contractors) should be assessed a serious fine for failing to produce a report meeting the milestone and the requirements of CERCLA and MTCA. This penalty should be set sufficiently high so that the contractor who produced this report pays entirely for the regulators to procure a qualified independent assessment of impacts to the River and potential health threats.

Response: Assuming that this comment refers to Chapter 4, the purpose of the preliminary evaluation (based on a simplified model that, as a whole, is quite conservative) is to focus further river investigations to provide data that are needed to complete a detailed baseline risk assessment for the Reach relative to 100 Area releases. The preliminary evaluation thus provides one of the bases for further investigations, while the detailed baseline risk assessment that uses the new information derived from the investigations (as well as new information derived from terrestrial operable unit RIs) will serve as one of the bases for making decisions on remedial options for the river (relative to the 100 Area).

Comment 125.† At this time, the DOE should also be required to consider the Columbia River Shoreline as the location for assessing annual exposure to the potentially maximally exposed member of the public. It is abundantly clear that the shoreline is the point of uncontrolled public use where public exposures and risks are greatest. This would mean abandoning the artificial claim that the maximally exposed individual is a resident living outside the official site boundary. Radioactive "shine" alone would expose the hypothetical public user/resident (remember Native Americans have an enforceable treaty right to live along the public access shoreline incident to exercising fishing rights) to an increase in radioactive exposure up to 800 percent above the EPA's legal limit for exposure of the public to radiation from all nuclear fuel cycle source (25 millirem per year), and this increase is just an average for certain shoreline areas – some areas would yield that dose in four weeks of exposure. Averaged over an entire section of Hanford Reach shoreline (i.e., the 100-K and 100-N Areas), annual exposures may range over 300 millirem – approximately three time the exposure for non-hanford shorelines. This would conservatively cause an expected additional eight fatal cancers per year per 10,000 population exposed.

Contrast this conservative estimate of potential impact from use of the Columbia River at Hanford with the claimed no significant impact in the DOE CRIEP. Yet, data on shoreline exposure levels are DOE's own data.

Response: Comment noted.

Comment 126.† There is no conceivable explanation for why the DOE's CRIEP excluded consideration of the health impacts of radioactive "shine" from Hanford facilities while claiming to assess Hanford's potential impact on the River and public users of the River.

Response: Acknowledged. Shine was acknowledged in the document, but deferred to terrestrial operable units for evaluation. This decision was made for logistical reasons as terrestrial operable unit Remedial Investigations will provide the information needed to evaluate this type of exposure. By acknowledging shine in the CRIEP, however, the need to use the information gathered in the terrestrial operable unit RIs in future detailed assessments of river use by the public is also acknowledged.

Comment 127.† Any new study must also consider the impacts of continued liquid waste discharges in terms of both increased contaminant load on the vadose zone and groundwater and the flushing of contaminants into groundwater and the River. A new study must also use data from RCRA groundwater monitoring programs – which reveal greater contaminant concentrations than this report – and an independent, credible assessment of health impacts from hazardous and carcinogenic groundwater contaminants.

Response: Acknowledged. Information gathered during terrestrial operable unit RIs will be used to evaluate baseline risks to the Columbia River. RCRA, CERCLA, and other DOE monitoring data are all used in cleanup decisions.

Columbia River United

Comment 128. Since 1943 the Hanford Nuclear reservation has been polluting the local and regional environment with radioisotopes, metal and chemical contaminants. Columbia River United hoped the CRIEP would honestly address the actual impact of fifty years of unsound environmental practices on the Columbia River ecosystem. After reviewing this document, Columbia River United must reject it as totally unsatisfactory as the found it to be only a White Wash, "Do Not Alarm The Public", everything is "A OK". It is hard to believe that after so much public involvement that the authors of this report actually thought Columbia River United would accept this form of cover up. Putting it directly, this report is a disgrace to good science and the agencies responsible for its production.

Response: The preliminary evaluation in Chapter 4 indicates that a complete assessment of 100 Area impacts on the Reach is not possible at this time. Therefore, further, although focused, investigation activities are proposed in Chapter 5.

Comment 129. To begin with, the report does not include all the data that has been gathered for the last 43 years. It does not include all effluents dumped into the

Columbia River from all sources, reactors, groundwater seeps, spills, radioactive shine, etc. The study does not address the air emissions being generated from all of the production facilities. It is as though the authors were given limited data and had no background of the past practices of the Hanford Complex, and were asked to put this evaluation together.

Response: Available monitoring data generated during the history of the site was examined and evaluated. It was beyond the scope of the document to provide an exhaustive summary of all available monitoring data. An effort was made however, to provide through the bibliography additional resources on effects of historical operations of the site on the Columbia River.

Comment 130. Page 2, paragraph 3. "In addition, the study extends upstream a sufficient distance to provide appropriate control information for evaluating impacts. The use of sample locations at Priest Rapids Dam or Vernita Bridge as controls assumes that these areas have not been significantly impacted by Hanford air emissions." This assumption is erroneous considering what the two ongoing health studies have shown in reference to fall out from Hanford. Do these researchers truly believe that what came out the stacks at Hanford never came down? Columbia River United recommends that the Brewster/Grand Coulee area is used for a control area.

Response: The Priest Rapids Dam and Vernita Bridge locations have long been used as upstream control stations for Reach monitoring. More detailed monitoring of the river has demonstrated that the Hanford Site has never had any discernable impact to water quality or sediment quality of the upstream portions of the Columbia. While past air emissions have been transported upstream, the amount of fallout into the river was insignificant and no increased concentrations of any substances have ever been detectable. The health studies referenced have also come to this conclusion; furthermore, the substances of concern in these studies have been shown to be short-lived isotopes that have not been released in significant quantities for more than 40 years. Moving the control stations to the Brewster/Grand Coulee area would adversely impact the quality of the monitoring data, as there are a large number of agricultural, domestic, and municipal inputs to the river between this area and the Hanford Reach that would confound data analysis.

Comment 131. Page 9, paragraph 5. "The Hanford Reach has been designated by the State of Washington as a Class A (Excellent) water body (Chapter 173-201 WAC). Such waters are suitable (and must be maintained suitable) for essentially all uses, including raw drinking water, recreation, and wildlife habitat." By stating this fact the report leads the reader to believe that all water along the Hanford reach is class A Excellent. This is not the truth. There are various areas along the shoreline that if one was to drink the water, they would exceed their maximum lifetime allowable dose. The plan fails to disclose and discuss known contamination and exposure threats which have been ranked by regulators as serious enough to warrant listing as CERCLA, and expedited response action sites. An example is mercury which was listed as "contaminant of concern" , WHC-SD-EN-T1-037. The plan fails to even mention RCRA Groundwater Monitoring Reports.

Response: It is our understanding that there has been no change in the designation of the Columbia River as a Class A (Excellent) water body and therefore, the statement is still factual. The CRIEP points out that contamination is entering the river and there are discharges that pose a risk on a localized basis. The DOE is addressing this contamination on a programmatic basis to ensure that water quality of the Columbia River is not degraded.

Comment 132. Page 61. One of the most alarming statements in the report was, "the recreational scenario assumes that adults are the only receptor population, and that young children do not need to be evaluated for this scenario". These assumptions are factually incorrect. Since when has the river been posted for "ADULT USE ONLY"?? Columbia River United believes that the effects of children would change the whole risk assessment and the intent of this report was to show no impact so children could not be considered. Go to any recreational area and you see children.

Response: See the final portion of the response to Comment 120. Note that exposure to children would be evaluated in the detailed baseline risk assessment.

Comment 133. Page 61. The CRIEP completely covers up the facts that there are severe health risks posed to the public at the outfalls, i.e., 200,000+(pCi/L) for tritium, 7,279pCi/L for strontium. It does not talk about the exceedingly high exposure from radioactive shine that the public could receive by spending time around the 100-K and 100-N areas and yet in this document they state "no immediate health effect". What about a few years later? The CRIEP states "that river users have limited access to the river bank along the Hanford Site". It's amazing that the authors can state such a fact, when in fact the Hanford shoreline might not be totally accessible in 1993, but all of the islands are, and there has been severe environmental degradation.

Response: See the response to Comments 120, 124, and 126.

Comment 134. In 1992, the Hanford Reach was nominated for a Wild and Scenic River designation, which will draw many more river users to the Hanford Reach, resulting in more exposure and more human health impact. The report completely suppresses scientific evidence showing that the Hanford Reach is severely degraded. The report downplays the impact DOE has made on the Hanford Reach for the past 50 years.

Response: If it were not for the existence of the Hanford Site, in all likelihood there would be no free-flowing Reach and, therefore, no proposal to establish a federally-designated wild and scenic river. Furthermore, if the Reach were severely impacted, it is doubtful that anyone would have nominated it for wild and scenic designation.

Comment 135. Page 73. The modeling for the recreational user is based on a one day a year exposure rate for 30 years. This is hardly a realistic number and again shows the blatant effort to reduce the potential human health impact. The authors refer to the cancer rate of x, but yet they never mention other health effects caused from radiation exposure.

Response: The modeling for this preliminary evaluation was based on an average exposure rate for the whole population. The concentrations of radionuclides needed to cause health effects other than cancer are significantly greater than concentrations that cause cancer. Therefore, the evaluation of cancer is the most conservative estimate.

Comment 136.† Page 41. The lack of consideration of the river sediment pathway is very telling as it is the sediment not the water where contaminant problems usually show up. "This does not necessarily mean that significant impacts have not occurred, only that the tools to evaluate impacts are lacking. Consequently, impacts due to river sediments will not be evaluated further in this report." This statement alone should make this report meaningless. Columbia River United recommends that the EPA and Ecology reject the CRIEP. This plan should be an embarrassment to all agencies. It is not scientifically sound and appears to have only been produced to suppress what is known of the true impact to the Columbia River ecosystem. As the production of this plan was an important milestone of the Tri-Party Agreement, DOE and its contractors should be assessed a serious fine for failing to meet a milestone and the requirements of CERCLA and MTCA. The penalty of this fine should be high enough to allow the regulators the procurement of a qualified independent assessment of the Hanford Reach/Columbia River and the true potential human and aquatic health impacts. This future document should be directed by the new Hanford site specific advisory board.

Response: Accepted in part. While sediments are not included in the preliminary quantitative evaluation in Chapter 4, note that Chapter 5 contains provisions to obtain data necessary to conduct such an evaluation in a baseline risk assessment. The statement in question will be modified to read: "river sediments will not be addressed further in this preliminary evaluation." This should eliminate any confusion on this issue.

Oregon Department of Energy

Comment 137. We reviewed the CRIEP, DOE/RL-92-28 Revision 0. We were very disappointed.

Response: Acknowledged.

Comment 138. We doubt the authors intended it, but the choices and assumptions made in the CRIEP seem to minimize the calculated risks at each step. This works against the protection of the public health and the public interest. It is important that this not happen in the implementation of the CRIEP activities. We encourage that outside interested parties (especially opposed parties) be included in all aspects of the implementation of the CRIEP to act as a counter balance against such effects. Our detailed technical comments are attached.

Response: Most of the assumptions used in the representative exposure pathways are quite conservative (e.g., no radiological decay, line source discharge of groundwater). Experience has shown that deterministic risk estimation done in accordance with EPA guidelines or the state MTCACR usually result in bounding estimates that exceed the 99.9th percentile of the distribution of risks for individuals chosen at random from the population of interest. New EPA

guidelines have defined bounding risk estimates as invalid for remedial decision making. Bounding estimates are appropriate for screening purposes and, as the preliminary evaluation in Chapter 4 is used to focus on contaminants and locations of most concern, the deterministic estimation is used appropriately. As the Tri-Party Agreement requires ongoing public review, opportunities for involvement in river characterization activities are ensured.

Comment 139. The CRIEP is limited solely to meeting milestone M-30-02. This milestone incorporates parts of milestones M-30-01 and M-30-03. These milestones state:

M-30-02 "Submit a plan (primary document) to EPA and Ecology to determine the cumulative health and environmental impacts to the Columbia River, incorporating results obtained under M-30-01."

M-30-01 "Submit a report (secondary document) to EPA and Ecology evaluating the impact to the Columbia River from contaminated springs and seeps as described in operable unit work plans listed in M-30-03."

M-30-03 "Complete all non-intrusive field work as identified in draft work plans for the following OU work plans: 100-HR-1, 100-DR-1, 100-BC-1, 100-BC-5, 100-KR-1, 100-KR-4, 100-NR-1, 100-NR-3, and 100-FR-1."

Response: Acknowledged.

Comment 140. The structure of the CRIEP is difficult to follow. The body of the "plan" is presented in chapter 5. The earlier chapters are dedicated to analysis of prior data. This is confusing. The document would be easier to understand if the "plan" is presented first, with the supporting information identified in separate chapters following the CRIEP.

Response: Acknowledged. Comments received from the public indicate significant confusion. As the preliminary evaluation of existing data is used to identify the data needs for Chapter 5, we believe that the current order of the presentation is appropriate.

Comment 141. Chapter five is written mostly in third person. The language used is highly tentative. It uses an excessive number of could's, should's and may's. The language of chapter five needs to be in first person direct form. It must specify the work to do, who will do it, and how to fund it.

Response: Acknowledged. The plan identifies the work that needs to be done to correct identified data gaps. It is beyond the scope of the document to identify specific organizations to conduct the work or how it should be funded.

Comment 142. The CRIEP identifies a proposed timeline for the activities in Table 5-1. This should be expanded to include all of the steps and sub-steps of the CRIEP and the responsible party(s) for each. To succeed the CRIEP needs to have defined tasks and goals with definite funding and schedules for completion. As additional data is collected, these dates and funding may need revision. The CRIEP needs to identify this, and allow for it.

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Response: The scheduling is consistent with Tri-Party Agreement procedures (note that RI and FS schedules are incorporated by reference). Funding is a programmatic responsibility that is beyond the scope of the document.

Comment 143. Many of the comments below and in our detailed technical comments are also stated in Chapter 5. Throughout our comments, "the CRIEP" refers to the entirety of the document in addition to the items in Chapter 5. The supporting information in the early chapters make several bad assumptions:

1. The CRIEP assumes that carcinogenic and other health impacts from radionuclides are not additive. This is evident from the way the nuclides of concern were chosen. The CRIEP excludes all nuclides which fail to individually exceed a regulatory limit. This neglects the cumulative effect of similar radiation from a variety of radioactive isotopes. Isotopes which behave in a similar manner chemically, and which emit similar radiations can be expected to cause similar damage. Because of this it is not justifiable to neglect each isotope that fails to exceed a regulatory limit prior to the calculation of exposure.

   There is no stated justification for assuming that the effects of radiation exposure from different isotopes are not additive, cumulative or synergistic. Lacking such data, it is important that all exposures be considered. For many isotopes, the exposure will be far below regulatory or health concern. The appropriate place to reach this conclusion and eliminate these is in the conclusions section of the report or plan, rather than in the data collection sections.

   By this, we do not mean to argue that sampling and analysis should be done for all individual isotopes no matter how infinitesimally small the exposure. It is important that the analysis include isotopes whose concentrations are at levels near to, but below the regulatory limits. The amount of money expended should be proportional to the potential risk. For initial analysis, testing for more isotopes is justified based on a lack of information about what may be present.

2. The CRIEP seems to make the implicit assumption that chemicals and nuclides are safe until proven harmful. This has been common practice until recently. It does not ensure that no harm is done, and it tends to minimize the apparent impacts of pollutants prior to determining whether there is a significant hazard or not.

   This is most evident in the discussion of hexavalent chromium. Hexavalent chromium is a known human carcinogen by inhalation. There is not sufficient information to judge its carcinogenic potential by ingestion. On page 70, the CRIEP states flatly that chromium is NOT carcinogenic by ingestion. This is wrong. Chromium has not been demonstrated to cause cancer by ingestion in humans. This is a far cry from demonstrating that it does NOT cause cancer by this route, especially when it is a known carcinogen via inhalation, a suspected carcinogen by skin contact, a known mutagen by numerous routes, and a

known neoplastigen. (Reference: Carcinogenically Active Chemicals, Lewis, 1991)

3. It is evident by the selection criteria (exceeding a regulatory standard) that the CRIEP assumes current standards for protection of health from chemicals and radionuclides are sufficient to guarantee safety. This is untrue. The regulations are based on the same assumption as item two above. They limit exposures to the levels which have not been shown to cause harm. This does not mean that they are harmless below these levels. This basis is very different from standards, such as those produced by the Food and Drug Administration which are usually based on levels which have been shown to be safe. Many of these standards are expected to be revised downward.

4. The CRIEP bases its evaluation of radionuclides on the BIER III information. It should use the BIER IV information. This increases the risk estimate by at least a factor of three. (See second paragraph on page 73. Given the uncertainties in the risk associated with low dose radiation exposure through both direct and indirect paths (e.g. immune system suppression or activation), all risk estimates in the CRIEP should be increased. They should be multiplied by a factor of 3 to account for the BIER IV report data. This is the latest data. Use of the BIER III data underestimates the risk. Even use of the BIER IV data will not a conservative estimate. It will only bring it in line with the most current information.

   Data on health effects of low dose radiation exposure is limited (first sentence on page 73). To be conservative, the risk results based on BIER IV should be multiplied by an additional factor of 10. This additional factor of ten is needed to account for the margin of uncertainty in our knowledge of the effects of low dose radiation exposure as discussed in the CRIEP.

   This yields a total multiplication factor of 30 times the risk estimated by the CRIEP for radionuclides. Because the CRIEP excludes all individual radionuclides that fail to exceed a regulatory limit by themselves (with 1989 data), the risks are potentially even higher than 30 times the risk stated in the CRIEP.

   The use of conservative estimates is necessary. On the other hand, if baseline estimates using the 'best' and most recent available data are not also presented, the study and plan may over state the risks. It would be reasonable for the CRIEP to contrast a base case using a linear model against a conservative estimate with the additional factor of 10 included.

5. The analytical model of the river used in the CRIEP is grossly different from reality. The river has numerous pools, margin areas, and sloughs with very low flow rates. These support a great deal of plant and animal life. The model may be helpful as a rough first estimate of effects, but it is of little value beyond that. A much more detailed model that includes the actual locations of releases is essential for the CRIEP to be meaningful. The cost of a mathematical model may be prohibitive and

unjustified. The model may need to be a physical or empirical model to yield meaningful results at reasonable costs.

6. The CRIEP bases its analysis of cumulative health impacts on exposures from on-going releases and fails to address historical contributions to the river and its sediments from reactor operations. M-30-02 makes no such limitation in scope. The historical releases of chemicals and radionuclides directly to the river must also be covered. This will dramatically impact the sediment pathway. The CRIEP ignores all aspects of chemical and radionuclide transport via the sediments.

7. The CRIEP ignores many routes of exposure, including skyshine, skin absorption and bioaccumulation through sediment and detritus. The CRIEP ignores the stagnant or low flow effects of the sloughs which were used as filtered discharge paths. It also neglects the low flow effects of the pools and channel margins. These low flow areas of the river are highly used by river life and may also be used by people. The aerial radiation maps of the site show these areas and the islands to be the most highly contaminated areas of the river.

8. The CRIEP is limited to the 100 areas. This appears to be a consequence of the milestone M-30-00 specifically addressing the 100 areas. It is a mistake to limit this plan solely to the 100 areas. The effects on the river occur across the entire length and breadth of the river.

   If the CRIEP is limited to the 100 areas, a separate study and plan will be needed for the rest of the river impacts. These will then have to be coordinated. The CRIEP must include study of intentional and unintentional discharges to the river, as well as uncontrolled releases from seeps, streams and surface contamination and runoff. The effects of the plumes from the 200 areas, the 300 areas, the 1100 area and specific discharge points must also be included.

   It makes more sense to integrate the entire site characterization and all site impacts on the river into a single plan and study. The fish and other biota of the river do not distinguish between one area of the river bank and another. They move along its entire face. Likewise, the river flows past the entire length of the site and the effects accumulate. The consequences to people downstream are cumulative. By treating them separately, this is missed.

9. The CRIEP assumes the hazards from contamination of the river by the site can be adequately assessed by subtracting the levels of contaminants and nuclides measured above the site from those below the site. The wide variations in river conditions and transport mechanisms make this assumption extremely suspect.

   This assumption makes it easy to ignore the effects of the Hanford site due to the mass of materials measured in the river background.

The added impacts from the site need to be assessed first by themselves, then in contrast to the background from natural sources and bomb debris. The EPA standard of one in a million risk of cancer is easily lost in the natural background cancer risk of 1 in 4.

10. The CRIEP states that no assessment has been made of the effects of sediment on radionuclide transport or fate. If a significant portion of the radionuclides are absorbed or adsorbed on sediments, they may not be found during water analysis. Filtration is commonly employed in water analysis as a first cleanup step. If they are carried on sediments or as colloids or with colloids, they may be filtered out prior to analysis being performed. The CRIEP does not detail the procedures used to analyze the water samples.

11. The CRIEP talks about the decreasing levels of nuclides in the river and leaves the impression that this implies that the levels of nuclides from the site are decreasing. This may be true, but is not supported by the data presented. The radioactive materials in the groundwater from the site have only just begun to enter the river. If no action is taken, these levels will likely continue to rise as radioactive materials are swept out of the soil column and into the aquifer.

    The decreasing levels of radionuclides in the river are attributable to the decay and removal of radionuclides left over from the atmospheric testing of atomic weapons. At the moment, the total levels show a decrease over time due to this effect. This may be reversed in the future as the contamination plumes flow into the river.

12. With the exception of chromium, the CRIEP fails to address reproductive and other hazards to fish and aquatic life which may require the use of lower standards for contaminants and radionuclides than those written into law. Many of the contaminants have reported impacts on aquatic life which are at levels considerably lower than the regulatory standards. The regulatory standards are based primarily on the protection of human health, and often do not consider the impacts on other animals or plants. As a consequence, for large releases, the indirect health impacts on people may exceed the direct impacts.

13. The CRIEP does not adequately address the health hazards posed to the aquatic ecosystems by the exposures in the river. This is particularly important for the endangered and threatened species.

14. The CRIEP makes no mention of other impacts on wildlife. Birds along the river use the muds and plants to build nests. These nests may be highly radioactive. The eggs and young birds are highly exposed to these muds and materials. At other sites around the nation, birds have used such nesting materials and spread radioactive contaminants across great distances. In some cases, they have moved these materials into structures which then set off radiation monitors. (INEL - Naval Reactors Facilities 1970's)

Other animals also use the streamside muds. These will need to be studied as well. Fish lay their eggs in the river sediments and gravels. This close proximity places them at risk.

15. The CRIEP views the river as a steady and unchanging thing. The natural cycles of the seasons, of day and night, floods, changes in power production at the dams, and of rising and falling water levels add greater complexity to the river. The CRIEP makes no effort to analyze what effects these variations may have on the shoreline, river margins, sloughs, pools and groundwater. These must be included if the CRIEP is to be meaningful.

Response: This comment was comprised of a number of separate comments. These are addressed individually using the numbers in the comment.

1. Acknowledged. See responses to comments 1(1st paragraph), 100, and 120.

2. The CRIEP does not intend to make any implicit assumption about the safety of any chemical or radionuclide. We have tried to be as explicit as possible that the CRIEP is a plan to guide data collection activities that would be used in a baseline risk assessment. It should be noted that the EPA IRIS database does not consider chromium to be carcinogenic via the ingestion pathway. Thus, it is not our bias that but rather the EPA IRIS database that guides our conclusions.

3. Agreed. The CRIEP used a standard to select contaminants for evaluation of selected exposure pathways to evaluate available data. The limitations are explicitly acknowledged in the report and that a baseline risk assessment, to be conducted, will consider a comprehensive list of contaminants and exposure pathways.

4. The reviewer misinterprets the method used to evaluate radiation exposure. On page 73 (paragraph 1), the CRIEP states that EPA guidance is based on the use of BEIR III and that the use of BEIR V (misstated by the reviewer as BEIR IV) could yield three times the risk. It was also noted that BEIR V states that the risk may be zero. Given the information in BEIR V, it is uncertain why the reviewer now wants to multiply by an uncertainty factor of 10 to 30. Also, since the CRIEP did not include a risk assessment, but a conservative screening, comparisons with a "base-case" risk assessment, using all pathways and contaminants, would be difficult. This idea may be feasible and a worthwhile goal in the comprehensive river assessment, but the tendency for achieving support for a risk assessment is to use the most conservative numbers and assumptions, especially when data have to be interpreted.

5. All models are simplifications of reality. The value of any model is to explicitly define the system and any assumptions used to derive the description of the system.

6. Historical contributions can only be evaluated by the residues that are left behind. It is counterproductive at this point to hypothesize what might have occurred during reactor operations because there is no way to test the hypothesis. Rather we can only note the condition of the river as it exists, compare it to a reference area and evaluate impacts as they are, not as they might have been. The CRIEP, however, does not ignore the sediments, but addresses past studies in Section 2.2.3, and proposes additional studies to characterize them so that a risk assessment (please keep in mind that the CRIEP is not a risk assessment) can be done.

7. Acknowledged. See response to comment 1, 100, and 120.

8. Acknowledged. This is the directive of the milestone M-30-00

9. Acknowledged. The CRIEP subtracts background to identify effects that can be attributed to the site. This is the most logical way to determine if the site poses a risk. It will be the decision of the risk managers to determine if the risk is sufficiently greater than background risks to warrant further action.

10. Acknowledged. It is beyond the document scope to discuss analytical methodologies.

11. Acknowledged. Most of the plumes from the 100 Area have reached the river. Consequently, it is unlikely that concentrations will rise much above their present levels, with the possible exceptions of N-springs and during remedial actions.

12. This was a limited evaluation meant to provide a hypothesis for testing by a baseline risk assessment.

13. The CRIEP provides several activities meant to assess and evaluate contamination in aquatic ecosystems (Activities 2-1 and 3-1), toxicity to aquatic organisms (Activities 4-1 and 4-2), and identify sensitive habitats (Activity 4-3). The reviewer should provide specific examples of where the plan fails to address aquatic ecosystems.

14†. Acknowledged. The identified pathway will likely be considered during a baseline risk assessment.

15. Acknowledged. The CRIEP consisted of a simplified evaluation of selected pathways to evaluate existing data collection activities to determine if the available information would support a baseline risk assessment and plan that would support collection of additional data since existing data were found lacking. It was beyond the document scope to provide an all encompassing study of the river and its ecology.

Comment 144.† Page 2. Final paragraph of section 1.1, first sentence. "Although the plan is limited in scope to the 100 Area and contaminants that are found there,"... This may meet the limited requirements of the milestone, but is overly limiting in understanding the impacts on the river. The river receives contaminants from the entirety of the site. It is important that



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ALL sources be evaluated together. The river and the river ecosystem do not distinguish between the various areas. These are man-made distinctions. They do nothing to protect the river and its ecology. This may necessitate a modification to the tri-party agreement to produce a meaningful plan.

Response: Acknowledged.

Comment 145. Page 3. First paragraph, fourth sentence. "To complete this plan, only existing, readily-available information was used." This overly limits the CRIEP. Does this imply that classified information was not used, even when it was potentially available?

Response: Classified information is not available to the public. Only information that was publicly accessible was used.

Comment 146.† Page 3. Item 1 makes the assumption that the hazardous components in the ground water will never be at higher levels than they are today. No justification is given for this assumption. Future levels of groundwater contaminants may easily be greater than those today due to migration of radionuclides and hazardous materials out of the soil column and into the groundwater.

Response: Acknowledged. Terrestrial operable unit RIs will evaluate the potential for increased groundwater contamination in the future, but insufficient information exists today to perform such evaluations. The concern noted is more than compensated for by assuming that the entire plume is at the 1989 maximum concentration and that the entire plume enters the river as a line source.

Comment 147.† Page 3, Item 2 makes the implicit assumption that any pathway other than that of river water as the primary transport medium is of negligible and ignorable importance. No justification is given for this assumption. As noted in later comments, the CRIEP itself indicates that skyshine, sediments and agriculture are major routes that must be considered and evaluated.

Response: The pathways selected for the preliminary evaluation are judged to be those that are most significant (except for the exclusion of sediment on the basis of insufficient data at this time). This is sufficient for the purposes of the preliminary evaluation. A detailed pathway evaluation will be included in the baseline risk assessment.

Comment 148.† Page 3. Item 4. The selection of the pathways is unjustified. The pathways must be individually evaluated based on data, rather than on paper assumptions.

Response: See the response to comment 147.

Comment 149. Page 3. Item 6. In addition to data gaps, additional data collection is needed for all hazardous and radioactive constituents known to have been discharged to the soil, river or groundwater. The depth of this analysis should be based on the findings of the analysis as they occur. It would not make sense

to drill wells every 100 feet on a grid and analyze all wells at all depths for all nuclides and all hazardous materials. It does make sense to do broad screening analysis and focus the analysis from there. It will also be more cost effective. Initial screening of this data will probably rapidly reduce the amount of data collection needed.

Response: Acknowledged. Terrestrial operable unit RIs are evaluating soil and groundwater contamination. This plan was intended to provide additional data collection in the river that was not covered by existing monitoring or data collection programs.

Comment 150.† Page 5. First paragraph, fourth sentence. "It is expected that any significant adverse impacts associated with activities in the 100 Area would be observed in the Columbia at the point of impact or immediately downstream of the 100 Area." Additional impacts must be considered.

A. Any downstream location which may act as a collection point for radioactive materials, especially the sediments behind the dams.

B. The dredged river sediments. The dams act as natural accumulation points for silt and soil. In time this must be dredged and the dredge spoils moved. If these soils are used for crops, the radionuclides deposited behind the dams may enter the human food chain.

C. The Hanford area is noted for its dust storms. These storms can disperse any radioactive materials on or near the surface over a broad area, including areas upstream of the contaminated areas.

Response: Acknowledged in part. Chapter 5 recommends extending the study area downstream to include McNary Reservoir. We agree that a dredging scenario should be considered for evaluation in the baseline risk assessment. With respect to the potential for discernable atmospheric contamination of the Reach from Hanford activities, see the response to Comment 130.

Comment 151. Page 12. Third paragraph. "On the basis of 1989 results"..."if their concentrations exceeded"... This paragraph carries several implied assumptions. Each of these must be justified.

A. The levels of contaminants found in 1989 are representative of those today. The 1989 data may be the most representative, or most recent. The CRIEP should clarify the reasons for the selection of this data set. It is appropriate that the available data from all years including 1989 be used, but the study and plan should not limit themselves to this data set.

B. The testing in 1989 was comprehensive and adequately identifies all plumes of all contaminants.

C. The groundwater is contaminated by materials which are wholly in the aquifer and no other source of material exists to charge the aquifer.

D. Any contaminants held up in the soil column that did not contaminate the groundwater to levels above the groundwater standards in 1989, will not reach levels which will exceed the standards or at which they are hazardous at any time in the future.

E. The national and state standards are sufficient for the protection of health and will not be lowered.

F. The contaminants do NOT act synergistically in their effects on the ecosystem or human health.

G. The contaminants do NOT act cumulatively in their effects on the ecosystem or human healthy. (Cumulatively with exposure over time.)

H. The contaminants do NOT act addictively in their effects on the ecosystem or human health, even if individual contaminants are found at levels below their individual limits. (Addictively by similar effects from different contaminants.)

I. The wells in the 100 areas adequately represent the groundwater.

Response: This comment was comprised of several separate comments. These are responded to individually.

A. Acknowledged. The report specifies that the 1989 data set was used because it was the most complete at the time the report was written. "Today" is a relative term. The use of data sets from previous years is relevant if it is desirable to examine trends.

B. The report states that data from existing data collection programs was used. See the response to comment 120 (1st part).

C. Acknowledged. This is only a plan to provide data to support a baseline risk assessment, the source and groundwater operable unit RIs will determine potential impacts to groundwater from contaminants in the vadose zone.

D. Acknowledged. See response to comment 151, part C.

E. If any national or state standards are lowered, those changes can be considered at that time. Until that possibility arises, the best and only defensible operating assumption is that the standards are stable.

F†. Interactions among contaminants will be evaluated in a baseline risk assessment.

G†. Cumulative effects will be evaluated in a baseline risk assessment.

H†. Additive effects will be evaluated in a baseline risk assessment.

I. Acknowledged.

Comment 152. Page 23, Tables 2-3 and 2-4. Table 2-3 does not list plutonium-241 or americium-241. These should be listed for completeness. Table 2-4 does not list plutonium-239 and 240, or americium-241. These should be listed for completeness.

Response: Woodruff and Hanf do not report plutonium-241, americium-241, or any other radionuclides not listed in the tables.

Comment 153. Page 32, fourth bullet. This bullet states that "These isotopes accumulated in aquatic organisms." This disagrees strongly with the last paragraph on page 36, which states that these isotopes do not accumulate in aquatic organisms! The CRIEP must include research and studies to determine which of these is correct.

Response: The reviewer has misstated the text in question. The fourth bullet on page 32 states that "These isotopes accumulated in aquatic organisms." This is a conclusion of the Robeck et al. (1954) study. The last paragraph on page 36 states that bioconcentration factors were lowest in higher trophic levels. This is considerably different from the reviewers characterization of the text "... which states these isotopes do not accumulate in aquatic organisms!" However, activities are proposed to assemble and evaluate biocontaminant monitoring data. It is not necessary to propose more research at this time.

Comment 154. Page 34, Table 2-7. There are numerous entries in the table showing negative concentrations of nuclides in the sediments. In three cases (ruthenium-106, cesium-134 and cesium-137) these are statistically significant and outside the error limits. These negative values bring all of the data into question. These must be explained and new data collected. The analytical procedures used need to be identified and described in detail! This is a major problem!

Response: Negative values are common in environmental radiological monitoring, and are not statistically significant because they are below the detection limit of the instrument. Uncertainity terms (error bars) are a function of factors such as sample size and counting time, and are a combination of counting error and analytical error. Error bars bound the sample result, not the detection limit. Background radiation in the laboratory instrument is subtracted from the result to estimate the radiation associated with the sample. Negative values indicate a level of radiation that is not discernably different from instrument background conditions.

Comment 155. Page 37, fourth paragraph, last line. "According to the authors, these residues seemed to exert little influence on reproductive success and were believed to originate on heron wintering grounds located off the Hanford Site." Both allegations must be supported or deleted.

Response: These were the conclusions of the authors of the cited article.

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Comment 156. Page 41, last paragraph. "This does not necessarily mean that significant impacts have not occurred, only that the tools to evaluate the impacts are lacking. Consequently, impacts due to river sediments will not be further evaluated in this report." This greatly limits the scope and accuracy of the CRIEP. The sediment impacts must be evaluated as a part of the CRIEP. If the techniques needed to perform this analysis do not exist, they must be developed and used.

Response: Chapter 5 identifies tasks to obtain the information needed to evaluate the sediments of the Reach.

Comment 157.† Page 42, third paragraph. "Other pathways not evaluated in the qualitative evaluation that should be kept in mind for future quantitative assessments include human ingestion of waterfowl, venison, irrigated crops, riparian vegetation, and beef and milk obtained from cattle fed irrigated forage." This paragraph limits the scope of the CRIEP to the eating of fish. In addition, herbs, berries and other plants irrigated from the site, including dryland and irrigated farming must be evaluated. The indigenous peoples of this area use a wide variety of plants as foods and medicines. This exposure route must be analyzed.

Response: A baseline risk assessment will evaluate appropriate pathways.

Comment 158.† Page 42, fourth paragraph. "Exposures in non-aquatic sensitive habitats (as derived from 40 CFR Part 300, Appendix A) or in non-aquatic critical habitats (as defined in 50 CFR section 424.02(d)) of endangered or threatened species to contaminants in the Hanford Reach do not, at this time, appear to be significant concern from the perspective of environmental evaluation." With this statement, the CRIEP dismisses all evaluation of threatened, endangered or sensitive species for health impacts. It is unacceptable to take threatened or endangered species to measure the impacts of the hazards on their health. None the less, it is essential that actual data be used to justify such a dismissal, rather than an out-of-hand assessment without supporting data.

Response: A detailed ecological risk assessment will be conducted as part of the baseline risk assessment.

Comment 159. Page 43, section 3.3.1, last paragraph. "Table 2-3 shows estimated groundwater flow rates"... This is in error. The flow rates are listed in Appendix B, Table B-1.

Response: Accept. The correct reference should have been to Table 2-2.

Comment 160. Page 44 onward. The model selected is overly simplistic and does not adequately evaluate the impacts on sloughs, pools and river margin areas. It does not adequately address mixing or entry effects. It is useful only as a rough first order estimate and should not be relied on any further than that. The model is only useful to one order of magnitude.

The first sentence of section 3.3.2.2 on page 50 states "the computational estimates provided by the model are order of magnitude results." The preamble to the model on 44 also indicates that the assumptions used in the

model are invalid. As a consequence, Figures 3-5 through 3-10 must be evaluated and compared to one-tenth of the regulatory limits (or other levels of concern, such as aquatic toxicities) to identify areas of non-compliance.

Response: Acknowledged. The document specifies that the modeling effort is an order-of-magnitude effort. However, the inputs to the model are extremely conservative. Thus, for the majority of the river, the model outputs are likely to be high. There is, however, the possibility that concentrations in localized areas may be underestimated, but the tasks set forth in Chapter 5 will allow the groundwater discharge model to be tested.

Comment 161. Page 51, Figure 3-5. 100K-1, 100N-1 and 100D-2 each show levels of tritium potentially in excess of drinking water limits (see previous item), by up to a factor of 5. Actual measurements listed elsewhere in the document confirm tritium levels in excess of the drinking water standard.

Response: Acknowledged. Drinking water standards are applicable at the tap. None of the three groundwater plumes referenced are used as potable water supplies; nor is the river in the vicinity of the discharge zone used for this purpose.

Comment 162. Page 52, Figure 3-6. 100N-1, 100D-1 and 100F-1 all show levels of strontium-90 distinctly in violation of drinking water standards by up to two and one-half orders of magnitude.

Response: Acknowledged. See response to comment 161.

Comment 163. Page 54, Figure 3-8. 100F-2 shows uranium potentially in violation of drinking water standards in the river.

Response: Acknowledged. See response to comment 161.

Comment 164. Page 55, Figure 3-9. 100D-1 and 100F-2 show nitrate ion potentially in violation of drinking water standards.

Response: The drinking water standard (MCL) for nitrate is 44 mg/L; expressed as nitrogen (rather than as nitrate) it is 10 mg/L. Figure 3-9 plots nitrate concentrations as nitrate. Also, see the response to Comment 161.

Comment 165. Page 56, Figure 3-10. 100D-1 shows chromium in possible violation of drinking water standards.

Response: Acknowledged. See the response to comment 161.

Comment 166. Page 59, section 4.1.1.1, paragraph 2. ..."U is a naturally occurring radionuclide (>9wt% $^{238}$U)"... It is not apparent what the authors intended to say here -- perhaps "(>99wt% $^{238}$U)"?

Response: Accepted. The reference to naturally occurring uranium will read "(99%wt% $^{238}$U)".

Comment 167.† Page 61, second paragraph. Children and infants are specifically omitted for evaluation of exposure for river uses. No justification is provided for this. Children are usually taken on outings. In addition to being more sensitive than adults, they are more likely to play in (and eat) the soil and sand. Also, the river exposures seem to presume that the radionuclides are dissolved in solution. Much of this material may be bound to colloidal and organic material. These will be ingested with the water, and may affect the transport paths and uptake of the radionuclides and contaminants.

Standard analytical techniques often use filtration as a first step in analysis. If this has been done for the river water samples, the values reported may not include the contributions from colloidal materials and sediment fines. The analytical procedures used for water samples must take this possibility into account. For total levels, the samples will have to be "digested" to free the radionuclides from any sediment or colloidal material present. The report must state the methodology used to create this data.

Response: Acknowledged. A baseline risk assessment will evaluate sensitive populations and the methods used to analyze environmental media.

Comment 168. Page 64, first paragraph. "Since upstream and downstream concentrations of U are identical, the intake value for this radionuclide is zero;"... This contradicts Table 3-1 which indicates that 100H-2 is contributing 580 pCi/second and 100F-2 is contributing 2,800 pCi/second. Additional contributions from other sources is not detailed. Given a minimum river flowrate of 1,020 cubic meters per second, this corresponds to a conservative river contribution to intake of 66 pCi in the Residential Scenario, and an ICP of 2.3E-9. This is small, but not zero.

Response: Within the bounds of model resolution, the difference between $C_0$ and $C_R$ is zero (see Figure 3-8). As an ICR of $1 \times 10^{-6}$ can be detected (with 95% confidence and 80% power) with a sample size of $10^{12}$ (more than 100 times greater than the human population of the planet), an ICR of $2.3 \times 10^{-9}$ is, for all practical purposes, zero.

Comment 169.† If a meaningful estimate is to be made of the contribution of the Hanford site to the health risk, then the risk posed by the releases from Hanford need to be evaluated separately from those attributable to natural background and nuclear weapons tests. These may then be compared to the background to place them in perspective. To wave away the risks entirely because the background is high is not acceptable.

The background risk for cancer in the general population is about 25% If other industrial river users were to use a similar logic, almost no preventative or control measure would be accepted. Each individually would disappear into the background created by all of the others. EPA has taken the approach of evaluating each risk separately with a one in a million chance as a threshold of concern. With all of the myriad of exposure sources, these risks add up. With a thousand separate exposures at one in a million, the collective cancer risk rises to at least one in a thousand.

Many of these exposures are not additive. They may act in additive, antagonistic, cumulative or synergistic ways to increase or decrease the total risk. If the exposures are synergistic, they may increase the risk many times beyond a simple addition of the separate risks. Similarly, assaults on the immune system are often not simply additive. This is recognized in the CRIEP in the discussion of threshold effects for some hazardous materials. Treating the risks as acceptable if they can just be hidden in the background data provides little in the way of public health protection.

Response: Acknowledged. A baseline risk assessment will evaluate total risk and risk attributable to the Site, but if the risks attributable to Hanford cannot be accurately detected because background is high, then the risks attributable to Hanford may be insignificant.

Comment 170. Page 68, Uranium. No mention is made of the hazards posed by the daughters of Uranium decay. These may be significant.

Response: The risk estimates for uranium are calculated using EPA slope factors that include risks attributable to daughters that are in equilibrium with the uranium.

Comment 171.† Page 70, last sentence of second paragraph. "The chemical contaminants of potential concern (i.e. Cr and $NO_3$) are not carcinogenic when ingested." This is an unproven statement without support. Hexavalent chromium is a known human carcinogen when inhaled. There is insufficient data to judge its potential to cause or promote cancer when it is ingested. It is a great and unjustified leap to go from insufficient data to a flat statement that it does not cause cancer by ingestion. Delete the sentence or provide scientific justification for its retention. The presumption that a chemical is non-hazardous until it has been proven by peer reviewed study to be harmful is not a conservative approach to the estimation of the hazard to public health.

Response: Agreed, see response to comment 48.

Comment 172. Page 70, third paragraph. "The residential water ingestion scenario is associated with a cancer probability of 8E-07 (Table 4-3), and is due almost entirely ($\approx 90\%$) to $^{90}Sr$. This is a negligible risk because it is less than the 1E-06 cancer probability considered significant for regulatory purposes (40 CFR 300.430)." The data used in this study is valid to only one decimal place. 8E-07 is indistinguishable from 1E-06 when measured to one decimal place. Much of the modeling used is only accurate to within one order of magnitude. If the 8E-07 number is subject to this degree of inaccuracy, it may be eight times the level of concern.

Response: A value of $8 \times 10^{-7}$ represents a value in the range of $7.50 \times 10^{-7}$ - $8.49 \times 10^{-7}$. Within the context of EPA guidance and state regulation, $8 \times 10^{-7}$ is thus distinguishable from $1 \times 10^{-6}$. The order-of-magnitude accuracy of the groundwater discharge/surface water mixing modeling could be interpreted as indicating that a reported value of $8 \times 10^{-7}$ represents a value in the range of $8 \times 10^{-8}$ - $8 \times 10^{-6}$. The inputs to the model, however, are extremely conservative (e.g., groundwater plumes assumed to contain contaminant concentrations throughout that are equal to the highest present concentration,

line source discharge to the river, low river stage, etc.), and we anticipate that model outputs overestimate actual conditions. The exception may be for localized areas at groundwater discharge zones, and Chapter 5 establishes tasks necessary to test the model output on this scale (as well as on the larger scale).

Comment 173. Page 70, formula at bottom. The RfD is misplaced.

Response: Accepted. The formula will be corrected.

Comment 174. Page 71, section 4.1.5, second paragraph. This paragraph is circular and self referential in its argument. Only six contaminants of concern were selected, and since two of these provided the bulk of the risk from these six, the screening procedure is deemed to be valid. The screening procedure can only be credibly evaluated if ALL of the potential contaminants are considered and the risks are summed. In addition, all of the potential inhalation, ingestion, and absorption routes need to be fully included. Because these were eliminated, they were not considered and their contribution to the total risk cannot be evaluated.

Response: The results of the preliminary evaluation were used to develop a hypothesis and to identify data needs required to test the hypothesis. The fact that two contaminants are shown to be responsible for virtually all of the risk is an outcome of the Pareto principle, the fact that one can expect much of the risk to be attributed to few of the contaminants. By use of appropriate screening procedures, efforts can be focused on the critical few contaminants rather than the trivial many. Once again, the results of the preliminary evaluation are not final; a baseline risk assessment will be performed.

Comment 175.† Page 72, fourth paragraph. This paragraph states that 25% of the exposure is attributable to agricultural products. This is an astounding statement! The CRIEP specifically omits any study or evaluation of this exposure route. In addition to the actual exposure, the social and psychological effects of this information can be dramatic and can lead to enormous loss of income to the farmers of Oregon and Washington! The farm products need not have a demonstrated risk for consumers to avoid them entirely. The perception of a risk is all that is needed. Based on this statement alone, it is essential that the agricultural ingestion route be studied as a part of this plan!

Response: Acknowledged. A baseline risk assessment will likely evaluate the agricultural pathway. It should be noted, however, that the dramatics of the reviewer are unfounded. The study cited dealt with the evaluation of crops irrigated in the area of Hanford and should not be extrapolated to all farmers of Washington and Oregon. It should also be noted that the total dose from Hanford operations to the maximally exposed individual in 1991 was 0.02 millirem, or 0.02% of the DOE limit (100 mrem/yr) and 0.5% of the EPA limit (4 mrem/yr) (Woodruff and Hanf 1992). Consequently, 25% of this insignificant total is also insignificant.

Comment 176.† Page 73, first line. "The uncertainty inherent in either challenge is likely to bound the accuracy of slope factors to no less than an order of magnitude." This greatly broadens the potential risk stated throughout the CRIEP. This increase must be reflected in all of the calculated risks.

Response: The radiological slope factors are used in the preliminary evaluation in accordance with EPA policy that existed at the time the document was developed. Meaningful quantitative evaluations of uncertainty are not possible with deterministic risk estimation techniques. Since development of the document, however, EPA has issued final exposure assessment guidelines that require quantitative uncertainty analyses to accompany risk assessments. The best way to meet this requirement is with a stochastic assessment. It is likely that DOE, EPA-10, and WDOE will modify Site risk assessment guidelines to comply with EPA's new guidelines prior to the baseline risk assessment being undertaken.

Comment 177. Page 73, second paragraph. "Given such an extreme range, EPA radionuclide slope factors are likely to represent an upper bound estimate of the carcinogenic potential of radioactive contamination." Quite to the contrary. As stated earlier in the paragraph, ..."recent calculations based on similar assumptions but including Japanese survivor data yield about three times higher risk." In addition to the ten fold increase needed to provide a conservative estimate from the prior item, an additional three fold increase is required based on BIER IV data as compared to the BIER III data used for the CRIEP. Together, these require that all of the risk factors calculated in this plan be multiplied by a factor of thirty! When additive, cumulative and synergistic effects are for all radionuclides are considered, this factor may be even larger.

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Response: The radiological slope factors used in the preliminary evaluation are those endorsed by EPA and were published after publication of BIER V. Additivity of contaminant exposure is assumed in accordance with EPA guidance and WDOE regulation.

Comment 178. Page 73, third paragraph. This paragraph contradicts the prior two in stating that the CRIEP is conservative. At each step the minimum possible risk was assigned to the data. Potential risks were neglected if they failed individually to meet a cut-off criteria. No additive, cumulative or synergistic effects were taken into account. This does not sound like a conservative approach.

As written, the report must be taken as a less than a lower bound on the risks associated with the releases into the river, rather than as an upper bound as suggested by this paragraph. Based on the comparison of risk data from the BIER IV report compared to the BIER III report, all of the risks in the CRIEP must be multiplied by a factor of three to reach a lower bound estimate of the risk. Even then, based on $^{90}Sr$ alone, the risk is greater than 1E-06 (2.4E-06). The last sentence of this paragraph ends with "would be more than adequate to demonstrate a bounding risk estimate for the residential scenario to be well below 1E-06." As noted above, the data presented in the report demonstrate that the bounding risk of the residential scenario is at least 2.4 times the 1E-06 level of risk. It may be much higher. This sentence is wrong and must be revised or removed.

Response: Risks were in no way minimized throughout the preliminary evaluation. The contaminant identification process dismissed only those substances that could be shown to have insignificant risk levels relative to regulatory action

levels. Additivity of contaminant exposure is assumed in accordance with EPA guidance and WDOE regulation.

The radiological slope factors used in the preliminary evaluation are those endorsed by EPA and were published after publication of BIER V.

Comment 179. Page 73, second sentence of the fourth paragraph. "Skyshine"..."provide a maximum exposure rate of approximately 0.03 mrem/hr along the shoreline (Brown and Perkins 1991)." This adds to the radiation burden to people exposed to a small degree. It adds to the radiation burden of aquatic and shoreline plants and animals to a much larger degree. This risk is significant for both and must be included in the risk assessment.

Response: Acknowledged.

Comment 180. Page 75, fourth paragraph. "Based on an evaluation of existing data, the NCRP has established that a chronic dose rate of 0.4 mGy/hour (1 rad/day) to the maximally exposed individual population of aquatic organisms should ensure protection for the population." This is a considerable leap!

There is no demonstrated protective function of radiation exposure. (Other than possibly cancer treatment by high dose x-ray.) The risk and adverse health impacts of this exposure may be minimal or acceptable at this level, but that does NOT make it protective!

Based on equivalent exposure to humans, this statement appears to be grossly unjustified. Exposures at this level may cause major changes to immune function and other biological processes. This opens the organisms to a variety of disease processes, even if they do not suffer immediate and direct physical harm from the radiation.

This in turn may cause indirect health impacts on people who consume these plants or animals. The assertion that this level of exposure is harmless is suspect at best. Additional justification of this statement showing the health impact on the whole population and ecosystem is needed. This assessment needs to cover all aspects of the health of these systems. It must not be limited to cancer.

Response: Please see NCRP (1991).

The NCRP dose rate was established for the protection of aquatic life.

Food chain impacts are preliminarily evaluated through the human fish consumption pathway.

Comment 181. Page 75, section 4.2.1.2. "The chronic ambient water quality criterion for the protection of freshwater aquatic life for hexavalent Cr has been set at 11 µg/L by EPA." This limit must be the basis for the maximum allowed hexavalent chromium levels in the river, including the naturally occurring chromium. In other words, if the natural background is 12 µg/L, then 0.0 µg/L of additional hexavalent chromium should be allowed. This limit puts all of the plumes in potential violation with the possible exception of 100BC-1.

Also, no single industrial user would ever be allowed to burden a river with its maximum carrying capacity of a contaminant. Certainly, no industrial user would be allowed to burden the third largest volumetric discharge river in the continental United States to beyond its carrying capacity of any contaminant.

Response: Acknowledged.

Comment 182. Page 81, section 5.1, last paragraph. This paragraph makes two references to 'under existing conditions'. The CRIEP and earlier discussions do not adequately address future levels of contamination from groundwater transport into the river. This must be a part of any study on the impacts on the Columbia River. There are no acceptable models that will adequately allow prediction of the transport of radionuclides from the vadose zone into the groundwater. The models for transport of these nuclides from the groundwater to the river are poor. They are especially difficult to use in zones such as the 100 areas where rising and falling water levels in the river can dramatically effect the subsurface hydrology.

It is highly likely that there will not be an acceptable model of vadose zone transport for several decades. It does not make a great deal of sense to push for extensive modeling in this fashion. Other approaches need to be utilized. The most important approach is to begin actively removing the source materials. The next most important is to begin immediately pumping and treating the groundwater to prevent it reaching the Columbia River. This pump and treat operation will probably not do much significant cleanup of the source material in the groundwater. It will act as a stop gap measure to pull back the contaminant plumes and to hold them in place while other work is done.

Response: Future risks will be estimated in the baseline risk assessment in accordance to the HSBRAM. Future impact evaluations will have the benefit of groundwater investigation data derived from terrestrial operable unit RIs. The current fluxes of contaminants from groundwater to the river were greatly overestimated for the preliminary evaluation.

Comment 183. Page 82, first sentence. "These zones of impact dissipate quickly downstream due to contaminant dilution." The Washington State Administrative Codes specifically disallow any consideration of dilution effects in the receiving body. See page 86, Activity 1A-3. "Under WAC 173-340-730(6)(b), no dilution zone is allowed to demonstrate compliance with the calculated standard when a surface water body is impacted by contaminant discharges through groundwater."

Response: Acknowledged. There was not intent to demonstrate compliance with a regulation, the objective is determine if there is an impact.

Comment 184.† Page 82, last paragraph. "The most effective and efficient long-term investigation for the river appears to be the Hanford Reach, which can be defined as that segment of the river bounded by Priest Rapids Dam down to the head of Lake Wallula; however, the lower boundary should be extended downstream of Hanford for the purpose of investigation of sediment and biotic impact. Therefore it is recommended that consideration be given to treating the river as a whole for the purpose of consolidating resources and increasing



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efficiency of actions required to comply with the Tri Party Agreement requirements."

Oregon emphatically agrees. The area of study should extend from Priest Rapids Dam past Hanford to McNary Dam.

Response: Acknowledged.

Comment 185. Page 83 & 84, section 5.2.1 Data Quality Objectives. All references to the Hanford Reach and the 100 areas need to be changed to reflect analysis and study of the entire river segment from Priest Rapids Dam onward past Hanford to McNary Dam.

Response: This document recommends that future river assessments extend downstream. The boundaries will be determined within the context of the Columbia River Comprehensive Assessment.

Comment 186. Page 86, Activity 1A-1. The identification of contaminants and impacts must also consider USDOE's duties under the Natural Resource Damage Assessment (NRDA) provisions of the Comprehensive Response, Cleanup and Liability Act (CERCLA). By dividing the assessment on an operable unit by operable unit basis, additive, cumulative and synergistic effects will be systematically ignored.

Response: It has not been identified or agreed upon at this time how the CRIEP or any other Hanford Remedial Technical Documents or work will meet the Natural Resource Trustees' expectations or needs. See the response to Comment 205.

Comment 187. Page 86, Activity 1A-3. "Under WAC 173-340-730(6)(b), no dilution zone is allowed to demonstrate compliance with the calculated standard when a surface water body is impacted by contaminant discharges through groundwater." Then the next paragraph says, "However, actual cleanup standards"...

Despite the legal requirements, the CRIEP is basing its actions on deciding what is acceptable, without specifying who would make such a decision, and what criteria they would use. This is unacceptable. Compliance with the law is mandatory. Compliance allows for protection of the human health and the environment and avoids costly legal entanglements that do nothing toward cleanup.

Response: See the response to comment 183.

Comment 188.† Page 87, third paragraph. ..."induced tracer studies with another plume will be considered." It is vital that any such study evaluate the potential impact of the tracer on the ecosystems, and on the contaminants and other materials in the path of the tracer. Many of the available tracer dyes are suspected carcinogens. Many of the tracers are potentially chelants for a variety of nuclides. The use of tracers may be helpful, but must be planned with caution.

Response: Acknowledged.

Comment 189. Page 87, second sentence of first paragraph of Activity 1A-4. "This conclusion, however, assumes that all hexavalent Cr in the groundwater remains in this valence state in the river water column. Hexavalent Cr is thermodynamically unstable in soils and natural waters, provided a sufficient amount of reducing agent such as organic material is present (Dragun 1988; Syracuse Research Corp. 1991)." This is a true and misleading statement.

Hexavalent chromium can be reduced by organic matter to trivalent chromium. This can either be accomplished under severe acid conditions (pH 1-2) with an excess of strong reducing agents present, or enzymatically under favorable conditions. If oxidizing conditions are present, and if the pH is neutral or high, then the reaction rate is nearly zero. Under adverse conditions, the chromium may convert over geologic time scales. Also, if oxidizing and acidic conditions exist, the chromium can equally as easily be converted from trivalent form to hexavalent form.

It is important to study the natural conversion of chromium from one oxidation state to another. It may even be possible to promote this in the soil column. The chances of this leading to great reductions in hexavalent chromium concentrations are small. Addition of tailored bacteria may have the greatest chance of success in this area. In the presence of other energy sources (foods), this is likely to fail. Such a study is needed to determine the fate of the chromium VI. It is not acceptable to use this as a justification for minimizing the potential effects of the chromium contamination of the soils.

Response: The reviewer is incorrect in his assertion that strongly acidic (pH 1-2) conditions are necessary to convert hexavalent chromium to trivalent chromium, the reaction rate is nearly zero under typical environmental conditions, or that chances of reducing hexavalent chromium in soils is small. The reviewer is referred to an article by Rai et al. (The Environmental Chemistry of Chromium, The Science of the Total Environment, 86(1989), 15-23) for additional details. The scientific literature supports the statements in the CRIEP.

Comment 190. Page 88, Activity 1A-4 - Cr Speciation. This activity identifies TOC as a contaminant to measure. Total Oxidizable Carbon, or Total Organic Carbon as it is variantly known is a very poor measure. Each form of carbon compound responds to the analytical test somewhat differently. The test does not identify broad ranges of organic compounds. This test is marginally useful as a course screening test. To be useful, the known targets of the search need to also be analyzed for. In particular, if chlorinated compounds may be present, EPA test procedures using techniques such as GC/MS (or better) are required.

Response: TOC is not included as a contaminant parameter, but rather as a general environmental indicator parameter that could influence chromium speciation. Organic contamination is not known to be a significant concern in the 100D-1 plume.

Comment 191. Page 89, Activity 2-1, second paragraph. The program also needs to be studied for test methodology, handling and preparation of blanks, insertion of spiked samples and known samples. Earlier data in the report show analysis

that are simply not possible. (e.g. Negative values of radioactivity.) This is an indication of a highly unacceptable testing program. The QA/QC, reliability, accountability and traceability aspects of the program need close scrutiny.

Response: The reviewer may be confused regarding the limitations associated with the measurement of environmental radioactivity. Please see the response to Comment 154. All monitoring of data collection programs at the Hanford Site are already governed by strict QA/QC programs.

Comment 192.† Page 90, Activity 2-2 - Surface Water Modeling, last paragraph. The selection of a model or models, must be done in an open process with extensive input from the States, Tribes and Public if it is to have any credibility at all.

Also, if the model is to make a cumulative impact assessment, it must consider all of the data inputs. The intentional removal of potential contaminants of concern in the early stages of data acquisition will fatally cripple the model.

Response: Acknowledged. However, all models are simplified representations of reality (there is, by definition, no such thing as a totally realistic model), and the elimination of certain parameters, on the basis of logically documented screening, will have no adverse effect on the model results.

Comment 193. Page 92, Activity 4-1 - Compilation of Ecotoxicological Data. This section discusses the low order of toxicity of soluble Uranium, then goes on to discuss Uranium's low degree of solubility. When this is combined with the intentional dismissal of the sediment pathway, the Uranium is intentionally missed by the CRIEP. This defect must be repaired. The sediment pathway must be included.

Response: The plan provides for collection of additional sediment monitoring data. This data will be used in a baseline risk assessment for evaluating potential impacts due to sediments.

Sierra Club

Comment 194. The Sierra Club's comments are limited because the CRIEP received was missing pages 24-62, which includes the introduction to the Risk Assessment.

Response: Acknowledged. We regret the error.

Comment 195. Section 4: This is an inadequate treatment of the risks associated with uses of the river. I will only mention a few problems. The assessments are not, as claimed, conservative. Most sensitive populations, such as children, should have been used in the recreational example. Fish consumption quantity was entirely too low, particularly for consumers of large quantities, such as Native Americans. The FDA uses 69 g/d for subsistence consumers and 140 g/d for high subsistence consumers. The assumption that all hikers carry soda and do not drink over 1 L of water is not valid.

Response: Acknowledged. See responses to comments 1 (1st part), 100, and 120.

Comment 196.† Section 4: We do not believe that cancer induction is the only concern for exposures to environmental radiation. Immune suppression has been noted, particularly in Ukraine and Russia, and should be mentioned.

Response: The immune system observations in Chernobyl are associated with extremely high exposures. The CRIEP was not a risk assessment, and thus did not examine all potential pathways or effects, only those judged to be the most likely. The comprehensive river assessment will be a better forum to evaluate all pathways of concern.

Comment 197. Section 4: What is the source of background radiation in the Columbia above the Hanford Reach? Have historical practices dispersed radiation in the area to a level that should not be ignored? How does it compare to other Western Washington rivers, for example? We have concerns that subtracting background could underestimate impacts.

Response: Background radiation is attributable to fallout from nuclear weapons testing or naturally-occurring radionuclides (potassium-40, radium, tritium, thorium, and uranium). The goal is to determine the impacts attributable to site activities. Therefore, background must be subtracted. Page 59, para 5, sentence 2, will be added as follows: "Background radiation in the Columbia River above the Hanford Reach is attributable to fallout from nuclear weapons testing or naturally occurring radionuclides (e.g., potassium-40, radium, tritium, and thorium).

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Comment 198.† Section 4: The environmental and ecotoxicity assessments should not suggest that impacts are minimal until much more actual monitoring and test data is available. The uncertainty discussion is appreciated. Data gaps do exist, such as the limitation of studying fish and drinking water. Potential whole body exposures, such as to water skiers downstream, should also be considered.

Response: See responses to previous comments on the purpose and limited use of the preliminary evaluation. Recommendations will be taken into consideration for the baseline risk assessment.

Comment 199.† Section 5: This study should extend beyond the Hanford Reach. Focus on data from 100 Area impacts is not sufficient for evaluating the entire impact of Hanford operations on the River. Species composition beyond the Reach should be studied and related to historical information. Downstream impacts, bioconcentration and other ecotoxicological studies, should extend as far as the mouth of the Columbia. Epidemiological information and interviews with populations living close to the River should be used to suggest what additional studies might be necessary.

Response: Acknowledged. See responses to previous comments on the purpose and limited use of the preliminary evaluation. Recommendations will be taken into consideration for the baseline risk assessment.

U. S. National Park Service

Comment 200. Page 5, Section 2.1.1, paragraph 1, last sentence. It should read "The draft environmental statement...". The final EIS is expected this fall.

Response: Accepted. The word "draft" will be incorporated into the final sentence of paragraph 3, page 5.

Comment 201. Page 20, and throughout the CRIEP. In the middle of the page, $Cr^{6+}$ is used but not defined. At the bottom of the page $^{3}H$ is used but not defined. This is done for other contaminants as well throughout the document.

Response: Accepted. Please note that tritium ($^{3}H$) was defined on page 12, paragraph 2.

Confederated Tribes of the Umatilla Indian Reservation

Comment 202. Introduction

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) has reviewed the Columbia River Impact Evaluation Plan (CRIEP) and provides the following comments. Our comments are organized into the following sections:

- The Tribal Context
- Need For a Comprehensive Review of Impacts to the Columbia River Environment
- The CTUIR's Concerns Regarding the CRIEP
- Review of the Technical Completeness of the CRIEP
- Proposed Data Collection Activities
- Conclusions

I. The Tribal Context

A. Historical Context

The Umatilla Indian Reservation is located near Pendleton, Oregon. It is occupied by descendants of three Columbia Plateau tribes: the Cayuse, Umatilla and Walla Walla. Together, the three tribes comprise the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). In historical times, the Wallulapum band, part of the Walla Walla Tribe, occupied a large area centered on the confluence of the Yakima, Snake and Columbia rivers. In addition, descendants of the Wanapum band, a band that resided along the Columbia River in the area now referred to as the Hanford Reach, are also members of the CTUIR. The eastern portion of the Hanford Nuclear Reservation, including the Hanford Reach, is located on these Tribes' traditional lands.

In 1855, the Cayuse, Umatilla and Walla Walla tribes entered into a treaty with the United States. As part of this treaty, the Tribes ceded 6.4 million acres to the United States in return for concessions by the United States. In particular, the Tribes retained the right to perform certain activities in their traditional lands. These rights include the rights to fish, hunt, pasture livestock and gather plants.

B. CTUIR Hanford Context

Because of its strong governmental interest in Hanford, the CTUIR is actively participating in Hanford clean-up planning processes. These planning activities range from participation as a Trustee for Natural Resources to participation on forums such as the Hanford Future Site Uses Working Group and the Tank Waste Task Force. The CTUIR is also providing comments on planning documents released for public review.

The CTUIR recently released a document that expresses the CTUIR's general concerns about Hanford cleanup activities. This document, Criteria for Evaluation of Proposed Changes to the Hanford Federal Facility Agreement and Consent Order, was developed for use in the TPA revision process. As a reference tool, it can be used by any party interested in learning the nature of the CTUIR's concerns at Hanford.

The Criteria provides the general framework for CTUIR's participation in Hanford cleanup under various environmental laws and regulations (CERCLA, RCRA and NEPA).

Following is one of the key topics discussed in the CTUIR's Criteria document:

> "Protection and restoration of the environment, both on the Hanford site and in areas affected by Hanford over which the CTUIR exercises off-reservation treaty rights. Protection of the environment guards the natural resources upon which treaty rights are based, including Columbia River fisheries and related resources."

C. Environmental Context, Importance of the Columbia River to the CTUIR

From salmon and sturgeon to tule reeds and eagle feathers, the ecosystem provides the very fabric of tribal culture. Any impact evaluation that considers the Columbia River environment should assist the CTUIR in understanding and evaluating the magnitude and future consequences of adverse impacts on natural resources.

The Columbia River and associated aquatic and terrestrial ecosystems are of great significance to the CTUIR. The meaningful exercise of tribal treaty rights within usual and accustomed areas is entirely dependent on the health of the ecosystem and its natural resources. A treaty right to fish, take wildlife or gather plants is hardly useful if individuals or populations of fish, wildlife or

plants have been reduced in their abundance, become threatened with extinction or themselves become human health risks.

Natural resources are significant to the CTUIR for a variety of reasons. Tribal members are subsistence hunters and gatherers. Wild game and fish form a major part of the diet of many tribal members. Likewise, plants collected from a healthy environment form an important feature of many tribal members' diets. Besides consumption as food, these resources are collected for religious ceremonies, cultural uses such as medicines, clothing, decoration and traditional crafts and recreational purposes.

All indigenous plants and animals have religious significance to CTUIR members who practice traditional Indian religion. In addition, these resources, such as chinook salmon, can be of great economic importance to the CTUIR.

The CTUIR's overall land management philosophy for Hanford is that environmental restoration must be considered the primary focus of activities. This ensures that timely and effective "clean-up" of contamination is conducted in a manner that optimizes sustained net flow of tribal benefit through the conservation, management and utilization of fish, wildlife, plant and cultural resources, while protecting the integrity, sustainability and diversity of the natural ecosystem.

Response: Acknowledged.

Comment 203. II. Need for a Comprehensive Review of Impacts to the Columbia River Environment

It is our understanding that the TPA M-30 milestones narrowly focus studies on impacts created by 100 Area activities. However, a true cumulative impact evaluations cannot be completed without a broader consideration of the collective effects of all contaminant-contributing Hanford operations on the river environment.

The CTUIR supports the development of a thorough environmental and human impact evaluation that considers the magnitude and effect of Hanford contamination and the fate and transport of contaminants throughout the natural ecosystem. An analysis such as this would culminate in a cumulative impact assessment documenting Hanford-induced effects on Tribal treaty-rights, natural resources and Tribal members. An assessment of the cumulative environmental effects both within the Hanford Reach and in downriver areas are critical components of remediation and environmental restoration at the Hanford Nuclear Facility.

Response: Acknowledged.

Comment 204.† A complete summary of the known information pertaining to contamination of the Columbia River environment should be provided. This summary would provide the framework for identifying data gaps, additional research needs, future remediation and environmental clean-up strategies and ecological and human dangers. The net result should broaden the understanding of historical, current and foreseeable impacts caused by Hanford

to the Columbia River environment. This baseline information would assist the CTUIR in quantifying impacts to Treaty-reserved rights, natural resources and the health and welfare of the tribal community.

The analysis should provide pathway analysis, deposition rates, uptake rates and consumption factors in assessing human health impacts. These data would allow the CTUIR to assess the magnitude and extent of impacts on the tribal community.

Response: Acknowledged. The preliminary evaluation (and the data summary leading up to it), did just this. We acknowledge that a more detailed evaluation, in the forms of additional investigations and a baseline risk assessment, are needed to test the hypothesis presented in the CRIEP.

Comment 205.† As a baseline, this analysis should identify damages to natural resources and attendant Treaty rights and provide information for future use in the Natural Resource Damage Assessment process. The CTUIR, as a Trustee for Natural Resources affected by Hanford operations, is profoundly interested in the development of future activities at Hanford related to the Columbia River.

Response: Any further NRDA is out of the scope of this document. It has not been identified or agreed upon at this time how the CRIEP or any other Hanford remedial technical documents or work will meet Natural Resource Trustee expectations or needs.

Comment 206.† III. The CTUIR's Concerns Regarding the CRIEP

A. THE CRIEP FAILS TO PROVIDE A CUMULATIVE HEALTH AND ENVIRONMENTAL IMPACT EVALUATION

The CTUIR believes that any assessment of cumulative health and environmental impacts should include a complete overview of impacts resulting from historical, current and foreseeable sitewide Hanford operations. This type of assessment should provide a comprehensive view of the collective effects of Hanford activities as opposed to considering only portions of the impacts. The CTUIR contends that such an approach represents both the letter and spirit of the TPA M-30 milestones.

The following discussion points out the major shortfalls of the CRIEP in disclosing information on cumulative health and environmental impacts and in failing to meet the overall intent of the TPA M-30 milestones.

1. Human Health Impact Evaluation

The CTUIR believes the CRIEP is inadequate. The CTUIR questions its validity in thoroughly evaluating human health impacts. This conclusion is based on the CRIEP's exclusion of ongoing Technical Steering Panel (TSP) and the Native American Working Group (NAWG) activities, dependance on incomplete data sets or analyses, uncertainties associated with the conclusions contained in the CRIEP and the failure of the CRIEP to review and integrate other research.

The TSP oversees the Hanford Environmental Dose Reconstruction Project (HEDRP) that is researching the amount, dispersion paths, deposition and health affects associated with past operations at Hanford. Two pathways are under review by the TSP, the air pathway and the water pathway. This panel is also associated with the Hanford Thyroid Disease Study (HTDS).

The CTUIR is involved with TSP through NAWG. On a regular basis, representatives of eight Columbia Plateau tribes convene to discuss impacts to tribal communities from the two pathways. This aspect is critical to note: tribal communities have increased exposure to environmental contamination because the use of fish, wildlife and plants for subsistence and cultural activities is at a much higher rate than the general population.

One particular TSP document that considered the River pathway notes that "Preliminary dose estimates were calculated to demonstrate the feasibility of reconstructing doses" [emphasis added]. The CRIEP however states that "In general, radionuclides are only evaluated with respect to the carcinogenic potential associated with ionizing radiation."

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Response: Acknowledged. The preliminary evaluation contained in the CRIEP was conducted to develop hypotheses that will be tested in a subsequent detailed baseline risk assessment. It also assisted in the identification of data needs for such an assessment and as a means of soliciting input from the public on the investigation and assessment of what is generally considered to be the most likely environmental medium to which one could be exposed. Note that this effort is being conducted under CERCLA and the Tri-Party Agreement; HEDRP is a separate program with distinctly separate objectives (although we acknowledge that information developed under HEDRP, especially transport models, may be able to be applied to Tri-Party Agreement efforts).

Comment 207. The CTUIR concurs with the statement in the CRIEP that "Uncertainty with respect to the toxicity assessment is related to uncertainty in the toxicity values used and uncertainty in the overall toxicity assessment. Research being conducted by the TSP is focused on identifying the correlation between human health impacts and Hanford-induced environmental contamination. Until this study and the model are completed, conclusions about health effects contained in the CRIEP are unsubstantiated and should be removed from the document.

Response: Acknowledged. Any conclusions in the document will be identified as preliminary and limited given the limited scope of the document.

Comment 208.† 2. Environmental Impact Evaluation

The DOE describes the CRIEP as a document that will provide the framework for determining cumulative health and environmental impacts to the Columbia River. It also states that the CRIEP will provide a characterization of river resources and valuable information for the 100 Area risk assessment.

The CTUIR question the legitimacy of the CRIEP for use as the baseline for future natural resource and ecosystem risk assessments because the cumulative effects from all Hanford operations on the Columbia River environment are not integrated into a single assessment. Only 100 Area

contamination is discussed; significant contributions and impacts from other contamination sources are disregarded.

The CRIEP should integrate all relevant data and contain a summary of environmental monitoring information from the beginning of Hanford operations in 1943 through the present in order to allow an analysis of environmental impacts from Hanford activities. Transport of chemical and isotopic compounds throughout the Lower Columbia River system should also be discussed rather than focusing the analysis only on the Hanford Reach of the Columbia River.

The analysis needs to view the Columbia River as not only water, but as an interdependent ecological unit (including wetlands, riparian and upland components) where no one part can be separated from the other. The CRIEP fails to integrate these fundamental concepts.

9413291.0634

Response: Acknowledged in part.

While the relevant milestones solely addressed the 100 Area, DOE is in the process of implementing the recommendation contained within the CRIEP to address the Reach as a programmatic unit.

The goal of CERCLA efforts is to remediate a site on the basis, in part, of what the human and environmental health problems are today. While today's problems are a function of past practices, past problems that may not exist today are not relevant. DOE is addressing past problems under a separate program (i.e., HEDRP). In addition, sufficient information is available for the Lower Columbia (below McNary Dam) to indicate that Hanford has no discernable impact on human or ecological health in this portion of the river (see Comment 66 from WDOH).

Because DOE has chosen to impose NEPA on Tri-Party Agreement efforts, the Hanford Site as a whole will eventually have to be evaluated in an integrated manner. The Tri-Parties have chosen to initiate evaluations on an operable unit basis because of obvious logistical reasons.

Comment 209.† B. THE CRIEP IS AN EXAMPLE OF THE MANAGEMENT AND POLICY PROBLEMS PLAGUING HANFORD SITE RESTORATION

The recently released Schedule Optimization Study (SOS) contains 57 recommendations regarding problems with management and policy at Hanford. These findings "indicate the most serious impediments to environmental cleanup of the Hanford Site are related to a series of management and policy issues that are within the control of the three parties managing and monitoring Hanford."

Recommendation twenty-two of the SOS states that "Hanford should develop a comprehensive sampling and analysis strategy for the site, including providing appropriate staff training." The issue statement for this recommendation is the "Failure of DOE to generate necessary supporting data."

The CRIEP is a clear example of this issue because it does not contain a comprehensive review of existing data.

The CTUIR's goal in participating in clean-up activities at Hanford is to ensure that cost effective, efficient and timely clean-up efforts protect Treaty rights and natural resources.

Response: Although a considerable amount of data was reviewed during the document preparation, a detailed review was beyond the document scope.

Comment 210.† C. THE DOCUMENT FAILS TO ADDRESS EXISTING INFORMATION PERTAINING TO CONTAMINATION OF THE COLUMBIA RIVER CORRIDOR

A specific example of the CRIEP's failure to provide an overall view of the impacts resulting from Hanford operation is found on page 12 of the document, where it is noted that "groundwater is the primary pathway for environmental contamination and impact on the Columbia River." The CRIEP also acknowledges the concept of "skyshine" as an additional potential pathway of contamination.

However, the plan fails to fully recognize the impacts caused from numerous other contaminant sources such as:

1. Miscellaneous Radioactive liquid wastes.
2. Radioactive sludge/radioactive solid waste.
3. Sanitary liquid waste.
4. Nonradioactive liquid waste.
5. Nonradioactive sludge/nonradioactive solid waste.
6. Leaking underground storage tanks.

Response: The CRIEP evaluates contamination input to the Reach from all known groundwater plumes in the 100 Area. Skyshine is acknowledged but deferred, for logistical reasons, to terrestrial operable units for data gathering purposes. The eventual baseline risk assessment will draw information from many efforts, including additional river investigations and terrestrial operable unit RIs.

Comment 211.† The CRIEP discounts historical contamination of the 100 areas and focuses only on groundwater plumes currently releasing contaminants to the Columbia River, i.e., upgradient groundwater contamination. No information is provided that discusses the amount of contamination (chemical and radioactive) that has been deposited as liquids to ground nor is there any discussion disclosing information pertaining to contaminants stored as solids in the upland soil column. A large portion of this contamination has yet to leach into the groundwater but will eventually reach the Columbia River in the near future.

Response: The CRIEP evaluates current contamination to determine if past practices have had any lasting impacts that can be discerned today. The source operable unit RIs are currently gathering information to determine if contamination in the soil will eventually migrate to the river. It will be used in future baseline risk assessments to determine what might occur.

Comment 212.† An additional example of the CRIEP's failure to fully consider all contaminants and existing information is illustrated by a recent presentation to the TSP by Battelle researchers. During the presentation, "Integrated River Pathway Activities/Scoping Studies," several technical approaches were identified that would be applied or included in their studies. One of these topics acknowledged the task of evaluating river effluents and the release of approximately two thousand fuel failures into the river environment.

These topics were also reported in a document prepared by UNC Nuclear for DOE in 1986 that discusses significant radiation sources found along the D-Island shoreline, across from the D-Reactor.

The CRIEP fails to account for these fuel failures and contamination of islands and shorelines. Therefore, the cumulative impacts resulting from Hanford operations have not been comprehensively integrated. Any preliminary findings of the CRIEP are unsubstantiated without this information and there is no basis for judging the cumulative impacts, let alone concluding that no adverse impacts have occurred.

Response: See the responses to Comments 208 and 210.

Comment 213.† D. THE DOCUMENT CONTAINS INADEQUATE TECHNICAL DATA AND PROTOCOL

Throughout the CRIEP, it is stated that only "readily available" data is used in this assessment. It is unclear what this term means. A complete review of over 50 years of information should be summarized in order to provide an overall view of the distribution and magnitude of past and present pollution of the Columbia River as a result of Hanford operations.

In addition, for purposes of assessing water quality and cumulative effects in the Hanford Reach and downstream areas on the Columbia system, other point and non-point source pollutants from sources other than Hanford operations should be fully considered.

Response: A more thorough data review will occur as part of the Columbia River Comprehensive Assessment.

Comment 214. Sampling and analysis at Hanford has been described as inadequate in the Schedule Optimization Study for the Hanford Site as previously described. An example supporting these findings is illustrated by the DOE's failure to incorporate EPA's comments on the document entitled "Sampling and Analysis of 100 Area Springs." EPA's comment questions whether a one-time synoptic sampling of springs along the shore of the 100 Areas is adequate to characterize and evaluate the impact to the Columbia River.

This is a significant issue because it is unclear in the CRIEP whether additional sampling was completed as requested by the EPA. Information in the 100 Springs document (Milestone 30-01) was incorporated into the CRIEP as baseline information and it appears that this single data set was used to formulate the preliminary impact assessment for the CRIEP.

Response: Spring sampling is not adequate to evaluate impacts to the Reach. Contaminant flux data are needed and these data are being obtained from terrestrial (groundwater) operable unit LFIs. Available groundwater flux data were used in the preliminary evaluation, not spring sampling data.

Comment 215. Furthermore, the CTUIR understands that the DOE is relying on water quality data collected from groundwater monitoring wells to predict water quality parameters from 100 Area shoreline seeps and springs. The data from groundwater monitoring wells is, in effect, being extrapolated to predict contaminant concentrations in seeps and springs in place of collecting water samples from these areas. In addition, offshore seeps and springs discharging to the Columbia River, which are potentially affecting the river system, have not been sampled.

Response: Acknowledged. Chapter 5 contains specific tasks and activities to characterize plume mixing within the river sediments and water column. This will allow for the hypothesis derived from the preliminary evaluation to be tested.

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Comment 216. The CTUIR believes that the monitoring well data used to predict contaminants in seeps and spring are inadequate for evaluating impacts to the Columbia River. The CRIEP should be designed with the most thorough set of data available and if conclusive data is not available, additional water quality sampling needs to be conducted. No conclusions should be made until the data gaps are filled and conclusive information gathered. The CRIEP should make it clear that the statements presented on environmental impacts are considered preliminary and inconclusive.

Response: Accepted in part. Additional groundwater investigations are being implemented under terrestrial operable unit LFIs and will be available for future, more detailed assessments. Although the CRIEP contains the qualifying statements requested, the document will be edited to clarify these points.

Comment 217. E. THE CRIEP MAKES PREMATURE STATEMENTS ON ENVIRONMENTAL IMPACTS IN THE ABSENCE OF DEFENSIBLE EVIDENCE

The CRIEP contains numerous statements that no adverse impacts on the Columbia River environment have resulted from 100 Area operations. The TSP has convened a subcommittee that is reviewing historical reactor operating records to accurately determine the "source term." Until the TSP has completed its activities, assumptions concerning environmental impacts from reactor operations are premature.

Response: Acknowledged. The document will be edited to clarify these points.

Comment 218. The CRIEP discounts adverse impacts on the Hanford Reach from spring discharges due to dilution with Columbia River water. However, the mixing process has not been evaluated and some contaminant releases may travel as a plume or slug for some distance before being dispersed. The CTUIR believes that localized impacts on natural resources must also be addressed and not

simply dismissed based on DOE's questionable assumption that biological organisms will move away from these areas.

Response: Acknowledged. The CRIEP recognized the potential for localized effects in Chapter 5 and recommended specific tasks and activities to characterize plume mixing within the river sediments and water column. This will allow for the hypothesis derived from the preliminary evaluation to be tested.

Comment 219. In addition, in the conclusion presented on page 24 of the CRIEP it is stated that contaminants of concern in surface water are not significantly different between upstream and downstream collection points. In fact, measured upriver and downriver Tritium concentrations differ by a factor of two in each of the six years between 1986 and 1991. This conclusion is also inappropriate because there is no evidence in the report that the data were statistically evaluated to compare differences and variability between monthly sampling periods, nor is there any reference to conclusive evidence supporting these findings.

Response: The report provides the data necessary to support the conclusion, and specifically notes that tritium concentrations downstream are different from upstream.

Comment 220. F. THE CRIEP PROVIDES NO EXPLANATION ON HOW IT FITS INTO THE OVERALL HANFORD ENVIRONMENTAL "CLEAN-UP" PROCESS

A 1990 Tiger Team report stated that "A single, cohesive plan for management of past practice activities performed under the TPA is necessary to ensure efficient planning, organization, coordination, budgeting, management, review and control of those activities."

This issue, identified by the Tiger Team, is clearly illustrated in the haphazard and piecemeal approach taken in the CRIEP. As such, this document falls substantially short of providing a comprehensive, integrated analysis that the CTUIR perceives to be the intent of TPA M-30.

Because the information summarized in the CRIEP will be used in the RI/FS process for establishing baseline information and in the subsequent development of remedial actions, the CRIEP should be rejected because it does not contain comprehensive and/or accurate information.

In terms of TPA language, the CRIEP is a "primary document representing final documentation of key data and reflects decisions on how to proceed." The CRIEP will become a reference document in the administrative record for 100 Area decisions and be incorporated by reference into CERCLA/RCRA decision making processes at face value as a representative description of 100 Area existing environmental conditions. The CRIEP is inadequate in fulfilling this important role.

Therefore, the CTUIR is deeply concerned with the CRIEP because missing and inaccurate information and erroneous or unwarranted conclusions in this analysis will carry through the CERCLA process, falling short of

meeting the CTUIR's needs in adequately describing Hanford-induced cumulative effects.

Response: Acknowledged. However, detailed programmatic management issues are beyond the scope of the CRIEP.

Comment 221. The DOE has acknowledged its responsibilities in bringing management of the Hanford Nuclear Reservation into compliance with applicable environmental laws and regulations. In Section 4 of the CRIEP on page 4, it is stated that restoration activities are being conducted pursuant to multiple federal and state statues, regulations and guidelines.

However, the National Environmental Policy Act (NEPA) is completely ignored in the CRIEP. It should be clearly stated in the document how it will be used for future reference in the CERCLA/RCRA and NEPA processes. As a primary document, the CRIEP should provide an overall view of how it will be used in future decision making processes.

Response: See the response to Comments 62 and 208. However, the CRIEP is only one of many documents related to the river to be used for decision making.

Comment 222. In addition, numerous other laws and regulations that should be integrated into the CERCLA/RCRA process are omitted. For example, the entire Hanford Reach of the Columbia River has been found eligible for Wild and Scenic River designation under the Wild and Scenic Rivers Act. However, no mention of the River's outstandingly remarkable resource values or river classification is mentioned.

Response: See the first paragraph of Section 2.1.1, p. 5.

Comment 223. In the purpose and objectives section of the CRIEP on pages 1 and 2, it is mentioned that M-30 milestones were developed to initiate a rescoping of the 100 operable unit work plans. The CTUIR requests that the Tribes be involved early in the scoping process which would begin the commitment of government-to-government relations. This would lead to the development of resolutions involving complex environmental issues surrounding Hanford clean-up in a facilitated manner.

Response: Acknowledged. The rescoping of workplans was conducted by the signatories of the Tri-Party Agreement.

Comment 224.† IV. Review of the Technical Completeness of the CRIEP

A. Introduction

The following section provides detailed comments on specific deficiencies of the CRIEP. These comments relate to technical aspects of Chapters 2 and 3, "Characteristics and Nature of Contamination" and "Contaminant Fate and Transport" respectively. The following comments are organized consistent with the organization of the CRIEP. Although every issue is not explored in detail, the following remarks are representative of the major problems the CTUIR finds with the current CRIEP.

B. Chapter 2 Review

Section 2.1.3, Hydrological Characteristics

This section provides general information on the Columbia River, but fails to adequately define basic known Hanford Site hydrology. Site hydrology is an important component in evaluating contaminant interaction with the river environment.

Response: Acknowledged. The Reach hydrology is defined for the purposes of the preliminary evaluation which looked at a very conservative low river stage only. We acknowledge that future assessments should be more realistic and that enhanced realism can be achieved, in part, by using better hydrological information.

Comment 225.† The information provided is poorly summarized and overgeneralized. For example, the long term average annual flow rate at Priest Rapids Dam is stated to be 3,400 $m^3/s$. This figure is an overall average from 68 years of record. However, the dam was constructed in 1959 and the hydrological regime of the river was substantially altered thereafter. It would be helpful to have a comparison of the flow rates prior to and following dam construction, rather than combining 68 years of record into one "averaged" measure. In addition, peak or maximum expectable flow rates from storm runoff, snowmelt or 100-year flood events should be reported.

Response: See the response to Comment 224.

Comment 226.† The document fails to mention substantial daily fluctuations in flow rate caused by Priest Rapids Dam management. Water levels at islands and shorelines along the Hanford Reach can fluctuate as much as 2 meters in a day. These fluctuations will have potential impacts on groundwater and sediment pathways, as well as contaminant fate and transport. The importance of these variations should be fully considered in this evaluation to adequately describe contaminant transport, deposition and bioaccumulation.

Response: See the response to Comment 224.

Comment 227. Appendix B provides additional background on hydrologic and hydrogeological characteristics for the Hanford Site; this material should be referenced in the subject section.

Response: Accepted. See the response to Comment 60.

Comment 228.† Section 2.1.4, Ecological Characteristics

This section fails to take an integrated ecosystem-level approach; the material presented is limited to the riverine and riparian zones along the Hanford Reach. At a minimum, the discussion should take into account all 100 Area habitats, adjacent upland sagebrush, steppe and bunch grass communities, as well as discussing the important wildlife areas north of the river.

Response: The information noted is being obtained under terrestrial operable unit LFIs.

Comment 229. The text or appendix should provide a complete listing of all State and Federal endangered, threatened and sensitive plant, fish and wildlife species found on-site. There are 24 listed plant species of special concern found at Hanford; the report, however, lists only five. There are 57 wildlife species with endangered, threatened, sensitive or candidate status listed for Hanford; the report lists only four species.

Response: Accepted in part. A reference to a complete listing of all endangered or threatened species found on the site will be provided. A sentence will be added to the end of Section 2.1.4.2, as follows: "A complete list of federal and state endangered and threatened species are found in Sackschewsky and Landeen (1992).

Comment 230. Section 2.2, Nature and Extent of Contamination

Table 2-1 is described in the CRIEP as containing the mean, standard deviation and range for all determined contaminants of potential concern in groundwater plumes identified in Appendix B of the CRIEP. However, the table does not provide this information. This data forms the basis for all later discussion regarding contaminants of potential concern; its absence from the document makes a meaningful review of the CRIEP infeasible.

Response: Accepted. Table 2-1 contains draft clean-up levels. The information referred to in the text needs to be presented for comparison.

Comment 231. The methodology used for selecting the contaminants of potential concern in the evaluation is highly selective and therefore suspect. First, identification of contaminants of concern is based on selective sampling of wells during only one year, 1989, in spite of the existence of more than 50 years of analytical data. Second, the results reported in Table 2-1 are only singular values that cannot be assumed to be necessarily representative of the full range of concentrations found in migrating contaminant plumes. In the absence of a more detailed sampling program, it is unlikely that the reported values represent meaningful data. There is no presentation of how this data compares to historical or TSP source term data.

Response: Acknowledged. See the responses to Comment 120.

Comment 232. In addition, no discussion of the rationale for the selection of "representative" wells to be used for such characterization is provided. The wide and irregular spacing of the selected wells (Figure 2-2 in the CRIEP) effectively precludes a systematic characterization of the nature, areal extent and concentration levels of constituents of interest and results in what are random measurements whose significance cannot be understood in the larger context. Nor is there any discussion in the CRIEP describing whether the monitoring wells used for data collection are in compliance with RCRA regulations.

Response: Wells have been positioned in a biased manner to intentionally detect contaminant plumes downgradient from waste facilities. The preliminary evaluation is very conservatively based on the maximum concentration detected in 1989 in any well monitoring a given plume. All data reported by DOE are subjected to a quality assurance review that considers, as appropriate, compliance with relevant environmental regulations.

Comment 233. Figure 2-5, showing "conceptual" flow directions from 100 Area facilities to the river, is so oversimplified that it is useless; it should be replaced with a more detailed, real-world representation based on measured water-levels and known historical plume migration pathways.

Response: Acknowledged.

Comment 234. As stated on page 12 of the CRIEP, the contaminants selected for consideration were identified for groundwater plumes only, but are then applied, without further discussion or qualification, to other (i.e., surface water and ecological) potential contaminant pathways. Such an approach not only ignores differences in transport mechanisms, but also differences in chemical interactions between contaminants and soil, water and biological systems and the much longer residence time expected in subsurface soils and groundwater.

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Response: Residence time in soil and groundwater and radiological decay are not accounted for, which is a conservative assumption. This is adequate for the purposes of the preliminary evaluation, but future assessments, which will have the advantage of more detailed data and analysis, will be more realistic. None of the contaminants of potential concern, except chromium, is subject to substantial chemical modification during transport; Chapter 5 contains provisions to characterize chromium speciation.

Comment 235.† 2.2.2.1. Hanford Reach Surface Water Contamination

The text suggests that several radiological and chemical contaminants are discharged to the River under NPDES permits, but will not be considered in this document. These contaminants should be identified and included in this analysis.

Response: This was only a preliminary evaluation. Future risk assessments will consider all potential contaminants.

Comment 236. The large amount of missing data provided in Table 2-5 makes the historical summary of Hanford Reach water quality unacceptable. Over 50% of the data are indicated as "Not Reported." This table does not include a review and comparison of TSP data nor does it account for PNL's Environmental Monitoring Program.

Response: The data in Table 2-5 are from the Environmental Monitoring Program. NR indicates that no analyses were conducted for the constituent in question during the given year.

Comment 237. Missing data are used to support the conclusion, "Except for $^3H$ and nitrate in 1987, levels of contaminants of potential concern measured downstream ... are not significantly different ... from levels measured upstream of the Hanford Site."

Response: Only the data reported are used to support the conclusion.

Comment 238. Emphasis placed on conclusions from a 1954 study are unfounded and totally disregard data and conclusions from more modern, current studies. Rather than providing quantitative data, only general statements are cited, e.g., "these isotopes accumulated in aquatic organisms" [which, how much?] and "measurable quantities of radioisotopes were entering the public drinking-water supply" [which, how much?].

Response: Please refer to the references cited for more information. A detailed quantitative description of 1954 data are not needed for the purposes of the preliminary evaluation.

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Comment 239. 2.2.2.2. Riverbank Springs

Geologic mapping of the seeps and springs on-site has not been carried out. This task was included in the preliminary agreement on scope for the M-30-01 milestone because of the inadequacy of available data, but was not completed. As a result, we have no reliable data regarding the location and flow rates for the springs that have been sampled, and no assurance that samples currently available are representative of the overall hydrological regime for the Hanford Reach area.

Response: See DOE-RL (1992d) and Dirkes (1990), referenced in the CRIEP.

Comment 240. Consequently, the CTUIR staff strongly disagree with the comment provided on pg. 33, "groundwater discharges to the river cause localized impacts on a small scale." No evidence regarding the type or size of the localized area or scale of the impact has been presented.

Response: See DOE-RL (1992d) and Dirkes (1990), referenced in the CRIEP.

Comment 241. Section 2.2.3, Ecological Contamination

The document states that environmental monitoring and scientific studies have been carried out for over 45 years, yet fails to provide an adequate summary of these data. The Plan fails to provide summary information on ecological contamination in shellfish, benthic organisms, amphibians, reptiles, waterfowl or terrestrial organisms. Nor is there an analysis comparing the reported data with available historical data.

Response: References are provided to studies and environmental monitoring programs that provide the information requested. It was beyond the document scope to summarize every study conducted on the Hanford Reach. Rather, significant findings in the available literature were summarized.

Comment 242. This section needs to present a more thorough and complete review in order to support the conclusion: "Environmental studies and monitoring to date have not shown, however, that the observed contaminant concentrations have resulted in any significant adverse impact to the Hanford Reach ecosystem." This conclusion is unwarranted and cannot be substantiated on the basis of the information provided.

Response: The statement in question is accurate, but it is not a final conclusion (if it were, there would be no Chapter 5.2).

Comment 243. The CTUIR agrees with the following statement, "... it should be noted that fish are mobile within the Hanford Reach and the opportunistic sampling methods used by the Environmental Monitoring Program may be insufficient to detect impacts."

Response: Acknowledged.

Comment 244. C. Chapter 3 Review

This chapter provides a cursory analysis of fate and transport for the "contaminants of potential concern" identified in Chapter 2. As noted above, the CTUIR disagrees with the selection process used to determine contaminants of potential concern. The following additional deficiencies are noted for Chapter 3.

The computational model developed in the CRIEP fails to consider all potential contaminant pathways. As noted earlier there is no justification for not including the "skyshine" exposure pathway.

Response: The preliminary evaluation was never conceived to address all potential contaminant pathways; only major pathways were included.

Comment 245. The computational model fails to consider potential contaminant uptake and transport mechanisms by amphibians and reptiles.

Response: Acknowledged. Fish were specified as the environmental receptor for evaluation.

Comment 246. The Plan needs to clearly state what criteria were used to assess the significance of the various pathways. Of the 30 pathways presented in this model, only three are considered in the analysis.

Response: The rationale requested is provided in Chapter 3.

Comment 247. The CTUIR staff disagree with the statement, "Potential impacts [from contaminated seeps and springs] would be limited to environmental receptors since human access to the 100 Area is limited by institutional controls. In addition, the seeps and springs are not always accessible, evident, or conducive to water collection." River areas adjacent to 100 Area seeps and springs are easily accessible by boat. Although the springs and seeps may not always be "evident", this would seemingly increase future potential impact, rather than

limit it. The conclusion regarding potential impact is unsubstantiated by the information presented.

Response: The fact that the shoreline is easily accessible does not alter the physical properties of the springs or seeps that makes them inaccessible, non-evident, or non-conducive to collection. The use of extensive was meant to convey that there may indeed be localized impacts, but these are not widespread or evident downstream.

Comment 248. The CTUIR disagrees with the conclusion, "it is not likely that any significant adverse downstream environmental or health impact associated with the river-water column would be extensive." Statistical problems with the data used to support this conclusion are discussed in Chapter 2, above. Note also that the use of the term "extensive" is inappropriate, as no information relating to the extent of any significant adverse impact has been presented. Finally, the conclusion completely discounts localized effects associated with potential contamination from seeps and springs discharging contaminants to the surface-water pathway.

Response: Accept in part. See the response to Comments 10 and 15.

Comment 249. The document states, "potential environmental impacts were evaluated by considering contaminant uptake by fish and by comparing derived contaminant concentrations in the river to ambient water quality criteria." It is unclear what data were used for the biotic pathway evaluation and there are no conclusions indicated as to the results of the research.

Response: No study is referenced. The cited section refers to the evaluation conducted in the CRIEP. All results are presented in the document.

Comment 250. Regarding the white pelican study, it is stated in the CRIEP that because "recent environmental surveillance reports show no measurable influence on fish from radionuclides released to the Hanford Reach . . . . Thus, it is unlikely that white pelicans are . . . adversely impacted." What data support this conclusion?

Response: We are unaware of any contaminant studies conducted on white pelicans using the Hanford Reach. However, if pelican food and habitat (the river) show near-background to no detectable levels of contaminants, it is unlikely white pelicans are adversely affected.

Comment 251.† There are a number of additional threatened, endangered and sensitive species that should be taken into account in evaluation of biotic pathways. These should include both animal and plant species of concern; the complete omission of terrestrial and aquatic plants as potential biotic pathways is not acceptable. Studies should be conducted on less mobile organisms such as those more likely to be permanent residents of the Hanford Reach and on those that live, feed or burrow in the bottom sediments.

Response: Acknowledged. Baseline risk assessments will select appropriate environmental receptors for assessment.

Comment 252. Section 3.3 states, "Contaminant transport is addressed below by subsurface, surface-water, and biological considerations." What follows, however, discusses subsurface transport only. The entire sections on surface-water and biological considerations are missing from the document.

Response: Section 3.3.2 addresses surface-water transport; Section 3.3.3 addresses biological transport.

Comment 253. Section 3.3.1 states "Table 2-3 shows the estimated groundwater flow rates and source concentrations derived from information in Appendix B." This is incorrect; the referenced table appears as Table 2-2.

Response: Accepted. The text will be corrected.

Comment 254. V. Proposed Data Collection Activities

On page 82 of the CRIEP, it is stated that "the consideration of spatial, ecological, temporal and administrative factors for any investigation points to an eventual need for characterizing the river on a programmatic basis." The CTUIR agrees that a collective and comprehensive environmental impact evaluation cannot be completed without such an approach. However, the CRIEP fails to meet this need.

Response: Acknowledged. The scope of the CRIEP is defined by Tri-Party Agreement milestones. Milestone M-13-80B provides for a comprehensive assessment.

Comment 255. Although Chapter 5 contained in the CRIEP attempts to provide guidance for future studies, the background information reported in the CRIEP is incomplete and the conclusions are selective at best. Therefore, the future study designs are suspect.

Response: Comment noted. However, the bounds on the background information (data on current contamination, selected contamination in the 100 areas) are sufficient to indicate additional data needs.

Comment 256. The tasks and activities planned for data collection should be designed to include an in-depth study into the impacts of historical Hanford operations on an ecosystem basis. As described earlier, additional indicator species such as amphibians need to be evaluated to better represent species and habitats that may be the most ecologically sensitive.

Response: See the response to Comment 254. Because of their mobility on both land and water, amphibians can be considered poor indicators of impact (e.g., if an impact is detected, what medium (land or water) can it be attributed to?).

Comment 257. Amphibians are excellent candidates for bioassay because, due to their biphasic life history (i.e., aquatic larvae and terrestrial adults), are exposed to contaminants in more that one media.

Response: Before bioassays or similar studies are initiated, the presence of contaminats at levels approaching known levels of significance to individuals or

populations (for instance, in comparison to studies reported in the toxicology literature) in their habitat should be documented.

Comment 258.† Additional studies are needed to fully understand implications of pathways other than those described in the CRIEP. It is insufficient to assess only the impact to fish. These studies would include human ingestion of waterfowl, venison, plants, irrigated crops, domestic livestock and other animal products.

Response: Acknowledged. However, the recommendations are not specific to the Reach and are equally applicable to a larger-scale investigation than just the 100 Areas.

Comment 259.† Other studies need to be completed on the radiobiology of important fisheries resources. An understanding of interactions between contaminated sediments and the effects on both spawning and rearing juvenile fall chinook salmon, for example, is crucial in protecting and enhancing this tremendous natural resource.

Response: Chapter 5 proposes studies on contaminant levels in sediment. Once the actual contaminant levels have been quantified, the results can be used to determine the need for additional work, such as bioassays.

Comment 260.† The CTUIR recommends that the following studies be incorporated into or added to the tasks contained in the CRIEP to further define biological impacts of Hanford on the Columbia River environment:

1. Activity 1A-3 - Studies should include an assessment of sediment partitioning to determine impacts of ambient sediment conditions. Studies should be completed on whole sediment and interstitial water in conjunction with chemical/radiological analysis.

Bioassays should include a variety of plant and animal indicator species to determine lethal and non-lethal end points and to define the link between contaminant uptake and concentration factors. These studies should also determine human exposure risk.

Long-term studies on the effects of nuclear waste materials that migrate from present storage sites and enter the Columbia River on fall chinook salmon and other salmonid species as well as sturgeon, whitefish, bass etc., need to be thoroughly studied.

Potential exposure scenarios need to be evaluated and data collected to determine effects of contamination on embryonic development, egg to fry survival and effects on juvenile fish species.

Evaluations need to be completed to determine the potential for contaminants to intersect and impact key fall chinook spawning areas in the Hanford Reach and downriver areas on the Columbia River. An example for the need of these studies is the previously described fuel rod failures and the rod fragments located in the Columbia River.

2. Activity 4-1 - data needs to be collected on the uptake, elimination and bioaccumulation in resident as well as migratory species. These types of assessments should include shorebirds, neotropical migrants, raptors and waterfowl such as the Canada goose as well as plant species.

3. Activity 4-2 - these activities should include studies to determine impacts on benthic communities as well as on organisms such as amphibians and reptiles.

4. Activity 4-3 - The CTUIR request that riparian species as well as upland and other terrestrial organisms be included in this activity.

Response: See the first portions of the response to Comment 16 that address Activities 1A-3, 4-1, and 4-2. Upland and riparian data are being collected under terrestrial operable unit Ris.

Comment 261. VI. Conclusions

The CTUIR has a direct governmental interest in the environmental health of the Hanford Nuclear Reservation and in off-site resources affected by Hanford as well as Tribal community health and safety. Environmental restoration at Hanford and in downriver areas of the Columbia River is CTUIR's top priority for protecting treaty rights and in protecting and restoring the natural resources upon which the CTUIR's treaty-rights are based.

Response: Acknowledged.

Comment 262.† Concern exists with the CRIEP because it does not adequately provide a comprehensive overview of the impacts on the natural environment. Concerning the contaminant pathway analysis, the CTUIR believes that DOE's assessment of the environmental impacts contained in the CRIEP are incomplete. The CRIEP falls short of evaluating the ecological data gaps because the study fails to integrate other research activities and focuses on only the surface water pathway. The CRIEP presents a narrowly defined human receptor pathway and does not adequately evaluate other pathways.

Response: Acknowledged. A baseline risk assessment will be conducted.

Comment 263. The exclusion of other pathways does not fulfill the requirements of a comprehensive cumulative impact evaluation nor does it set the stage for future impact evaluations.

Response: The milestone M-30-02 was to develop a plan to conduct a cumulative comprehensive impact evaluation. The CRIEP lays the foundation for ensuring that data is available for conducting a baseline risk assessment. Further data evaluation will occur under milestone M-13-80B.

Comment 264.† Chinook salmon are used as the primary indicator in evaluating human exposure to contamination in the CRIEP. Tribal members of the CTUIR utilize a variety of aquatic and upland terrestrial organisms and numerous vascular

plants for subsistence. These resources represent pathways of potential contamination and should be considered in any cumulative impact assessment.

Response: Acknowledged. This recommendation will be considered for implementation in the baseline risk assessment.

Comment 265.† Many organisms indigenous to the Hanford area that are extremely sensitive to contaminants are ignored. For example, amphibians, macroinvertebrates and vascular plants associated with wetlands and backwater sloughs may be subject to higher concentrations of contaminants due to deposition of contaminated river sediments. Organisms residing in these areas may be more representative of the impact caused by Hanford than more mobile organisms and are generally considered more appropriate biological indicator species. These species would more accurately represent the magnitude and extent of contamination from Hanford operations, yet they receive only a cursory examination in the CRIEP.

In summary, simply evaluating the surface water of the Columbia River and predicting environmental impacts based solely on this information is inappropriate. The TPA itself states that a comprehensive evaluation of the Columbia River is the intent of this CRIEP. Clearly, this CRIEP does not fulfill these goals.

Response: The reviewer again mistakes the intent of Milestone M-30-02. Please see the response to Comment 263.

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Comment 266. Page 1 Paragraph 2: Sentence 1 Where is Milestone M-30-01, and why is it not listed in the references? This statement does not agree with Page 1 Paragraph 3: Sentences 2&3.

Response: Accepted in part. Milestone M-30-01 is discussed on Page 1, Paragraph 6, Sentence 2 and is referenced under "DOE-RL, 1991a" (Page 96). The text of Page 1, Paragraph 3, Sentence 2 will be changed to the following: "The purpose of the preliminary impact evaluation was to assess the adequacy of existing data and proposed data collection activities in order to support a future baseline risk assessment that will determine the cumulative health and environmental impacts to the Columbia River".

Comment 267. Page 2 Paragraph 1: Sentence 2 Is the evaluation referred to supposed to be M-30-01? This shows the establishment of CERCLA guidelines for scientific data collection.

Response: The reference is to Milestone M-30-02. Milestone M-30-01 requires the submission of a secondary report which evaluates the impact of contaminated seeps and springs on the Columbia River. This document (CRIEP) provides a plan which includes additional sources of river contamination.

Comment 268. Page 2 Paragraph 1: Sentence 4 Quantification means: to determine or express the quantity of. Should this word be qualify, or be a qualitative assessment?

Response: Because this document is a scoping plan it is only a qualitative assessment. However, selected human health and environmental effects are quantitatively evaluated in Chapter 4. Human health risks are calculated through multiplying the estimated doses under residential and recreational scenarios, by the estimated carcinogenic slope factors and non-carcinogenic reference doses. The environmental risks are quantitatively estimated by dividing the ambient water column concentration by the representative toxicity criterion to obtain a contaminant-specific environmental hazard quotient (EHQ).

Comment 269. Page 2 Paragraph 3: Sentence 1 The reference M-30-00 is missing in the Bibliography.

Response: Accept in part. Milestone M-30-00 is referenced under "DOE-RL 1991a". This reference will be added to the text of Page 1, Paragraph 3, Sentence 1.

Comment 270.† Page 2 Paragraph 4.- Sentence 2. This sentence establishes that there is no quantitative assessment. This statement is in conflict with the previous statement on Page 2 Paragraph 1: Sentence 4.

Response: The impact evaluation provided in this document is only preliminary. It does not consider all of the exposure pathways and scenarios which would be conducted in a full baseline risk assessment which this plan recommends in Chapter 5 in order to support final records of decision at Hanford.

Comment 271. Page 2 Paragraph 6: Sentence 2 Does the NCP supersede the guidance of CERCLA, RCRA, or ECOLOGY? If not why was it mentioned?

Response: The NCP comprises the regulations which enact the requirements of CERCLA (a legislative Act). It does not supersede other federal or state regulations, such as RCRA (federal) or any Washington State Department of Ecology regulations.

Comment 272. Page 2 Paragraph 5: Sentence 3 There needs to be a specific reference to time here for this statement to be scientifically valid. Controls can become biased if the reference parameters are restricted, thus, the items in parentheses need to be deleted or changed.

Response: The control samples were collected in 1989 at two upstream (background) locations, at the Priest Rapids Dam and at the Vernita Bridge. The contaminant concentrations and the plumes identified in Chapter 2 of the report provide sufficient background information for the preliminary and qualitative nature of the impact evaluation provided in Chapter 4 of this report.

Comment 273. Page 3 Paragraph 1: Sentences 4 & 5 These two sentences are not in agreement with Page 1 Paragraph 3: Sentence 2.

Response: The monitoring effort mentioned in these two sentences is an ongoing program conducted by Pacific Northwest Laboratories for the Department of Energy. The purpose of the Columbia River Impact Evaluation Report is to assess the adequacy of the existing data, and to suggest additional data needs necessary to determine cumulative human health and environmental impacts to the Columbia River.

Comment 274. Page 3 Paragraph 1: Sentence 6 This sentence establishes the fact that except for the 1989 data set, the rest of the data sets are incomplete. This raises the question of the methodology used, scientific repeatability, quality assurance and quality control under the Tri-Party Agreement.

Response: The 1989 data represents the most complete data set available for use as a baseline in this study. Stating that "...1989 was the most complete data set" does not mean that data from other years is incomplete. Data from other years was included in this evaluation for completeness.

Comment 275. Page 3 Paragraph 1: Sentence 8 This document was published June 1993. If the data sets are incomplete as late as 1992, the methodology of statistical data gathering including the 1989 data set is in question.

Response: The report was written in 1992. The data base used is sufficient for the qualitative assessment of potential impacts to the river. However, recommendations for further analysis are presented in Chapter 5.

Comment 276. Page 3 Paragraph 2 Item 1: sentence 2 What is the primary standard to be used? The CERCLA, RCRA, Tri Party Agreement Regulations or the NCP? Which one is to be used, ambient water quality, drinking water quality, or Class A (Excellent) surface water body standards? Does the identification approach take into account the geochemistry of the systems including the decay products, mass balance, pH, Eh, reactivity, exchange capacity of the aquifer, speciation effects, temperature, or time?

Response: CERCLA, NCP, RCRA, and the Tri Party Agreement are all applicable and relevant appropriate requirements (ARARs) that apply at the Hanford Site. The most protective applicable standards are used to establish the identity of the contaminants of potential concern, i.e., the ambient water quality and drinking water standards (CWA and SDWA). Laboratory analytical results were the only criteria used to determine contaminants of potential concern. Decay products are considered in the evaluations because their toxicities are evaluated in the EPA slope factors for the parent radionuclide which is in an equilibrium with the daughter isotope. Geochemical parameters were not considered because their effects on the analytes detected are theoretical not empirical.

Comment 277. Page 3 Paragraph 4 Item 3: Sentences 2 & 3 The contaminants of potential significant adverse effects have not been established. These sentences establish the identification of exposure pathways and listing of several paths, but do not list time, geochemistry, transformation products, temperature, pH, Eh, reactivity, speciation, subsurface geology, ion mobilization, or other significant aspects for evaluating contaminant pathways.

Response: This document is not a baseline risk assessment. However, the method used to evaluate contaminant fate and transport was highly conservative because of the qualitative nature of this report.

Comment 278. Page 3 Paragraph 5 Item 4; Sentences 2 & 3 Have the selected exposure pathways been judged? If so, by who, at what time, and using what methods? These threats to human health and the environment were evaluated using the NCP risk assessment. Were they supposed to be assessed according to EPA guidelines, or other guidelines? There is a standardization problem with which guidelines to be followed.

Response: The selected pathways were judged by the authors to be most significant for the purposes of a preliminary evaluation. This is explicit in the document.

Comment 279. Page 3 Paragraph 7 Item 6: Sentence 2 The word "adequate" needs further defining in terms of the Tri-Party Agreement, CERCLA, RCRA regulations and the Endangered Species Act.

Response: The term "adequate" is understood to be sufficient to provide sufficient analytical information to support subsequent 100 Area baseline risk assessments and future remedial actions at 100 Area sites.

Comment 280. Page 4 Paragraph 1: sentence 2 This sentence establishes that the document is bound by CERCLA, RCRA, and Washington State statutes Model Toxics Control Act and the Hazardous Waste Management Act. This section does not include the Tri-Party agreement and the Endangered Species Act.

Response: The first sentence of Page 4, Paragraph 1 states "The Hanford Site restoration activities are being conducted by multiple federal and state statutes, regulations, and guidelines." The Tri Party agreement and the Endangered Species Act are among the ARARs referred to in sentence 1, and in paragraph 2.

Comment 281. Page 4 Paragraph 6: Sentence 1 A summary of the preliminary impact evaluation results is already supposed to have been done with the completion of Milestone M-30-01. This statement is out of context.

Response: Milestone M-30-01 requires the submission of a report to EPA and Ecology which evaluates the impact of contaminated springs and seeps along the 100 Area of the Hanford Reach to the Columbia River. The CRIEP report is a plan which considers the cumulative effects of these and other significant contaminant sources on the Columbia River in order to make a preliminary determination of potential impacts to human health and the environment, according to Milestone M-30-02. The results of the evaluation were used to develop a plan to ensure collection of sufficient data to adequately characterize the 100 Area of the Columbia River to ensure CERCLA cleanup. The M-30-01 Milestone requires the completion of a separate report on springs and seep data.

Comment 282. Page 5 Paragraph 1: Sentence 4 It would also be expected that any adverse impacts would occur in the sediments lying in the low energy pools not only downstream but cross stream due to sediment transfer.



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Response: Accepted in part. River sediments are a primary pathway for contaminant migration in the Columbia River. However, a consensus impact assessment methodology does not exist at this time. One of the standard methodologies may be agreed to during the comprehensive river assessment, after discussions with DOE, EPA, Ecology, and the public. Additionally, there is no evidence of past or present significant ecological impacts associated with contaminated sediments. This does not mean that significant impacts have not occurred, only that evaluation tools to measure impacts in this pathway are lacking. Data collection activities required to fill the data gap are discussed in Section 5.2 of the CRIEP report.

Comment 283. Page 5 Paragraph 4: Sentence 5 This statement does not make allowances for temperature extremes that dominate the climate. The daily temperature can make a large difference in the solubility of the readability of all of the constituent contaminants and the transporting medium. The local wind direction is extremely variable and also needs to be taken into affect.

Response: Accepted in part. Most field analytical instruments have temperature ranges for operation. The effect of temperature extremes on field water quality instruments should be accounted for if they are used outside of their effective ranges (e.g., calibration of water conductivity instruments to ambient air temperature).

Accounting for local wind direction can be applicable in quantitative transport modeling, but the purpose of section 2.1.1 is to provide the general environmental characteristics at the Hanford Site, the effect of temperature extremes and wind direction on surface water transport modeling are beyond the scope of this section.

Comment 284. Page 6 Figure 2-1 The legend is not complete. This map of the Hanford Site is not the map to use if you reference such sites as the McNary Dam and the Priest Rapids Dam (Page 5 Paragraph 3: Sentence 1). The arrow above the words YAKIMA RIVER is very misleading, what does it indicate, secondary wind direction, north, or current flow? The arrow near the words COLUMBIA RIVER has the same effect as the previous mentioned arrow. The arrows are not listed in a legend box, along with typical map items you would expect to find such as bridge symbols, boundary symbols, and feature pointers, this is not standard cartographic nomenclature. Because there are islands depicted in the river channel there should be some references to the current flow and sediment transport patterns, due to the earlier reference Page 5 Paragraph 4: Sentence 5 that the area is important for spawning salmon and steelhead fish.

Response: Accepted in part. A reference to the location of the McNary Dam will be included on Figure 2-1, (similar to the Priest Rapids Dam location) and a description of the arrow above the Columbia and Yakima Rivers (river current flow) will be included in the legend. The location of the Priest Rapids Dam is indicated on Figure 2-1, but because of its distance from the site it would not be appropriate to place its location on a Hanford Site map. The reference documents for the locations of chinook salmon and steelhead trout spawning grounds are referenced in the text of Pg. 5, Para. 4, Sent. 5.

Comment 285. Page 7 Paragraph 1: Sentence 6 The word "significant" needs to be further defined in terms of operational changing of the ecology, with a comprehensive description of the baseline ecology.

Response: The last sentence of pg. 7, Para. 1 provides a reference to the documents which detail reactor operations at each 100 Area operable unit. A comprehensive description of the baseline ecology of the site and the effect of reactor releases on the ecology is beyond the scope of this plan.

Comment 286. Page 7 Paragraph 4: Sentence 5 Converting cubic meters to cubic miles is not a standard conversion and is cumbersome. The most common usage is in acre-feet.

Response: Accepted. A conversion to acre-ft will replace $mi^3$.

Comment 287.† Page 7 Paragraph 4: Sentence 6 Because of the importance of the river mentioned on Page 5 Paragraph 4: Sentence 5, the reference to the amounts of water that pass by the Hanford Reach, there should be a description of the hydrological characteristics, including, quantitative geomorphology, role of river bars, Stability of sediments, and bedload characteristics,

Response: The CRIEP is a preliminary impact evaluation conducted to assess the adequacy of existing data and to provide a plan which evaluates impacts to the Columbia River in the vicinity of the 100 Areas. The purpose of the CRIEP is to identify future data collection efforts in support of a comprehensive site characterization and baseline risk assessment. A description of the geomorphology, role of river bars, sediment stability and bedload characteristics can only be meaningful after further information is collected, as described in Chapter 5.

Comment 288. Page 7 Paragraph 5, Sentence 2 The conversion for 1020 M3/s is not 36,000 f3/s; it is, more correctly 36,021 ft3, keeping with the standard significant figure. Why was cubic feet used instead of gallons per minute? This sentence also establishes the variability of the significant flow rate.

Response: The figure 36,000 incorporates the three significant figures in 1,020.

Comment 289. Page 7 Paragraph 5, Sentence 3 The sentence does not mention where the rates are recorded nor do the rates agree with the statement in Page 7 Paragraph 4 Sentence 6.

Response: This sentence illustrates the fluctuations in river flow discussed in sentences 1 and 2, Pg. 7, Para. 5, for the gaging station at Priest Rapids Dam. The reference to "...daily averages can vary from 1,000 to 7,000 $m^3/s$..." in Pg. 7, Para. 4, Sent. 6 refers to daily average flows, whereas the reference to flows of up to 12,700 $m^3/s$ (in subject sentence) are peak spring runoff measurements, not daily Columbia River averages.

Comment 290. Page 7 Paragraph 5: Sentence 4 Which low annual flow rate is supposed to be the rate to be used in a study for determining the baseline ecology, the rate mentioned at Page 7 Paragraph 5: Sentence 2, or the rate mentioned in this sentence?

Response: The baseline ecology is not defined in the CRIEP report. However the flow rate used in the Hanford Reach contaminant transport model (Section 3.3.2), used to estimate contaminant concentrations in the preliminary environmental evaluation, represents the minimum flow rate of 1,000 $m^3/s$. The minimum flow rate is used in order to maintain a conservative estimate of contaminant dilution.

Comment 291. Page 8 Paragraph 1: Sentence 2 & 3 Longitudinal bars are a primary indicator of non-stable river channels indicating the river is actively moving sediments irrespective of the dams or, the dam practices. The indication that the river channel is relatively stable does not apply here, especially without the use of a time parameter.

Response: The subject sentence indicates that the channel remains relatively stable based on the controlled flow of the Columbia River. However, this does not mean that there are not periodic fluctuations in river flow which contribute to riverbank erosion and sediment redeposition. The longitudinal bars are features which pre-existed dam construction, therefore their presence does not indicate significant river bank erosion. Without the upriver dams, much larger fluctuations in river flow would occur which would significantly contribute to sediment redeposition. Therefore the dams create a relatively stable river channel along the Hanford Reach.

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Comment 292. Page 8 Paragraph 1: Sentence 4 Where are the references for this determination?

Response: Acknowledged. The sources will be identified.

Comment 293. Page 8 Paragraph 1: Sentence 5 Indicating the existence of low energy areas implies there are references to support this sentence. This also leads to the acknowledgment that the contaminants (many are heavy metals) would migrate to areas such as those mentioned.

Response: Acknowledged. See response to comment 291.

Comment 294. Page 8 Paragraph 2: Sentence 1 The definition of riverine is anything pertaining to or formed by a river, not just the channel to the high water mark.

Response: Acknowledged. Webster's New World Dictionary defines riverine as "on or near the banks of a river; riparian 2. of, like, or produced by a river or rivers." However, in order to distinguish between riverine and riparian we define the high water mark of the river as the difference between the communities.

Comment 295. Page 8 Paragraph 2: Sentence 2 The term "unaltered" is inconsistent with the statement referenced on Page 7 Paragraph 1: Sentence 6.

Response: According to a study by Robeck (Robeck et al. 1954), conducted during the period of reactor coolant water releases into the Columbia River, there were no apparent immediate effects on the aquatic population (see Section 2.2.2) even though significant quantities of radioisotopes were released into the river.

Comment 296. Page 8 Paragraph 2: Sentence 3 This sentence establishes the reference to the term "lacustrine" indicating the study encompasses the lacustrine environment including the lacustrine sediments.

Response: Acknowledged.

Comment 297. Page 8 Paragraph 2: Sentence 4 The term "Littoral" specifically pertains to the benthic ocean environment or depth zone between high water and low water; also; pertaining to the organism of that environment. A synonym for littoral is inter tidal which is inconsistent with the statement on Page 6

Response: Acknowledged. We agree that the word littoral is derived from the latin word "litoralis" meaning seashore, however, it may also be used for a generic shoreline, as in the subject sentence for wetlands along the shore of the Columbia River. We do not understand the reference to page 6 of the text, which is Figure 2-1.

Comment 298. Paragraph 3, Sentence 2. Seasonal and impounded is repeated.

Response: The text refers to two types of wetlands according to the USFWS wetland classification system. The "seasonal and impounded" is necessary to both types.

Comment 299. Page 8 Paragraph 4: Sentence 1 This is an incomplete definition in terms of this document.

Response: Accepted. We will expand the definition by inserting the following in sentence 1, ". . . much of the year <u>below the level of the river's high water mark."</u>

Comment 300.† Page 9 Paragraph 6: Sentence 1 The term "fast moving water" needs to be quantified, how fast, in what direction, and are there eddies?

Response: Acknowledged. However, quantifying the flows in sloughs, slack-water areas and along shores with fast moving water is beyond the scope of this qualitative plan. This information is appropriate to a detailed surface water flow model, based on the modeling results presented in Chapter 3, should not be necessary to evaluate the effects of Hanford Site contaminants on the Columbia River and the potential human health and ecological risks based on exposure to the river. However, if an adequate sediment transport model is used in subsequent investigations this type of data may be required.

Comment 301. Page 9 Paragraph 6: Sentence 3 The Endangered Species Act has not been mentioned and especially should be at Page 4 Paragraph 1: Sentence 2.

Response: Accepted in part. A reference to the Endangered Species Act will be provided in the subject sentence.

Comment 302. Page 9 Paragraph 7: Sentences 1 & 2 Are the terms "shore substrate" and "cobble and gravel substrate" being used appropriately in the sense of

ecological terminology or does the term "cobble and gravel substrate" explicitly refer to a mapped subsurface unit?

Response: The term "cobble and gravel substrate" is referenced in the text from an ecological treatise on the Columbia River (Fickeisen et al, 1980). It is assumed that it refers to the standard geological classification system based on particle size.

Comment 303. Page 10 Paragraph 1 Sentence 1 This sentence does not agree with the statement on Page 8 Paragraph 2: Sentence 2.

Response: This sentence only refers to riparian tree species, there is a diversity of other riparian species. Refer to the discussion in Section 2.1.4.2 for a description of the riparian plant species in the Hanford Reach.

Comment 304. Page 10 Paragraph 4: Sentence 1 The endangered species act has not been mentioned and especially should be at Page 4 Paragraph 1: Sentence 2.

Response: See response to comment 280.

Comment 305. Page 10 Paragraph 6: Sentences 2 & 3 To adequately assess the ground water flow the wells, data should be supplied as to the well construction, depth, and inter-well subsurface geology correlations. The well positions need to reflect a distinct correlation to the subjects being monitored, the well spacing on Figure 2-2 do not.

The legend is incomplete, and the map has not been adequately detailed or labeled. Are the wells bottomed out in the same subsurface unit?

Response: The qualitative nature of the CRIEP report does not require that details concerning well construction, depth, and inter-well subsurface geology correlations be discussed. A reference to the source document for this data (Evans et al. 1990) is provided in sentence 1 of the same paragraph. Precise well locations that correlate to monitoring subjects are not required for the surface water modeling performed in Chapter 3, since the model conservatively assumes the maximum detected concentration is fluxed into the river as a vertical line source. This model also assumes the river with an infinitesimal width, that the discharge is at constant contaminant mass discharge rate, and is distributed uniformly over the depth of the river at the riverbank.

Comment 306. Page 12 Paragraph 1: Sentence 1 The term "Soil" indicates that the subsurface has been determined, and that the contamination products flowed through distinct horizons. The term "Current primary pathway" indicates that the subsurface has been adequately mapped and modeled.

Response: Acknowledged. The work plans for each of the 100 Area waste sites provides information on historical soil and groundwater analysis conducted at each site.

Comment 307. Page 12 Paragraph 2: Sentence 1 Why were only the major chemical and radiological contaminants listed? This is not an inclusive list. Elements

that should have been included are Rubidium (86Rb), Ruthenium (106Ru), and Cesium (137Cs).

Response: The major contaminants found in groundwater during the 1989 monitoring program are tritium, cobalt-60, strontium-90, hexavalent chromium, and sulfate, as referenced in the text of the subject sentence (Evans, et al, 1990).

Comment 308. Page 12 Paragraph 2- Sentence 2 Designating the nitrate ion and Tritium as the indicator species for "conservative" ground water movement does not take into account the geochemistry involved with the interaction of competing ions and the sorptive properties of a major subsurface constituent, montmorillonite.

Response: Acknowledged. Both tritium and nitrate have been found in groundwater plumes throughout the 100 Area. However, because the model used in this plan (Section 3.3.2) is a conservative model, contaminant concentrations are assumed to migrate completely. This conservative assumption is made in order to bias the results of the preliminary risk assessment in Chapter 4 to be more protective of human health and the environment. The interaction of site contaminants with the geomorphologic features and the resulting ionic interactions will no doubt occur, but quantification, at best, can only be estimated because of the high degree of uncertainty with such a model, which is beyond the scope of the CRIEP report.

Comment 309.† Page 12 Paragraph 2: Sentence 5 The term "Soil Column" is used in the context that the discharges were done to a unique soil stratigraphic unit, when in fact the act of trenching removes some or all of the soil. The term "soil column" also refers to a homogenous unit with non-distinguishable inter-units. The aquifer has not been adequately defined in terms of consistency, pore space, lithology, pH, Eh, geochemistry, or subsurface geomorphology. Nowhere is the mention of the distribution coefficients for each of the elements, along with the cation exchange capacity, the selectivity quotient and the total competing cation concentration. This information is essential to determine the effects of how the distribution coefficients are affected by ion exchange, precipitation, substitution, redox reactions, and acid-base buffering. The movement of the elements through the subsurface needs to be adequately explained.

Response: Acknowledged. The physio-chemical features discussed in the comment (e.g., effects of soil CEC, pore size, Eh, etc.) are components to modeling subsurface contaminant persistence and mobility. However, this is beyond the scope of this preliminary plan designed to propose future data collection activities to ensure the adequate characterization of 100 Area impacts on the Columbia River.

Comment 310. Page 12 Paragraph 2: Sentence 6 The plume maps are not complete enough pertaining to controls showing what is indicated in this sentence. For example the well positioning does not reflect ground water movement as indicated in the water table diagram.

Response: Acknowledged. Appendix B provides a description of the hydrology and groundwater contamination at the 100 Area. A reference to Appendix B will be added to the text of this sentence, as follows: "Appendix B provides a description of the hydrogeology and groundwater contamination at 100 Area sites."

Comment 311. Page 12 Paragraph 3. Sentence 1 Which standards are used? Who determined which standard to use? Why are the results of Evans et al. regarded as the standard for determining what is and what is not the contaminant of potential concern? Why weren't the standards used for the endangered species act used?

Response: The referenced ARARs represent the most complete list of federal and state water quality standards used at CERCLA and MTCA hazardous waste sites. For each contaminant of potential concern, the most stringent of these standards (i.e., most protective) was used to characterize human health and environmental risks in the CRIEP evaluation. The Evans et al. (1990) report was used because it represents the most complete set of recent river monitoring data, although data from other years was reviewed.

Comment 312. Page 12 Paragraph 3: Sentence 2 This list is not complete and doesn't reflect the most basic of geochemistry modeling for the contaminants listed in the partial list on Page 12 Paragraph 2. Sentence 1 The more stringent regulations would have listed more, not less elements of concern not to mention 137Cs, 86Rb, 106Ru, 96Mo, 60Co, and all of the daughter products from the decay of uranium including radium.

Response: Cobalt-60 and sulfate were detected at concentrations below the screening evaluation discussed in Pg. 12, Para. 3, Sent. 1. They were therefore "screened out" for use in the human health and environmental evaluations because they did not exceed regulatory levels which can be less protective than the regulatory risk-based ICRs and HQs in the NCP (e.g., ICR < 1E-06; HQ < 1.0).

Comment 313. Page 12 Paragraph 4- Sentence 4 Ground water discharge is not a standard term and does not reflect actual ground water movement in terms of rates.

Response: Acknowledged.

Comment 314. Page 12 Paragraph 5; Sentence 1 Table 2-1 does not show the mean, standard deviation, and range for contaminants of potential concern. It shows identified regulatory thresholds for drinking water, chronic aquatic and ground water. The title itself is misleading in terms of language, who set the levels? The best option from this table is obviously the chronic aquatic.

Response: The table will be revised to include the information specified in the text.

Comment 315. Page 12 Paragraph 5: Sentence 2 This is not a statistical table.

Response: Acknowledged. See the response to Comment 314.

Comment 316. Page 12 Paragraph 5: Sentence 3 This sentence is an indicator of the degree of quality of statistical sampling. Where are the controls on the Quality Control? How were the instruments calibrated, the samples taken, by who, at what time, at what location, at what depth, at what temperature, at what salinity, at what pH, Eh? The document needs to be more explicit about this type of information. How can the "statistics" show even a generalized indicator of plume characteristics let alone an indicator of ground water quality, when most of the essential information gathering techniques are left out?

Response: Acknowledged. Information regarding quality control and field instrument techniques is beyond the scope of this document. The information gathering techniques can be found in the source document, Evans, et al. 1990.

Comment 317. Page 13 Figure 2-3 The legend is incomplete. A solid line is an indicator of a high degree of certainty to within meters, yet the wells which provide the controls are up to kilometers apart. There is a dilution error by using wells not in the suspected plume.

Response: Acknowledged. However, the figure indicates that it is a generalized groundwater map. It is only used for illustrative purposes and is based on a source document, which is referred to in the legend of Figure 2-3 (Woodruff and Hanf, 1991). This document and Figures B-5 through B-11 should be referred to for a more detailed description of groundwater plumes in the 100 Area.

Comment 318. Page 14 Figure 2-4 The legend is incomplete. A solid line is an indicator of a high degree of certainty to within meters, yet the wells which provide the controls are up to kilometers apart. The designation of generalized basalt indicates the basalt may or may not be at the location designated by a solid line depicting a high degree of certainty to within meters and the controls are not within that degree of accuracy. The distribution of the most recent wells indicates that the subsurface has not been explained as to the subsurface gradient, otherwise why sink so many wells up gradient from the suspected contaminant plumes? Instead of using a map of this scale, it would have been as easy to produce a larger scale map with 10 times the detail, depicting river currents, well depths, subsurface features, and buried river channels.

Response: See the response to Comment 317.

Comment 319.† Page 15 Figure 2-5 This picture is too simplistic for use in a document dealing with endangered species. This is an inadequate characterization that doesn't accomplish the flow directions from the gradient contours (Page B-4 Figure B-3).

Response: Acknowledged. This is a conceptual site model designed to illustrate the relative direction of 100 Area groundwater at the various sites along the Hanford Reach. The approximate flow directions are used in the preliminary surface water transport model in Chapter 3. A detailed evaluation will follow after further site evaluation based on additional site data collection, as identified in Chapter 5, are completed.

Comment 320.† Page 20 Paragraph 1; Sentence 1 Why was the data used restricted to 1989? Based on what has been presented so far, the deletion of data because of incompleteness would seem to be in order. The intentional dumping of radioactive waste began in the 1940's until the 1970's. The study needs this additional information in order to accomplish the objectives, that being a comprehensive evaluation. There should also be dates for the actual data collection, and a complete quality control assessment on the standards.

Response: The preliminary evaluation in Chapter 4 indicates that a complete assessment of 100 Area impacts on the Hanford Reach is not possible at this time. Therefore, further focused investigation activities are proposed in Chapter 5.

Comment 321. Page 20 Paragraph 1: Sentence 2 What was the procedure for estimating the flow rates? What was the source? Was there a mass balance calculation done for each contaminant? Because the rates are estimated, what is the amount of error involved? How was the maximum rates found? How long of time period was the rates measured? Were there any other contaminants found? What were their concentrations? What was the depth of the wells? What was the depth of the samples? What was the type of aquifer the samples were taken from? What was the porosity? What was the mineralogy? Were the samples taken at the same time of year/day? What was the distance from the source? Where are the locations of the other wells used in determining the 'data'?

Response: The references for this data are footnoted at the bottom of the table. Estimation of groundwater flow rates are provided in Appendix B. Table 2-2 is provided for illustrative purposes. It is taken from the primary document, (Evans et al. 1990), which should be consulted for specific field collection, well construction, and geo-chemical data. Appendix B provides data on hydraulic gradient and conductivity, aquifer thickness, plume width and groundwater discharge rate for each waste site in the 100 Area in order to provide the basis for the preliminary, conservative estimate of surface water transport in Section 3.2.2.

Comment 322. Page 20 Paragraph 2: Sentence 2 Is there a valid reason for evaluating a structure such as a subsurface plume when the data presented so far is at the very least incomplete?

Response: The evaluation in Chapters 3 and 4 provide a preliminary qualitative evaluation of contaminant migration in the Columbia River (Chapter 3) and the potential human health and ecological risks associated with exposure to estimated contaminant concentrations (Chapter 4). The risk characterization is based on a conservative exposure model for groundwater. Because the results of the preliminary risk assessment indicate that there is a negligible risk for human and ecological exposure to the Columbia River water because of its dilution of the groundwater, under conservative transport and exposure assumptions, it proves to be a valid data base and transport assessment method for the purpose of evaluating future data collection and site characterization requirements.

Comment 323. Page 20 Paragraph 2: Sentence 3 The contaminants identified are not sufficient for adequate identification, and tracking in terms of a proper

evaluation. The document has not provided proper information to determine plume characteristics in terms of ground water movement or geochemistry.

Response: Refer to Comment Response No. 322.

Comment 324. Page 20 Paragraph 2: Sentence 4 The Hanford Site Baseline Risk Assessment was supposed to be done already. The screening process needs to be thorough yet comprehensive.

Response: The Hanford Site Baseline Risk Assessment Methodology (HSBRAM) was completed in 1992. Ongoing baseline risk assessments and qualitative risk assessments (QRAs) continue to be conducted at the Hanford Site throughout the source and groundwater operable units in each Area (100, 200 and 300) according to the HSBRAM.

Comment 325. Page 20 Paragraph 4: Sentence 2 The time factor makes a difference in the ground water flow rates. What was the sampling process, at what times, from which springs, and by who?

Response: Three reference documents are noted in the text of this paragraph (Evans et al. 1990, Dirkes 1990, and DOE-RL 1992d). These source documents should be consulted in order to obtain the details regarding sample collection activities at the springs.

Comment 326. Page 20 Paragraph 6 The document failed to take into account sulfates, transformations, complexations, especially as some complexants are as toxic as their parent compounds. The geochemical environment was not considered leaving out important information such as pH, Eh, and temperature.

Response: The CRIEP addressed groundwater contamination through comparisons with ARARs. No fate and transport modeling was conducted.

Comment 327. Page 20 Paragraph 6: Sentence 2 How is it evident that N03 is associated with the reactor discharge? Where are the maps depicting this?

Response: Nitrate contamination is evident because elevated levels are closely associated with the 100 Area waste sites, as shown on Figure 2-3.

Comment 328. Page 20 Paragraph 7: Sentence 2 The most mobile radiological contaminant present is Ruthenium 106 determined in 1971 by Matthes (Matthes; Properties of Ground water: 1980; Harper and Sons; NY page 96). The most mobile element really depends on many factor's most of which have not been mentioned, such as pH, Eh, transmissivity, adsorptive qualities of the clays in the particular aquifer and much more. To make a statement on what the most mobile elements are, without any documentation seems far-fetched. The 3H may actually only provide a basis on recharge rates, you cannot tell based on the information presented so far.

Response: Tritium is the most mobile contaminant of potential concern for purposes of the CRIEP evaluation. Ruthenium-106 was identified in Evans et al (1990) but at levels comparable to its method detection limit and was not considered a contaminant of concern for the CRIEP evaluation.



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Comment 329. Page 21 Figure 2-2 What does the last column on the right side mean? Are the estimated flow rates actually draw down rates? What are the basis for these figures? Why did the authors choose to use L/min. when the standard notation for ground water is in feet per day? How was the maximum source concentration calculated, were there any mass balance calculations on the constituents, what was the well spacing?

Response: The last column of Table 2-2 summarizes the groundwater flow rates for each contaminant of potential concern in each waste site's groundwater plume. It is based on estimates described in Appendix B, Section B.2.2 and in Table B-1.

Comment 330. Page 22 Paragraph 1: Sentence 1 Where on the spring were the samples taken, by who, at what time of year, with what type of methodology, and what was the matrix of the spring aquifer?

Response: The springs referred to in Sentence 3 (not sentence 1, as listed in the comment) are referenced in the text as Dirkes (1990) and DOE-RL 1992d.

Comment 331. Page 22 Paragraph 3 What were the daughter products detected, i.e. Radium. Why was the big picture (namely the Public) left out at the discovery of uranium entering the river? Were speciation and adsorption's within the aquifer taken into account? Why is there no description of interaction between the elements?

Response: Uranium-238 detected in spring samples collected in 1991, was documented in a public document in 1992, Sampling and Analysis of 100 Area Springs, DOE/RL-92-12, as referenced in the text of the subject sentence. This document should be consulted for a detailed assessment of spring sampling in the 100 Area.

Comment 332. Page 22 Paragraph 5, Sentence 6 How much contamination has leaked through the pipelines, at what locations, and were there any monitoring wells? Were there any injection wells on the Hanford Reach?

Response: Limited Field Investigation Work Plans for 100 Area source operable units provide detailed descriptions of the history of site waste disposal activities and should be used as reference for further information concerning leaking pipelines and other waste units in the 100 Area.

Comment 333. Page 22 Paragraph 6: Sentence 1 This is not a complete list. Were the material safety data sheets (MSDS) for each operation looked at?

Response: Material Safety Data Sheets (MSDS) are not applicable to characterizing environmental site contamination, they are used to communicate the hazards associated with commercial materials as related to worker safety issues.

Comment 334. Page 22 Paragraph 6: Sentence 2 This it not a sufficient list The magnitude of comprehensive evaluations that are to be done in order to satisfy Milestone M-30-02 as listed on Page 1 Paragraph 6: Sentence 1, would dictate that all the pertinent information be used.

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Response: 1989 and 1990 data were used in the CRIEP evaluation because it represented the most recent and comprehensive data set available at the time of the document preparation, 1991-1992.

Comment 335. Page 22 Paragraph 6: Sentence 5 What additional contaminants are being referred to here? Are there direct discharges to the river that have not been discussed in this document?

Response: The additional contaminants are those referred to in sentences 1 and 2, paragraph 6, page 22.

Comment 336. Page 23 Figure 2-3 and Figure 2-4 In addition to the curies, What was the quantity of materials involved? This table represents a significant source of radionuclides with no ion sizes, charges, or reactivity coefficients. The source material has not been referenced and the methodology for determining how these figures came about has not been referenced.

Response: Curies are the only measurement units listed in Tables 2-3 and 2-4 (not Figures 2-3 and 2-4, as indicated in the comment) because subsequent impact evaluations are based on exposure to activity measured in pCi/L.

Comment 337. Page 24 Paragraph 2: Sentence 1 What were the methods used in collecting the samples? Were the samples taken at the same time of year? Were the samples taken at the same place, at the same depth, by the same person(s)?

Response: The reviewer is referred to Jaquish and Bryce (1990) for information regarding sample collection methods.

Comment 338. Page 24 Paragraph 2: Sentence 2 If the samples were not tested for all of the constituents the amount of error for the study will outweigh any attempt to quantify the results.

Response: Acknowledge. Analytical methods for speciating radionuclides were not developed until the early 1970s, and have become standardized in several methods in the last 10 years, which is partially why current sampling data is used in the CRIEP report.

Comment 339. Page 24 Paragraph 2 Sentence 4 The ability to identify individual radionuclides has been available since the 1970's. Why has this information not put to use.

Response: Activities of individual radionuclides are provided throughout the document. The referenced section refers to historical measurements made in the 1940's, 1950's and 1960's.

Comment 340. Page 24 Paragraph 3: Sentence 2 The table on Page 25 Table 2-5 is not complete, yet the statement on Page 24 Paragraph 3: Sentence 2 clearly indicates that this provides quantitative data. The amount of error outweighs the quantity of results. This is not a valid statement.

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Response: Sentence 2 of Paragraph 3 is only concerned with annual averages for selected contaminants found at upstream and downstream locations. All of the contaminants of potential concern are listed in Table 2-5.

Comment 341. Page 24 Paragraph 3: Sentences 2 and 3 Were the chemical tests taken at the same time period? Were the tests taken at the same sites? What was the methodology used for the sampling? The geochemistry of the river has not been taken into account. The sampling stations are not representative for the amount of area the river covers. The statement on Page 5 Paragraph 3: Sentence 1, clearly states that there are 58 miles of Hanford reach. The statement on

Page 8 Paragraph 1; Sentence 5 states that there are low energy areas in the river yet the sampling stations do not take this into account. The sentence on Page 7 Paragraph 4: Sentence 6 states that daily flow rates can vary from 1000 m3/s to 7000 m3/s. Have the flow rates been taken into account? If the flow rates have been taken into account, where are they? The reported results do not allow for adequate evaluations to be used for the purpose of ensuring adequate progress toward Hanford Site compliance with CERCLA (Page I Paragraph 2: Sentence 2).

Response: The purpose of Tables 2-6 through 2-8 was to provide an evaluation of the cumulative effect of 100 Area Discharges to the Columbia River by comparing concentrations of the contaminants of potential concern in the river before entering and after leaving the site. Since the purpose of the CRIEP was to provide a preliminary impact evaluation based on currently available data to serve as a basis to evaluate future data collection needs, it is not necessary that the CRIEP evaluation provide a comprehensive analysis of the river. The text on Pg. 24, Para. 2, Sent. 1 provides a reference to the source document for the data in Figures 2-6 through 2-8, the Hanford Site Environmental Report, Jaquish and Bryce 1990, which should be consulted for details concerning sampling and analysis methods.

Comment 342. Page 24 Paragraph 3 This paragraph indicates that the methodology in the Hanford Site Environmental Reports are to be questioned seriously about any validity.

Response: The authors do not agree with this statement. This paragraph only states that it was not possible to use the same reporting period for every potential contaminant because the data were not measured every year. This does not mean that the whole collection program is invalid.

Comment 343. Page 24 Paragraph 4., Sentence 2 (Bullet 1) The figures do not illustrate that the levels of contaminants are decreasing because the data is incomplete, and are not adequate to infer any type of trends.

Response: The data in Figures 2-6 through 2-8 are annual averages for nitrate, tritium, strontium-90, and cobalt-60, based on approximately 20 years of monitoring. Based on this data, it is evident that the levels of these contaminants in both upstream and downstream locations are decreasing.

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Comment 344.† Page 24 Paragraph 4: Sentence 3 (Bullet 2) Because the data is not significantly different, is this due to chance, or to sampling procedures? Have other tests been used such as the x2, or the Z test?

Response: The one-sided t-test on mean values from 1985 through 1989 has a confidence interval of 0.05, which is judged to be sufficient to evaluate the difference between upstream and downstream data. The sampling procedures used throughout the monitoring program were consistent, therefore the 5% chance that the statistical test is wrong is due to random error.

Comment 345. Page 24 Paragraph 5: Sentence 1 The data does not support a conclusion of this magnitude in light of the importance of this document.

Response: Acknowledged. The use of this analysis provides a preliminary assessment of the impact of the Hanford Site's impact on the Columbia River. Future data recommended in Chapter 5 are designed to evaluate this conclusion by focusing future studies on identifying contaminants of potential concern based on an operable unit-by-operable unit basis, by characterizing groundwater flux into the river, and by characterizing contaminant mixing in discharge zones.

Comment 346. Page 28 Figure 2-6 Because the nitrate ion is conservative and moves with the water, why is there a peak? Was there an error in the sampling, or were the locations variable? What was the time of year? Was there any quality assurance involved? The figure does not depict any trends, especially since the samples were taken at non-representative stations at variable times.

Response: The sampling area for downstream samples was consistent, at the Richland Pumphouse water intake. The Hanford Site Environmental Report from 1982 provides no reason for the nitrate concentration peak in 1982.

Comment 347. Page 29 Figure 2-7 Because there are admitted gaps in the data collection (Page 24 Paragraph 4: Sentences 3 and 4) the sampling methodology is in question. What is important is not the "quantitative" view but the qualitative view, i.e. the overall concentration is important.

Response: Acknowledged.

Comment 348. Page 30 Figure 2-8 The 1990 concentration amount is not significantly different from the 1976 concentration amount. Why have the decay products not been taken into account?

Response: The half-lives of uranium isotopes are all in excess 100,000 years ($^{238}U$ [99% of naturally occurring uranium by weight] has a half life of 4.5 billion years), therefore no appreciable decay is expected to occur in 14 years.

Comment 349. Page 3-1 Figure 2-6 How are the river flow rates taken into account with this chart?

Response: River flow rates were normalized because upstream and downstream samples were collected at approximately the same time according to a regular

annual schedule. Variation may have occurred throughout the 20 years of monitoring, but as stated in comment No. 347, it is the overall concentrations which are important.

Comment 350. Page 32 Paragraph 4: Sentence 4 River sampling was done only once during this study. Why weren't the sediments sampled? There were only two sample sites listed. Does this means that a one time shot with two samples is what the evaluation is based on?

Response: As stated in the text of Pg. 32, Para 3 the studies were based on Columbia River samples at the Priest Rapids Dam (upstream) at the Richland Pumphouse (downstream), and in springs located along the 100-Area of the Hanford Site. Additional sediment sampling is identified as an activity that needs to be conducted.

Comment 351. Page 32 Paragraph 5: Sentence 2 What were the methods involved in terms of evaluating the relative volumes between the springs and the river. Did the sampling include any sediment sampling? How many samples were taken? Where were they taken? Where there more than two samples taken?

Response: The text of the referenced reports, Dirkes (1990), and DOE-RL (1992d), should be consulted to determine what the methods involved in spring sampling.

Comment 352. Page 32 Paragraph 5: Sentence 3 This sentence establishes that there are radionuclides exiting from springs along the river. If the Dirkes study found results that indicated that radionuclides were in fact entering the river, why was there no follow up examination on the sediments? Many of the radionuclides do not float, thus, do not add up significantly in samples taken from the top of a water column. The results should have been oriented towards the chronic aquatic levels. The term "negligible" is a qualitative statement based on what parameters? Is this "negligible" discharge applicable to spawning steelhead and salmon?

Response: Acknowledged. Sediment sampling is identified as needed work in Chapter 5; also, PNL has monitored the river sediment for several years. The term "minimal" means that the amounts detected in downstream samples were consistent with the background concentrations measured upstream for most contaminants (Co-60 and Sr-90 were slightly elevated over background), which were all significantly less than ambient water quality and drinking water standards.

Comment 353. Page 32 Paragraph 5: Sentences 4 and 5 The 7,279 pCi/L would not be negligible to a person who is swimming near the spring. Both samples were nearshore, please define "nearshore" in terms of distance, depth, and river bed composition.

Response: Acknowledged. The text indicates that these levels represent a localized impact to the Columbia River. However, according to the conservative surface water transport model demonstrated in Figures 3-5 and 3-6, high levels encountered adjacent to the springs are diluted rapidly, due to the large dilution

of Columbia River flow, to exponentially lower levels. The term "nearshore" is simply a qualitative evaluation of distance, and not a specific measurement.

Comment 354. Page 32 Paragraph 5: Sentence 6 - 8 This spring is one tenth of a mile or about 161 meters downstream from the previously mentioned stream. What was the sampling distance from the shore, the depth, and the riverbed composition.

Response: This refers to spring and river sampling which occurred at a spring located 0.1 mile downstream of the Dirkes (1990) sampling location. Details concerning field sampling activities and the exact location of sampling may be found in the reference listed in the text, DOE-RL 1992d.

Comment 355. Page 32 Paragraph 5: Sentence 9 The river has a large volume, but the solution to pollution is not dilution.

Response: Acknowledged. However, since this report is on the impacts to the Columbia River, dilution of contaminant sources, such as springs, is a very important factor in evaluating the overall effect to the river's water quality, even though impacted areas of elevated contaminant concentration exist.

Comment 356. Page 33 Paragraph 1: Sentence 1 Where are the locations for these samples, at what depth, and at what time of year were the samples taken?

Response: Details concerning field sampling activities and the exact location of sampling may be found in the reference listed in the text, Dirkes 1990 and DOE-RL 1992d.

Comment 357. Page 33 Paragraph 2: Sentence 2 The term "relatively" needs to be defined. The springs are called intermittent. Where is the references for this? Where is the information depicting the actual aquifer dimensions? Does the springs discharge extend out into the riverbed?

Response: The springs were small relative to other springs sampled. Details concerning the size of the springs and the exact location of sampling may be found in the references listed in the text, Dirkes 1990 and DOE-RL 1992d.

Comment 358. Page 33 Paragraph 2. Sentence 3. This statement reflects a casual attitude towards the hydrological cycle, when in fact there are many readily available sources that tell us that 98% of a river's water is derived from ground water.

Response: Acknowledged, however, only a small fraction of the Columbia River is from groundwater under the Hanford Site.

Comment 359. Page 33 Paragraph 5: Sentence 2 Where is the data for this observation?

Response: Acknowledged. The source of this information is referenced on Pg. 33, Para. 2, last sentence 3, McCormack and Carlile 1984, Buske and Josephson 1989, Dirkes 1990, DOE-RL 1992d).

Comment 360. Page 33 Paragraph 5: Sentence 3 Did these tests include lower water column sampling, or bed load sampling?

Response: Details concerning field sampling activities may be found in references listed in our response to Comment 359.

Comment 361. Page 33 Paragraph 6: Sentence 1 How did this statement become quantified as to the amount of contamination present? Where were the samples taken, at what depth, and at what time of year?

Response: This is based on data referenced in sentence 3 of the subject paragraph, (Jaquish and Bryce 1990). Further details concerning field sampling activities may be found in the reference cited.

Comment 362. Page 33 Paragraph 6: Sentence 2 Intermittent sampling at odd intervals is poor methodology in scientific reasoning.

Response: Intermittent sampling referenced in this sentence refers to sampling events which occurred at different times throughout the period of 1957 to 1989. It does not refer to samples collected at intermittent intervals in the sediment column.

Comment 363. Page 34 Table 2-7 This table is not valid from a scientific standpoint.

Response: We disagree, the table provides results from the referenced study. There is no valid reason for doubting those results.

Comment 364. Page 35 Paragraph 1: Sentences 3-5 There is not enough data statistically to make assumptions, especially using only four samples and referencing people who did not provide sediment sampling reports. Why use the word "Probably"? Does this mean you are not sure, or that you don't know, or that the results are worse than you want to report?

Response: The sediment samples came from four areas, but multiple samples were collected at selected area, and these were used in the statistical evaluation. The word "probably" is technically the correct term to describe statistically evaluated probabilities, which the subject paragraph describes. The report the data came from was the Jaquish and Bryce (1990), as referenced in the preceding discussion on Pg. 33, Para. 5, last sentence, not Woodruff and Hanf (1991).

Comment 365. Page 35 Paragraph 2: sentence 1 Where are the sample locations? Are they representative for the stream morphology?

Response: This information may be found in the reference listed in the subject sentence, DOE-RL 1992d.

Comment 366. Page 35 Paragraph 2 Sentence 4 Without the use of reference samples, how is the basic premise of scientific methodology to be validated? This is not the quality of documentation the taxpayers expect and deserve.

Response: Acknowledged. Further sampling to characterize sediment conditions relative to background are provided in Chapter 5.

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Comment 367. Page 35 Paragraph 4. Sentence 5 What was the basis for the conclusion in this statement? There is no evidence that the sediments will be diluted. The statement is technically incorrect.

Response: The continued addition of uncontaminated sediments from sources above Hanford will dilute the concentration of radionuclides.

Comment 368. Page 35 Paragraph 5: Sentence 1 Who selected the sites for sampling? What was the criteria? Was qualitative geomorphology taken into account?

Response: This information may be found in the reference listed in the subject sentence, Woodruff and Hanf 1991.

Comment 369. Page 36 Paragraph 1 Sentence 1 Were these samples taken on dry land? At what time of year?

Response: This information may be found in the reference listed in the subject sentence, Sula 1980.

Comment 370. Page 36 Paragraph 2: Sentence 2 (Bullet 2) How could there be areas of increased concentration when the river dilutes the concentration as the statements on Page 32 Paragraph 5; Sentence 9 and Page 33 Paragraph 5, Sentence 3.

Response: Localized areas of higher concentrations should occur throughout the river because of depositional effects due to channelization and bottom characteristics. However, the overall process will be dilution, not concentration.

Comment 371. Page 36 Paragraph 2: (Bullet 3) This paragraph does not make sense. Were the metallic flakes determined through aerial surveys? The presence of metallic 6OCo swirling around in the drinking water for lots of people and the environment to ingest is a staggering idea.

Response: The text will be clarified. The description of the aerial survey should be a separate paragraph. The detection of metallic $Co^{60}$ flakes is an ongoing effort.

Comment 372. Page 36 Paragraph 4: Sentence 4 Radioactive materials have been determined to cause known adverse effects on the environment and all that resides in it.

Response: Acknowledged. However, radionuclides appear to favorably partition to lower trophic levels, according to the studies referenced. (Authors assume comment refers to Para. 5, not paragraph 4).

Comment 373. Page 36 Paragraph 5: Sentence 2 The free-floating plankton are the bottom of the food chain.

Response: Acknowledged, as the text of the subject paragraph indicates.

Comment 374. Page 36 Paragraph 5: Sentence 3 Where are the data for this statement? Where were the samples taken, by what method, and at what time?

Response: This information may be found in the reference listed in the subject sentence, Becker (1990).

Comment 375. Page 36 Paragraph 5: Sentence 4 The use of the term "biodilution" cannot be substantiated with the data that has been provided. The term "biodilution" is not valid according to current scientific opinion (try looking this term up in a current biology reference).

Response: The sentence simply states that biodilution of radionuclides appear to occur in higher trophic levels, based on this data. If the term "biodilution" is not found in a text book does this mean that the process does not occur?

Comment 376. Page 37 Paragraph 2: Sentence 1 The term "opportunistic sampling" is another term for fishing isn't it? How many fish were caught, at what locations, and at what depth? This is not a very comprehensive sampling method for such an important document. Does the information from the fish obtained provide a method for ensuring adequate progress under the regulations as listed on Page 1 Paragraph 2: Sentence 2?

Response: Acknowledged. The term "opportunistic sampling" refers to a common fisheries practice of collecting aquatic species using mass collection techniques such as electric shock or netting. However, the work is not equivalent to recreational fishing. Bioassay methods used to assess aquatic tissue concentrations collected through opportunistic sampling are sophisticated, highly technical, and provide widely accepted analytical results. The program referenced in the subject paragraph should be consulted for the number of samples collected and the analytical methods used.

Comment 377. Page 37 Paragraph 2; Sentence 4 Why was wet weight used instead of dry weight?

Response: Acknowledged. This information may be found in the reference listed in the subject sentence, Woodruff and Hanf 1991.

Comment 378. Page 37 Paragraph 2: Sentence 5 Where were the fish caught, at what time of year, and at what depth?

Response: Acknowledged. This information may be found in the reference listed in the subject sentence, Woodruff and Hanf 1991.

Comment 379. Page 37 Paragraph 2: Sentence 6 Are the regulations under the Tri-Party Agreement for quality assurance and quality control being followed here? Why are these methods i.e. opportunistic sampling and using wet weight being used as the best methods for such an important document?

Response: The data referenced is from the Hanford Environmental Monitoring Program. This data is considered to satisfy Milestone M-30-02, which requires that the CRIEP evaluation consider the adequacy of existing data in order to propose future data collection activities designed to adequately characterize the

impact to the Columbia River. The use of wet weights are commonly used to compare aquatic organisms because of the difficulty in drying organisms that are high in fat tissue. This is not an abnormal method.

Comment 380. Page 37 Paragraph 3: Sentence 2 Because the Canada geese usually eat food out of the muds, and their eggshells were found to have 9OSr, was this aspect further inspected? Were the sediments adequately tested for contaminants?

Response: Acknowledged. Section 5.2.2.3 outlines a plan for a characterization of the river sediments pathway, which includes river sediment monitoring.

Comment 381. Page 37 Paragraph 3: Sentence 5 Were the collection methods used for waterfowl the same as those used for fish, namely, opportunistic sampling?

Response: Acknowledged. Waterfowl were collected opportunistically.

Comment 382. Page 37 Paragraph 4: Sentences 2 and 3 There is not enough data from one sample location to make inferences on levels of contamination, especially without reference samples.

Response: Acknowledged. The subject sentence quotes data reported in the reference study which compares data from the site to data collected at other sites. This comparison is valid because the other sites provide a reference value. There is no inference made based on the referenced data to levels of contamination expected at other locations at the Hanford Site.

Comment 383. Page 37 Paragraph 4: Sentence 4 Were the great blue herons themselves sampled?

Response: Acknowledged. Samples of Great Blue Herons were collected, according to Fitzner et al. 1988, referenced in the text of the subject sentence.

Comment 384. Page 37 Paragraph 4; Sentence 5 Where did the authors get the reproductive data? Where the great blue herons tagged? What was the methodology?

Response: Acknowledged. This information may be found in the reference listed in the subject sentence, Fitzner et al. 1988.

Comment 385. Page 37 Paragraph 5: Sentence 4 The concentrations of these four elements remained constant through what? What was the levels of concentration? The paragraph's subject is on the food web.

Response: The four elements listed in the sentence refer to the concentrations were detected in phytoplankton, caddisfly larvae, and whitefish, as discussed in the preceding sentence.

Comment 386. Page 38 Paragraph 1: Sentence 3 Could the conclusion indicated on this sentence be a result of the data collection methodology?

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Response: Acknowledged. Conclusions regarding any study are always the result of the interpretation of the results from the data gathered according to the testing methodology used. Further analysis on future testing methodologies, as recommended in Chapter 5, are designed to verify that past testing methodologies accurately represent the Hanford Site impacts to the Columbia River.

Comment 387.† Page 39 Paragraph 2 Sentence 3 The analysis of contaminant transport is premature in the terms of the material presented so far.

Response: Acknowledged. The results are not premature given the highly qualitative , but conservative, nature of the surface water transport model presented in Section 3.3. The recommendations presented in Section 5.2.2.1, Tasks 1A-1 through 1B-2 are given in order to refine the preliminary impact evaluation provided in Section 3.3. This would provide a less conservative model which more accurately describes groundwater fluxing, contaminant dilution, surface water flow, sediment characteristics and transport, etc.

Comment 388. Page 39 Paragraph 5: Sentence 2 This conclusion is not based on the information presented so far.

Response: Acknowledged.

Comment 389. Page 41 Paragraph 2: Sentence 2 How does this statement relate to Page 21 Table 2-2? This statement is in conflict with the statement on Page 33 Paragraph 2: Sentence 3.

Response: The flow rates listed on Table 2-2 are estimated according to the model provided in Appendix B, which uses the number of plumes per waste site, hydraulic gradient, hydraulic conductivity, aquifer thickness, and plume width to calculate groundwater discharge for each waste site in the 100 Area. The flow rates do not consider the vector for groundwater flow (i.e., seeps, springs or subsurface flow).

The statement on Pg. 33, Para. 2, Sent. 3 is not in conflict with the subject sentence, since both indicate that flows from seeps and springs contribute less groundwater to the river than subsurface flow.

Comment 390. Page 41 Paragraph 3: Sentence 4 This statement does not agree with the statement on Page 32 Paragraph 2: sentence 3 (Bullet 3).

Response: The subject sentence is referring to potential current and future exposures to groundwater directly at the seep and spring locations in the 100 Area. The text on Pg. 32, Para. 2, Bullet 3 refers to data collected in 1954 at the Richland Water Supply Pumphouse, many miles downstream from the 100 Area seeps and springs.

Comment 391. Page 41 Paragraph 3: Sentence 5 This statement indicates that the water and sediment sampling methodologies are opportunistic also.

Response: Acknowledged.

Comment 393. Page 41 Paragraph 3: Sentence 2 What exactly is "indirect discharges" from ground water? Was this determined using the opportunistic sampling of springs?

Response: The term "direct" and "indirect" are used to distinguish the difference between permitted releases (direct) as a part of current Hanford Site operations and non-planned or natural groundwater releases (indirect). (Authors assume the commentor referred to Page 41, Paragraph 4, not Paragraph 3).

Comment 394. Page 41 Paragraph 4: Sentence 2 Based on the information and methodology presented so far, the differences of contaminant concentrations from the two sample points is not enough to make a definitive statement indicating little or no difference.

Response: The conclusions referenced in section 2.2.2.2 Support this statement. Additionally, the surface water modelling results in section 3.3.2 support the conclusion that high dilution factors occur.

Comment 395. Page 41 Paragraph 4; Sentence 3 This statement on high dilution factors is erroneous based on the information presented up to this point.

Response: Acknowledged. Any overall conclusions regarding whether or not the Site has an impact on Columbia River water quality will be removed from the text of the CRIEP report. These conclusions are only appropriate after future, comprehensive studies characterize potential impacts. However, it should be noted that data collected for over 20 years of the Hanford Site environmental monitoring program have been collected and analyzed on a scientific basis. Figures 2-6 through 2-8 demonstrate the repeatability of these results.

Comment 396. Page 41 Paragraph 4 Sentence 4 This statement is not based on scientific fact and has not been proved to the point of repeatability.

Response: Comment Noted.

Comment 397. Page 41 Paragraph 4 Sentence 5 Refer to the statement on Page 36 Paragraph 1, Sentence 1 (Bullet 3), the next time you are water skiing.

Response: Acknowledged.

Comment 398. Page 41 Paragraph 6: Sentence 2 This statement establishes that there is no information of value on the sediment contamination.

Response: There is a significant amount of river sediment data available from sampling that occurred from 1957 through 1989, therefore the reviewer is referred to Section 2.2.3. The subject sentence indicates that a consensus impact assessment methodology had not been developed during the time the CRIEP was prepared (1991 to 1992).

Comment 399. Page 42 Paragraph 5: Sentence 1 Does this statement mean that because of the insufficient data, improper methods, poor record keeping, indifference to

regulatory procedures, and disregard for scientific methodology that the public should disregard this report?

Response: The subject sentence indicates quite the opposite. The decision was made to disregard contaminant fate (persistence) because of a lack of site specific physio-chemical data. This was done in order to maintain the conservative nature of the CRIEP assessment. By disregarding chemical fate analysis, we assumed that contaminants of potential concern would not degrade, but would be maintained at original concentrations. This results in risk estimates (Chapter 4) that are more protective of human health and the environment.

Comment 400. Page 43 Paragraph 1: Sentence 1 It is apparent that you have used these assumptions throughout this whole document.

Response: Acknowledged. It is always appropriate to use conservative estimates in preliminary qualitative evaluations in order to ensure protection of human health and the environment.

Comment 401. Page 43 Paragraph 1: Sentence 2 The word incomplete should be inserted for the word preliminary.

Response: The authors do not agree with this comment.

Comment 402. Page 43 Paragraph 2: Sentence 1 The data presented in Section 2.2 is invalid due to the methodology, lack of quality assurance and lack of quality control.

Response: Reject. The discussion of methodology, quality assurance, and quality control is beyond the scope of this document.

Comment 403. Page 43 Paragraph 4: Sentence 3 The term "flux" is defined to be: a product of total volume divided by the input. In this case the input involves the radioactive waste. The calculations have to be derived from mass balance calculations for each constituent and for all the interaction products between the individual contaminants and the reaction products between the contaminants and the host media.

Response: Acknowledged. The approach used in this model was very conservative due to a lack of sufficient data at the time of CRIEP report preparation. A focused study of groundwater contaminant fluxes is proposed in Section 5.2.2 in order to provide a more realistic assessment of flux magnitude and location.

Comment 404. Page 43 Paragraph 5: Sentence 2 This statement is based on data that is essentially invalid for calculating plume concentrations, especially without considering speciation, exchange capacity, bonding affinity, ionic radius, exchange rates temperature, pH, Eh, ion selectivity, distribution coefficient of the host media, or the ground water flow system.

Response: Refer to Comment Response No. 403.

Comment 405.† Pages 44-67 This computer model is too simplistic for making an assumption on ground water movement into a river system. The model does not

take into account that the aquifers often intersect the river at oblique angles, thus greatly increasing the potential discharge surface area above and beyond the model used. The model does not take into account the time, or the permeability of the aquifer, or the mobilization coefficients of the contaminant species.

Response: Acknowledged. This is only a preliminary model which uses conservative assumptions for groundwater. Milestone M-30-02 requires the development of a plan to evaluate human health and environmental impacts to the Columbia River. Therefore, we decided to use a simple model which overstates expected concentrations, dilution, and flow rates in order to create exposure point concentrations for use in the risk characterizations in Chapter 4. A refined model which incorporates the best scientific evidence about the Hanford Reach is recommended in Section 5.2.2.

Comment 406. Page 79 Paragraph 3 Sentence 2 The neglect of considering these parameters leads to inadequate assumptions.

Response: Acknowledged. This is a conservative assumption. Assuming partitioning would effect the preliminary nature of the model and make it less protective of human health and the environment. Partitioning may be taken into account in future RI/FS activities at 100 Area waste sites.

Comment 407. Page 79 Paragraph 4: Sentence 2. Assuming that the groundwater investigations are complete is a bad assumption based on the information presented up to this point.

Response: Acknowledged.

Comment 408. Page 6: Figure 2-1. The sentence does not mention where the rates are recorded. The sentence also establishes the fact that the lowest mean flow rates occur during the months of September and October precisely during the time of the spawning of the fall Chinook Salmon as referenced on Page 5 Paragraph 3: Sentence 5. The most important flow data are for times of spawning (Fall), not average annual flows. The Nez Perce Tribe Department of Environmental Restoration and Waste Management recommend that additional flow data be collected during the Fall.

Response: We assume the reference is to Pg. 7, Para. 4, Sent. 6, not Figure 2-1. The source for this information is found in the reference to Stenner et al. (1988), which is referenced in the subject sentence. Page 7, Para. 5, Sent. 2 indicates that the minimum flow rate of 1,020 $m^3/s$ was established at the Priest Rapids Dam gaging station. The minimum flow rate (1,000 $m^3/s$), measured at this upstream gaging station was used in the conservative surface water flow model discussed in Chapter 3. Average annual flow rates were not used to estimate flows in the model.

Comment 409. Page 21: Table 2-2. The Nez Perce ERWM maintains that no relationship is evident between the calculations presented in appendix B, the groundwater discharge analyses used to develop a groundwater discharge rate for contaminated groundwater discharging to the Hanford Reach in the 100 Area, and the "estimated flow rate" presented in Table 2-2, in liters/minute.

Groundwater velocity rates would be more appropriate to estimate the potential for contaminants in the 100 Area groundwater Plumes to impact the Hanford Reach.

Response: The estimated flow rates calculated in Appendix B (Table B-1) relate to the estimated flow rates listed in Table 2-2. For example, in order to calculate the total flow rate for the 100 BC Area using information in Table 2-2, both groundwater plume flow rates must be added and their sum divided by the liter/gallon conversion factor of 3.78. This totals 400 gpm, as listed in Table B-1. Similar calculations must be done for all other Hanford Reach areas.

Comment 410. Page 24: Paragraph 1: Sentence 1. The CRIEP provides very little information concerning monitoring periods, sampling design, or data collection methods. The NEZ Perce ERWM asserts that without addressing these aspects, additional sample collections may be based on the assumption that none of the existing data are usable. The Columbia River Impact Evaluation Plan should identify previous data collection details, at least by reference, to identify those previously collected data that could be usable and to identify areas of data gaps.

Response: Information concerning initial monitoring periods, sampling design, and data collection methods are found in the monthly H.I. Environs Reports, information on recent sampling may be found in the summary results published in the annual Hanford Site Environmental Report, as referenced in the preceding paragraph to the subject sentence.

Comment 411. Page 24: Paragraph 2: Sentence 2. The Nez Perce ERWM asks for more data on these specific radionuclides.

Response: The CRIEP report only summarizes past investigations performed, more detailed information may be obtained by referring to the referenced document in the preceding sentence.

Comment 412. Page 36: Paragraph 3: Sentence 4. Could more information including the references from Becker 1990 be provided to the Nez Perce ERWM for clarity here?

Response: The reference for Becker (1990) is provided in Section 6 and is available to the public.

Comment 413.† Page 41: Paragraph 6: Sentence 3. The Nez Perce Tribe Department of Environmental Restoration and Waste Management observes that on Page 90: Paragraph 7: 5.2.2.3 Task 3, contaminants entering the Hanford Reach from discharging groundwater are retained or deposited within the river sediments. However, although monitoring is proposed under this task, details concerning sediment data collection activities are not provided. Data needs to provide input for addressing the sediment pathway for risk assessment include analysis for chemicals of concern, particle size analysis, evaluation of suspended sediments, and data for hydraulic modeling of sediment distribution and transport.

Response: Data collection needs for sediment sampling are outlined in the Description of Work (DOW) for sediment sampling in the 100 Area, as

referenced under Activity 3-1; River Sediment Monitoring (Pg. 91, Para 2). Implementing the DOW is the first phase of development of a comprehensive river sediment monitoring program.

Comment 414.† Page 42: Paragraph 2: Sentence 2. If this sentence is related to the sentence above (Page 42: Paragraph 1: Sentence 2), would it make sense to verify the amount of exposure occurring through the consumption of waterfowl also as referenced to the statement on Page 37: Paragraph 3: Sentence 2? The Nez Perce ERWM states that the American Indian population and their subsistence gathering provides yet another potential exposure pathway that should be examined. The statement on Page 36: Paragraph 1: Bullet 1 refers to shoreline contamination. The waterfowl including the endangered white pelican eat food from these shores.

Response: Acknowledged. According to the cited reference, Woodruff and Hanf (1991), data on waterfowl tissues were collected in their investigation, but they concluded that human exposure would be greatest through the fish ingestion pathway. The subject sentence in the CRIEP simply reports the conclusions of the Woodruff and Hanf (1991) study.

Comment 415. Page 42: Paragraph 2: Sentence 4. The Nez Perce ERWM would like to see the data and the applicable excerpts from Woodruff and Hanf in support of this statement.

Response: The reference for Woodruff and Hanf (1991) is provided in Section 6 and is available to the public.

Comment 416. Page 42: Paragraph 4: Sentence 1. The Nez Perce Department of Environmental Restoration and Waste Management asserts that because this is an environmental evaluation, it would make sense to consider the Endangered Species Act before superficially treating endangered and threatened species.

Response: The Endangered Species Act is considered in the evaluation of ecological exposures, as discussed in subsequent sentences in the subject paragraph. However, it was qualitatively concluded that there are no significant exposures to endangered and threatened species identified in the Act.

Comment 417.† Page 42: Paragraph 4: Sentence 3. Does this mean that Chinook salmon spawning in the radioactive contaminated sands and gravels along the Hanford reach are not eaten by bald eagles? The Nez Perce Tribe Department of Environmental Restoration and Waste Management notes that spawning salmon in the area may not feed, but they do breathe and pass large amounts of water across their gills, providing yet another pathway for contamination. The relative importance of uptake from food vs. absorption from water across the gills should be discussed in the Columbia River Impact Evaluation Plan, with the data collection methods to support addressing this issue for risk assessment identified. Bioavailability of contaminants should also be considered.

Response: Acknowledged. The subject sentence refers to the conclusions of Weiss and Mitchell (1992), as referenced in sentence 4. It is recognized that exposure through absorption will contribute to chinook salmon and, hence, bald eagle exposure doses. Because of this, Task 4, Activity 4-3; Compilation of Sensitive

and Critical Habitat Information (Section 5.2.2.4) requires that a baseline risk assessment be conducted which specifically assesses the threats to sensitive and critical habitats.

Comment 418.† Page 43: Paragraph 1: Sentence 3. The Nez Perce Tribe Department of Environmental Restoration and Waste Management believes that ignoring sediment accumulation is not necessarily conservative.

Response: Acknowledged. Ignoring the river sediment data is a non-conservative assumption which adds uncertainty to the risk evaluation. The uncertainty discussion in Chapter 4 (Pg. 79, Para. 5, Sent. 1) identifies this uncertainty.

Comment 419. Page 43: Paragraph 2: Sentence 1. The Nez Perce Tribe Department of Environmental Restoration and Waste Management would like to know if the "empirical data" are the same as the data used to construct Page 16: Table 2.1?

Response: The empirical data referred to in the subject sentence represent data collected from environmental samples in the Hanford Reach of the Columbia River and at the Hanford Site. The values listed in Table 2-1 are standards for drinking water quality, ambient water quality, and groundwater quality, as discussed on Pg. 12, Para. 3.

Comment 420. Page 43: Paragraph 4: Sentence 3. The Nez Perce Tribe Department of Environmental Restoration and Waste Management would like to point out that the descriptions in Subsection 3.3.1 and Appendix B of the calculations performed to derive contaminant flux through the cross-sectional areas of each plume are difficult to understand or duplicate. Subsection 3.3.1 states that groundwater transport "was estimated based on information presented in Appendix B. This appendix identifies groundwater plumes, groundwater flow direction, and estimated flow rates. The contaminant concentrations together with the estimated flow rates were used to derive a contaminant flux for each ground water plume." Appendix B appears to calculate specific discharge rates for each plume using a macroscopic continuum approach. This is, it is assumed that for any cross section A, the specific discharge, v, is defined as $v=Q/A$, where v is specific discharge, Q is the volumetric flow rate, and A is the cross-sectional area of the aquifer materials through which the plume passes (Freeze and Cherry 1979).

This is confusing because the groundwater discharge analysis summary presented on Table B-1 shows hydraulic gradient, hydraulic conductivity, aquifer thickness, and plume width in terms of feet (ft) and feet per day (ft/d), with groundwater discharge rate reported in gallons per minute (gpm). Furthermore, paragraph two under the groundwater discharge analyses subsection of page B-8 mentions that pumping rates or scenarios are being evaluated. Does this mean that the pumping rates presented in Table B-1 are equal to the volumetric flow rates for each plume?

The Nez Perce Tribe Department of Environmental Restoration and Waste Management also notes that hydraulic conductivity values reported in Liikala et al. ranged from 49 to 5940 ft/d (p. B-8). Therefore, use of a single hydraulic conductivity value of 700 ft/d for all plumes is likely to introduce

error into the estimates of transport rates and volumes of contaminated water reaching receptor points. This range of hydraulic conductivity values being average into a single value also calls into question the validity of assuming that plumes can be segregated into separate streams for purposes of assessing impacts to the Columbia River due to spring discharges, as discussed on Page B-15.

Response: Acknowledged. The pumping rate was used as the volumetric flow rate for each plume identified at 100 Area waste sites because the qualitative surface water transport model requires a conservative discharge rate calculation. Use of this preliminary, qualitative model does not disregard the fact that plumes can be segregated into separate streams due to spring discharges or because of potential inconsistencies in groundwater flux throughout the Hanford Reach.

Comment 421.† Page 43: Paragraph 5: Sentence 2. The Nez Perce Tribe Department of Environmental Restoration and Waste Management requests the collection of more site-specific data to allow more refined calculations of groundwater concentrations.

Response: Acknowledged. Section 5.2.2.1, Characterization of Contaminant Input Pathways recommends the collection of site-specific data in order to characterize 100 Area contaminated groundwater pathways and other input pathways.

Comment 422. Page 44: Paragraph 3: Sentence 4. If the river is assumed to be of uniform dimensions, then turbulent mixing would not occur because of laminar flow conditions.

Response: Accepted. A sentence which states "In addition, turbulent mixing would not occur according to the model, because laminar flow conditions would prevail." will be added to the text. In reality, turbulent mixing does occur. The simplified model is conservative in assuming the contaminants are not diluted as quickly through mixing.

Comment 423. Page 50: Paragraph 2: Sentence 2. Based on the information presented so far it is true that the level of accuracy is adequate. But the Nez Perce ERWM maintains that concluding that a problem does or does not exist based on this information is preliminary and without supporting information.

Response: Acknowledged.

Comment 424. Page 50: Paragraph 3: Sentence 1. The use of a line source to represent contaminant release resulting from groundwater discharge is likely the largest departure from the natural system incorporated into the model.

The Nez Perce ERWM believes that the use of a line source is only one of many departures from the natural system. The largest departure is the amount of distance that needs to be mapped.

Response: Acknowledged. However, the meaning of the second comment is not clear.

Comment 425. Page 50: Paragraph 3: Sentence 3. In the natural system, we anticipate the groundwater discharge to occur throughout the surface area of the river bottom, resulting in a distributed contaminant source.

The Nez Perce ERWM notices that the use of a line source should be replaced with the integration of an area source.

Response: Acknowledged. However, the use of a line source is appropriate given the qualitative, conservative nature of the CRIEP report.

Comment 426.† Page 50: Paragraph 3: Sentence 5. Consequently, the model has a tendency to overestimate the contaminant concentrations in the source areas due to the highly concentrated source term or to underestimate the concentration at the discharge point due to the assumption of instantaneous vertical mixing.

The model does not reflect a concentrated point source, but actually reflects a very narrow band of possible contamination concentrations. Assuming instantaneous vertical mixing may prove to be wrong in light of the very different flow velocities on the bottom of a river near a source

Response: The line source was used to qualitatively model the transport of 100 Area contaminants throughout the Columbia River. As discussed in the CRIEP text, this model does not accurately portrait groundwater fluxing or source discharges, it tends to overestimate contaminant concentrations in the source areas due to the highly concentrated source terms. However, away from the source areas, the estimated concentrations become representative of the release from the distributed source. Section 5.2.2 provides recommendations for further site characterization.

Comment 427.† Page 79: Paragraph 4: Sentence 2. The Columbia River Impact Evaluation Plan can be very useful for identifying where the areas of need are.

Following are some examples:

- There is a lack of scientific information on the contaminant plume fluxes.
- The unbounded host aquifer should be mapped and its physical properties need to be determined.
- The mineralogy of the Hanford subsurface should be determined.
- The structural configuration of the subsurface should be mapped.
- The water quality should be examined from a geochemical perspective.
- The intersections of the seeps, springs, plumes and the river should be precisely determined.

- There should be a comprehensive well positioning program to adequately account for the plume boundaries.

- Quality control and quality assurance should be given a high priority.

- There should be a complete aquatic sampling program.

- The plumes should be proved in a fashion similar to proving an ore body.

- The Columbia River should be geologically mapped on a 1" to 100' scale and the geomorphology considered.

- The river bottom sediments should be mapped and the sediment transport characteristics determined.

- The water level has known to be variable from season to season. This affects the sediments, the springs, and the environment and should be considered.

- The ecology of the plants, fish and waterfowl should be further identified (separately and together) for contaminant pathway understanding.

- The contaminant mixing modeling needs to be examined from a multi-dimensional perspective.

- The contaminant pathways for fish need to be determined.

  Monitoring stations need to be set up in strategic positions based on the geologic mapping program.

The characterization of the Hanford Reach will be extensive, and must be comprehensive and scientifically sound. The gaps in the data are evident in the Columbia River Impact Evaluation Plan and illustrate the need for a total and comprehensive rewriting of this document. The Columbia River Impact Evaluation Plan does not meet the objectives outlined on the first page.

Response: Acknowledged. Most of the bulleted suggestions are implicit in the recommendations identified in the text of Section 5.2.2.