

Hanford Natural Resource Trustee Council Work Group
U.S. Department of Energy
Meeting
August 26, 2004

Name	Organization	Phone
Steve Wisness	DOE	509-373-2859
Don Steffeck	USFWS	503-231-6223
Jay McConnaughey	Yakama Nation	509-945-4797
Wade Riggsbee	Yakama Nation	509-943-5432
Brian Barry	Yakama Nation	541-388-9995
Russell Jim	Yakama Nation	509-452-2502
Tom Stoops	Oregon Dept. of Energy	503-378-8328
Larry Goldstein	Ecology	360-407-6573
John Sands	DOE	509-372-2282
Astrid Larsen	DOE	509-372-0477
Jamie Zeisloft	DOE/RL	509-372-0188
Jim Rasmussen	DOE/RL	509-376-2247
S.J. Olinger	DOE/RL	509-376-6628
Susan Hughs (phone)	Oregon Dept. of Energy	503-373-7429
Ken Niles (phone)	Oregon Dept. of Energy	503-373-7429
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Hanford Natural Resource Trustee Council
MEETING AGENDA
August 26, 2004

- Describe DOE's proposed path forward for addressing Trustee data needs. (Shirley Olinger-20 min)
- Discuss DOE's priorities for scope and schedule (risk assessment and injury assessment) based on anticipated DOE funding. (All-10 min)
- Trustee expectations, resources/services of concern and review of technical work group draft. (Don Steffeck-45 min)
- Summary process and schedule for current ecological risk assessments. (Jamie Zeisloft-10 min)
- Process, schedule and team for identifying and filling data gaps. (All-20 min)
- Next steps. (All-15 min)

Larsen, Astrid P

From: Goldstein, Larry [lgol461@ECY.WA.GOV]
Sent: Friday, September 03, 2004 3:00 PM
To: Don Steffek (don_steffek@fws.gov); Tom Stoops; Brian Barry (bbarry@bendcable.com); Jay McConnaughey (j.mccon@verizon.net); Steve Wisness (Steven_H_Wisness@RL.GOV); 'Larsen, Astrid P'; John Sands (john_p_sands@rl.gov); VIGUELAV@dfw.wa.gov; 'Susan Hughs (SusanCHughs@state.or.us)'; Barbara Harper (bharper@amerion.com); Wade Riggsbee (riggsbee@owt.com)
Subject: Draft August 26 meeting minutes

Attached please find a draft summary of the August 26 meeting. This summary is intended to highlight the important points and no effort was made to capture everything. Some trustees felt it would be useful to document this key meeting to ensure everyone is in agreement (more or less). I believe this will help us move forward, and welcome your feedback. Thanks.

Larry



HNRTC Work
Group_062604a.doc (...)

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DRAFT
Hanford Natural Trustee Council Work Group
And USDOE Meeting Summary
Richland, Washington
August 26, 2004

Present:

Don Steffek, USDO/FWS
Tom Stoops, State of Oregon
Russell Jim, Yakama Nation
Brian Barry, Yakama Nation
Jay McConnaughey, Yakama Nation
Wade Riggsbee, Yakama Nation
Shirley Olinger, DOE-RL
Steve Wisness, DOE-RL
Astrid Larsen, DOE-RL
Jamie Zeisloft, DOE-RL
John Sands, DOE-RL
Jim Rasmussen, DOE-ORP
Larry Goldstein, WA Dept of Ecology

Via phone:

Lauri Vigue, WDFW
Susan Coburn Hughs, State of Oregon
Ken Niles, State of Oregon
Bryan Foley, DOE-RL
Barbara Harper, CTUIR

AGENDA

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- Discuss DOE's priorities for scope and schedule (risk assessment and injury assessment) based on anticipated DOE funding. (All)
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- Process, schedule and team for identifying and filling data gaps. (All)
- Next steps. (All)

Larry summarized the recent history on the issue of integrating natural resource injury assessments into Hanford ecological risk assessments (ERAs). This meeting is a follow-up to the mid-July Council meeting with Keith Klien. DOE had asked for technical assistance from the trustees¹ in defining what additional work might be necessary for the ERAs to meet the objectives of an injury assessment.

Shirley started the discussion by saying it is critical the “delta” or difference between the two types of studies be well-defined in order for remedy selection to be holistic. A collaborative process is very important. We need to identify a few key studies to show DOE headquarters what needs to be done. The cost impacts need to be approved by headquarters and she is willing to go before the Change Control Board. There is a placeholder for a possible request for FY ‘06. The FY ‘05 budget is “fixed.” The FY ‘06 budget decisions won’t be made until February 2005. She stated that we must prioritize the studies. To be able to defend the request we “must start small.” It was proposed we work through the upcoming 100/300 Areas RCBRA Data Quality Objectives process to define new studies.

The DOE path forward was described. DOE will take the first-cut of the technical work group proposed injury studies list and compare it to existing and planned ERA work. They will look for ways to incorporate new data needs.

There was mention of the trustees proposed Project Management Plan that quantified the level of effort and budget to enable the trustees to work much more effectively with DOE. The PMP was characterized by DOE as “too big, too complex and too expensive.”

One advantage to incorporating injury assessments into the ERAs is the latter are part of remedial decision making and driven by TPA milestones. There is a budget.

Jamie noted that under CERCLA DOE is the “lead agency” for remedial actions and wears three hats; potential liable party, trustee and lead agency. Larry responded that EPA signs the CERCLA Records of Decision and Ecology the RCRA site wide permit under the TPA, which governs decision-making at Hanford. There was agreement that all the trustees, including DOE, have equal standing.

Don presented the work group’s materials and concepts. The similarities and differences between an injury assessment and an ERA were described in detail. There was a common understanding that in an injury assessment is deterministic, i.e., injury is determined and quantified, whereas an ERA is conceptual. Examples of how PRPs and trustees work together on injury assessments at other large, complex sites were given. There appeared to be agreement among the participants that integration of injury assessments into the RI/FS process is desirable for many reasons.

¹ For purposes of this summary “trustees” refer to the non-Potentially Responsible Party (PRP) organizations. DOE is also a natural resource trustee at Hanford.

There appeared to be agreement on the definition of baseline, as defined in a 1997 DOE report to Congress as, "the condition that would have existed in the absence of release." There was agreement on the desirability of remedial actions to return the site to baseline conditions, to minimize residual injury, and to minimize long-term liability.

There was much discussion about lost services, past injury and how to identify injury that occurred in the past but not present or future. Air releases were offered as an example. Another example is Gable Mountain Pond and B-Pond which are now capped with clean fill, but native vegetation is not allowed to grow.

A distinction was made between "Phase 1" remediation which is intended to restore natural resources to the greatest extent possible, and "Phase 2" which could be mitigation for lost services. DOE will need to account for this in future budgets.

Don summarized by media examples of the types of studies needed to help inform the injury assessment process. Jamie noted that in the Central Plateau ERA many studies are already planned that will address injury assessment data needs. The trustees expressed surprise, noting the most recent DQO Issues Comment Resolution Matrix on this topic read that, "NRDA data requests will be considered on a case-by-basis." The 100/300 Area RCBRA work plan however, does have specific text on bioassays and biomarkers.

The trustee expectations were discussed at length. The focus was on limited resources. The trustees were challenged that if NRDA issues were a priority, use existing funds to find the expertise. Shirley and Steve questioned if the trustees are making the best use of resources, offering for example, that rather than having "big meetings" the trustees should identify experts to work closely with DOE and their contractors on these issues. Shirley emphasized the desire for three experts to represent the trustees in future meetings to define injury assessment studies. Steve also suggested we should re-visit how the Council operates at the meeting in Lowell. For example, perhaps the Council doesn't need to meet quarterly "just for the sake of meeting."

Shirley and Steve emphasized existing funding to the trustees, including funds to Ecology to staff 72 people, and that \$10 million was going to be spent over the next 2-3 years for ecological risk assessment work in the 100, 200 and 300 Areas. The 100/300 areas final remedy selection would be completed in 2007 and 2008.

Several trustees pointed out that the limited funds they receive from DOE are barely sufficient for the scope of other Hanford-related work which they already are involved with, and it is not reasonable to suggest that these funds can be stretched any further. Jay noted that the scope of the draft PMP included the need for 10-12 independent experts to assist in identifying and refining the list of specific studies.

Wade suggested a matrix of studies, risk assessments and TPA milestones would be good to help identify priorities and data needs. He suggested NRDA milestones to help drive priorities and budgets. DOE responded these milestones are not needed and would be "a very difficult sell."

Shirley stated that Keith Klien is still very interested in meeting with the senior officials from trustee organizations to discuss possible funding alternatives for NRDA activities. This meeting could occur once the technical staff agree on potential studies and associated costs. It was agreed such a meeting is overdue. Most participants agreed.

Ken addressed the issue of the states' Notice of Intent and said Oregon's goal is to not need to file a lawsuit. He agreed starting small is logical, but reminded DOE of the history with the trustees wherein whenever trustees pushed hard on an issue the DOE response has been agreement to cooperate but little else, and little has changed. The trustees are at a point where they have made it clear much more needs to be done to support them and meet the requirements of CERCLA.

Susan noted it is incorrect to view NRDA as extra work that takes money away from cleanup. This work is a statutory requirement and must be in the RL and ORP work scope and budget. She also emphasized that the proposed list of studies shouldn't be viewed as definitive because it is the result of minimal effort given time and resource constraints.

DOE remarked that the frustration being expressed by the trustees goes both ways, and offered the lack of participation by trustees in the DQO processes as example. The trustees disagreed, and expressed disappointment senior management at DOE believes this to be the case.

Shirley summarized the DOE commitment to consider natural resource risks in the ERAs to ensure selected remedies adequately address risk. The goal is to restore the site to baseline conditions to the greatest extent possible. Lost services will be addressed in Phase 2. The trustees need to advise DOE on the cost of additional studies and provide technical assistance. If justifiable, DOE will take the proposed budget to the Change Control Board.

Russell Jim concluded by saying many tribal issues are not addressed in this matrix and list of studies. The Native American Use Scenario is not something the Yakama can buy into. There also needs to be greater access to these meetings, noting there were insufficient phone lines.

Larsen, Astrid P

From: Don_Steffeck@r1.fws.gov
Sent: Wednesday, August 25, 2004 11:31 AM
To: steven_h_wisness@rl.gov; astrid_p_larsen@rl.gov
Cc: viguelav@dfw.wa.gov; danl@nezperce.org; susan.c.hughs@state.or.us; lgo461@ecy.wa.gov; j.mccon@verizon.net; bharper@amerion.com
Subject: presentation materials for tomorrow's meeting



Ecological Risk
Assessment.doc...



HANFORD_NRTC_
DRAFTA.doc (51 KB...



Injury_draft_r2.xls
(100 KB)

hi steve and astrid,

attached are the presentation materials we're planning to talk from tomorrow. i'll bring hard copies for all tomorrow, but we thought you might want to review these before the meeting. i'm leaving for richland in about a half hour, see you this afternoon.

(See attached file: Ecological Risk Assessment.doc) (See attached file: HANFORD_NRTC_DRAFTA.doc) (See attached file: Injury_draft_r2.xls)

thanks, don

Don Steffeck
Chief, Environmental Contaminants, Region 1
Phone: (503) 231-6223

I Ecological Risk Assessment (ERA) and Natural Resource Injury Assessment:

Purposes, Similarities and Differences.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Superfund, has two major components that are related to the environment; 1) cleanup/response, and 2) Natural Resource Damage Assessment (NRDA). The cleanup/response part of Superfund provides for remediation of the air, water, soil, and biota in order to protect the environment. NRDA provides for the restoration of natural resources from past, present and future injuries to the condition they were in prior to, or but for, the release. Injury is defined in the regulations (43 C.F.R. Part 11) as "measurable adverse change, either long or short term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to arelease". Baseline is defined in a DOE report to Congress (1997) as "the condition that would have existed in the absence of the release."

Purposes

ERA is used for the cleanup/response part of Superfund. It is a method of evaluation used to ensure the cleanup is protective of natural resources. Natural resource injury assessment is used for the NRDA part of Superfund. Injury assessment is a method for evaluating measurable adverse changes to natural resources as part of the NRDA process leading to restoring natural resources to their condition prior to the release.

A summary of the purposes of the ERA and NRDA are:

ERA

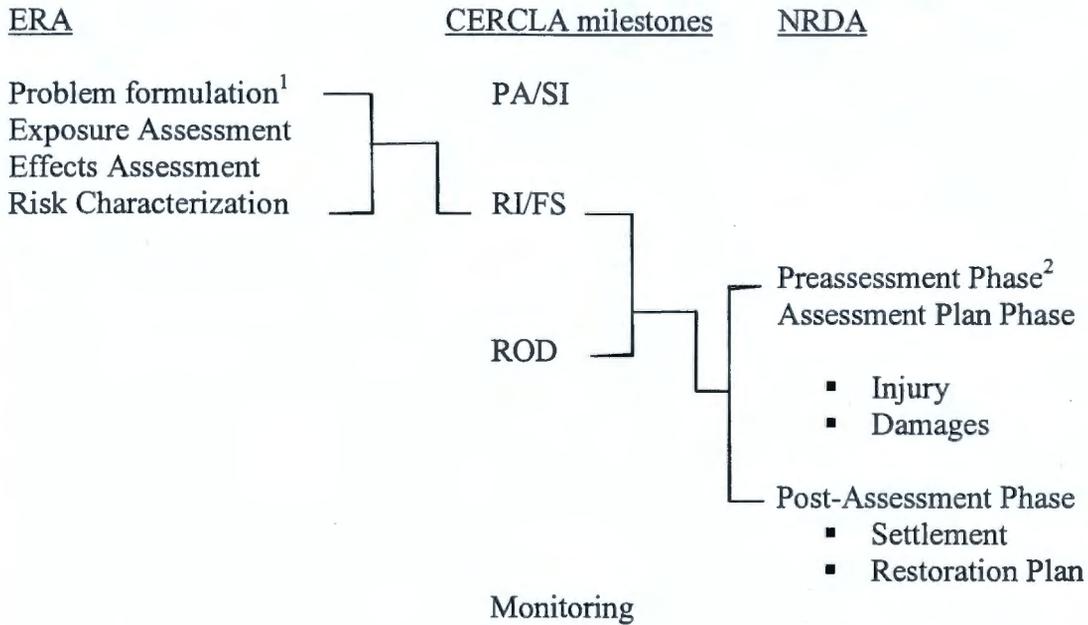
An evaluation of actual or potential effects of hazardous substances to natural resources to be used to determine and analyze cleanup alternatives and actions for the protection of the environment.

NRDA

A quantitative analysis of past, present, and potential future injury to natural resources used to determine what is required to restore the natural resources to their condition prior to the release(s) of hazardous substances.

Similarities and Differences

Methodologies/Process - portraying where ERA and NRDA fit into the CERCLA process

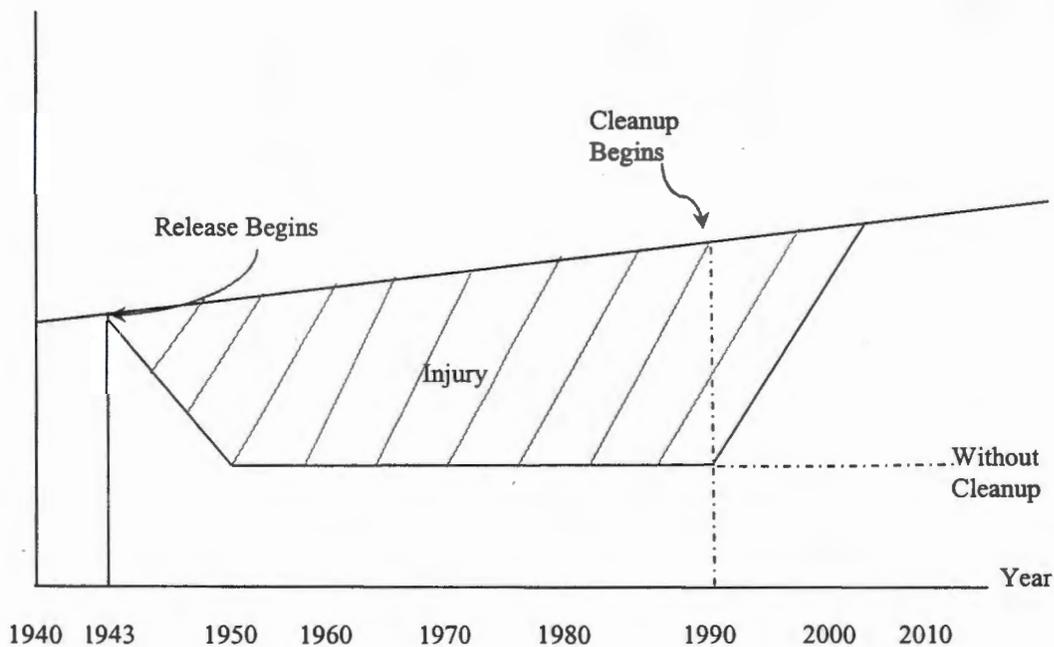


¹ USEPA Ecological Assessment of Superfund Site: An Overview (1991)

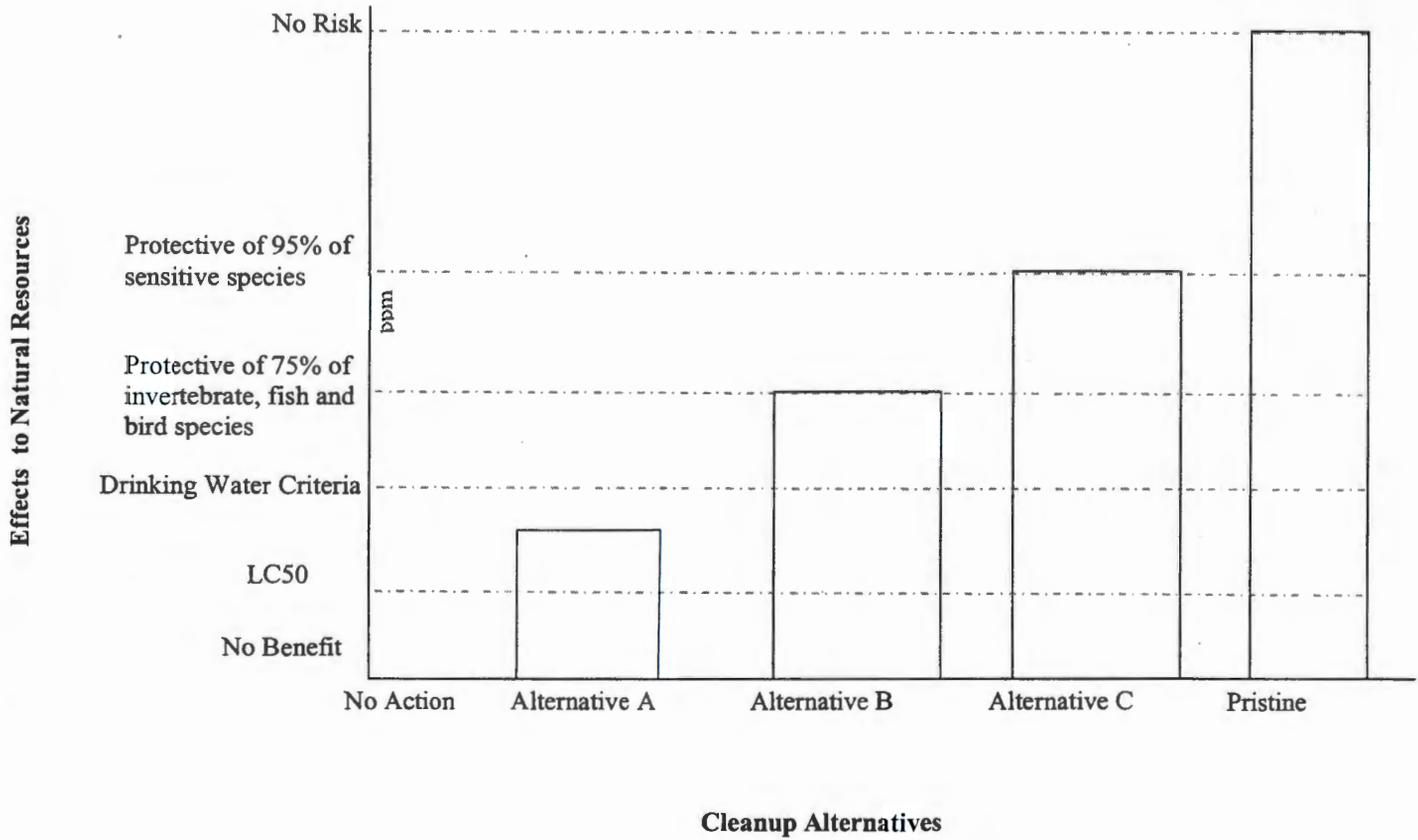
² USDOJ 43 CFR, Part II Natural Resource Damage Assessment Regulations under CERCLA (1994)

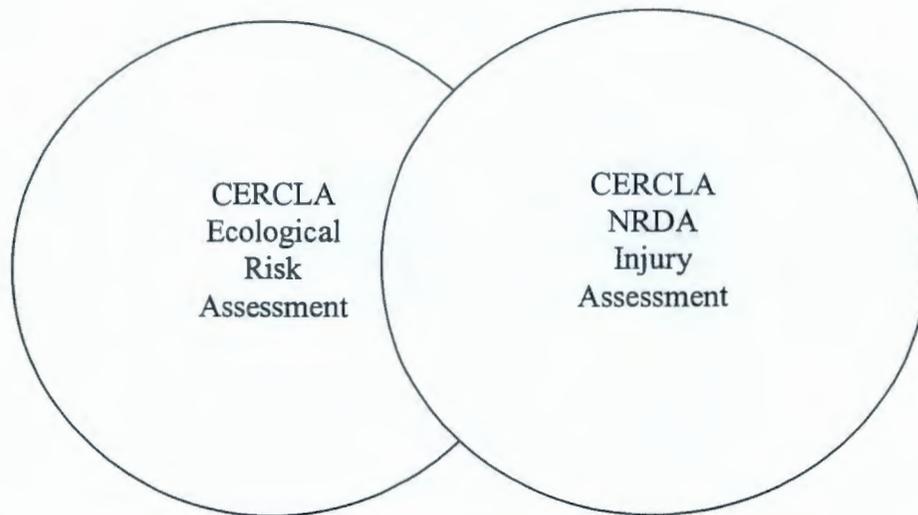
Example of Natural Resources Service Lost

Fishing User Days or other Natural Resource Injury



ECOLOGICAL RISK ASSESSMENT





Tasks Common to Eco Risk and Injury Assessment

- Develop inventory of all releases.
- Establish nature and extent of contamination.
- Develop list of potential contaminants of concern.
- Establish baseline/background conditions.
- Identify T&E species, species of special concern, sensitive species, and indicator species in areas where contaminants have come to reside.
- Document exposure of contaminants to natural resources.
- Identify and evaluate effects of contaminants on natural resources exposed.

Tasks Different to Ecological Risk and Injury Assessment

Ecological Risk Assessment	NRDA Injury Assessment
Conceptualize exposure to COPCs <ul style="list-style-type: none"> • Ingestion of contaminated prey • Ingestion of contaminated media • Dermal exposure • Inhalation • Absorption 	Demonstrate exposure to COPCs <ul style="list-style-type: none"> • Ingestion of contaminated prey • Ingestion of contaminated media • Dermal exposure • Inhalation • Absorption
Temporally projects into the future	Temporally past, present and future
Identify critical effect concentrations and evaluate the risk.	Demonstrate adverse effects due to exposure <ul style="list-style-type: none"> • Toxicity studies • Changes in fecundity • Population declines or adverse modifications. • Increase in physiological effects • Increased incidents of cancers • Etc.
Establish cleanup levels that are protective of the environment.	Determine potential damages and appropriate restoration.

II HANFORD NRTC TECHNICAL WORK GROUP PROPOSED NRDA INJURY STUDIES

Introduction

This document was prepared in response to the Department of Energy (DOE) request that the Hanford Natural Resource Trustees who are not potentially responsible parties (non-PRP) provide technical assistance to DOE in determining what data, studies, information, and analysis would be needed for a CERCLA natural resource damage assessment at Hanford. This work would be in addition to currently planned and ongoing Ecological Risk Assessments (ERAs) at Hanford. In responding to that request, the non-PRP Trustees determined it was helpful to first prepare an outline describing what a natural resource injury assessment at Hanford would entail. This document could then be compared to existing descriptions of the ERAs to determine what additional work is needed to support natural resource injury assessments.

Certain caveats apply in using this document. This document was prepared by a technical work group consisting of representatives from the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, Oregon, Washington, National Oceanic and Atmospheric Administration, and the U.S. Fish and Wildlife Service. The work group recognizes that an outline describing a complete natural resource injury assessment that captures the universe of potential injury to natural resources at Hanford would be far more comprehensive and detailed than this document. However, this type of comprehensive document could not be prepared at this time for several reasons. First, the time constraints imposed by DOE for this project limited the amount of detail possible in this outline. Second, for the purpose of comparing an injury assessment to an ERA, it is not necessary to develop a comprehensive list/outline. Third, the non-PRP Trustees lack the resources necessary to develop a comprehensive outline. Fourth, a natural resource injury assessment at Hanford will be unique. While prior injury assessments conducted at other CERCLA sites are relevant and provide some guidance, they do not address the unique conditions and circumstances at Hanford.

Generally, this document is divided into four sections; an introduction, general methodologies with study examples, trustee expectations, and a matrix of potential investigations, contaminants, and natural resources for consideration.

GENERAL METHODOLOGIES BY NATURAL RESOURCE MEDIA

Air

1. Inventory of historic releases
2. Establish extent of contamination and pathways
3. Determine background
4. Document any exceedances of standards or criteria
5. What resources are exposed to the constituents released?
6. Quantify Injury

Some Studies:

- Review any potentially useful data developed for the human health “Downwinder” case
- Acre/year of services lost
- Identify the extent and concentrations of contaminants in depositional impact areas such as Gable Mountain, etc.
- Evaluate exposure rate and potential effects to biota located close to release sites
- Identify most sensitive species for various COPECs released

Surface Water

Include sediments and ephemeral ponds in addition to streams and the Columbia river

1. Inventory historic, current, and potential future releases
2. Establish extent of releases and pathways
3. Determine background
4. Document any exceedances of standards or criteria
5. What resources are exposed to the constituents released?
6. Quantify Injury

Some studies:

- Collect sediment cores from depositional areas
- Evaluate exposure and effects to benthic, macro, micro fauna (ex. 100D)
- Develop pathway studies for different trophic levels
- Evaluate potential amphibian/reptile injury
- Identify most sensitive aquatic and terrestrial receptors (snails?)
- Develop toxicity and DNA breakage studies to document potential injury
- Review historic information such as the West Lake sediments to determine baseline
- Sample ephemeral ponds for potential seasonal pathway to biota
- Evaluate sediment toxicity to insitu salmon and resident species
- Determine if there are seasonal or daily flux of contaminants to the Columbia river

Groundwater

1. Inventory historic releases
2. Establish extent of plumes
3. Determine background
4. Document any exceedances over standards or criteria
5. What resources are exposed to the constituents released?
6. Quantify injury and analyze data

Some Studies:

- Install wells identified by State and EPA (technically defensible groundwater network) and analyze data
- Develop an independent verification process for SAC (i.e. compare empirical data to model outputs)

- Quantify lost services
- Identify and determine if groundwater invertebrates have been exposed/affected by contaminants

Soil (includes off-site)

1. Inventory of historic releases, including waste management units and remediated sites
2. Establish extent and pathways
3. Determine background
4. Document any exceedances over standards or criteria
5. What resources are exposed to the constituents released?
6. Quantify injury

Some Studies:

- Quantify contamination left in place following remediation
- Quantify injury to soil
- Document habitat loss as a result of remediation
- Evaluate potential pathways and conduct an analysis (soil to biota; microbiotic soil crust to macrobiota, plants and animals, etc.)

Biota

Template for Biota Evaluation Process:

1. Determine habitat use (historic, current, future)
2. Document exposure (spacial, temporal) using tissue residue studies and other actual data
3. Determine the toxicology of release(s)
4. Develop injury determination and/or assessment to biological communities, individuals, and/or guilds; using a combination of field & lab studies to determine potential demonstrated or projected effects
5. Quantify injury

Some Studies:

- Conduct a pathway analysis (food web) to determine if contaminants are moving through trophic levels for both aquatic and terrestrial systems
- Review past and “secret” or classified studies
- Quantify habitat loss to species of concern
- Define injury categories and assessment endpoints
- Determine onsite effect level(s) of radionuclides
- Conduct toxicity testing and toxicity assessments for single and complex mixtures of contaminants with key species
- Utilize sturgeon as a surrogate for long-term exposures to various contaminants
- USGS follow-up chromium study by Dr. Farag (Resident fish species study)

Note: These topical studies do not include quantifying potential interim losses for services and non-consumptive uses, e.g., recreational fishing, cultural services. However, data developed from this matrix could be used for this purpose.

TRUSTEE EXPECTATIONS

1. Written description of DOE-RL's and ORP NRDA strategy at Hanford.
2. Review of and input to NRDA project lifecycle baseline per DOE's project management order.
3. Access to raw data.
4. Full participation in planning and implementing performance monitoring of remediation results. Need sufficient information to understand monitoring results on a *project* as well as *site-wide* scale.
5. Oversee an integrated technical team to design, conduct, and evaluate injury assessment studies.
6. Have opportunity for independent data collection, analysis, and verification funded by PRP as part of integrated approach.
7. Funding of Trustee work scope in cooperation with DOE and regular scoping and implementation discussions.

Objective is to determine incorporate as many of the studies into the RA & the rest will be reviewed later

1. our approach
Eco risk assessment w/ trustee involvement to clean up aspect we can

2. lots of commerciality on studies & data that can be developed during RA

3. Not appropriate time to do injury - after clean-up ROD & PMS

4. maybe for the most part the injury will be done later

however there may be exceptions

STUDIES	Background	Release Evaluation	Pathway/Extent of Contamination	Food Chain	Extent of Exposure	Biomarkers of Exposure			Injury	Biomarkers of Injury													Lost Services			
						Tissue Residue	Other			Biomarkers of Injury	Toxicity Tests (acute & chronic)	Mortality	Growth/Development	Physiological Malfunction	Cancer/Disease	Avoidance	Behavior abnormalities	Physical Deformation	Endocrine Disruption	Genetic Impacts	Community Structure	Habitat Service Loss		Other		
RESOURCE/SPECIES																										
TERRESTRIAL																										
Non-Biotic Resources:																										
Air	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Soils	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface Water	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mammals:																										
Omnivores				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Canivores				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Herbivores				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Birds:																										
Migratory				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Resident				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
T&E Species:																										
Species of Special Concern				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Reptiles:																										
Reptiles				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Amphibians:																										
Amphibians				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Insects:																										
Insects				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Plants:																										
Medicinal				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Native Grasses				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Microbial Crusts				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sagebrush				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Agricultural				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
RIPARIAN/NEARSHORE																										
Non-Biotic Resources:																										
Air	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Soils	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface Water	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Biological Resources:																										
Mammals				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Birds				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Reptiles				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Amphibians				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Insects				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Plants				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish:																										
Invertebrates																										
Contaminants of Concern: Radionuclides, Inorganics (metals), Organics, Pesticides/Herbicides																										
For initial list of contaminants, refer to lists in the Central Plateau Risk Assessment DQO Workbook (2004) and CRCIA Identification of Contaminants of Concern (1995)																										
Individual Species: to be determined, refer to Hanford Site Species Listings at www.pnl.gov/ecomon/species																										
For the Columbia River, refer initially to Appendix B, Tier 1 Species List for the Screening Assessment, CRCIA (1996)																										

Work in Progress

STUDIES	Background	Release Evaluation	Pathway/Extent of Contamination	Food Chain	Extent of Exposure	Biomarkers of Exposure	Tissue Residue	Other	Injury	Biomarkers of Injury	Toxicity Tests (acute & chronic)	Mortality	Growth/Development	Physiological Malfunction	Cancer/Disease	Avoidance	Behavior abnormalities	Physical Deformation	Endocrine Disruption	Genetic Impacts	Community Structure	Habitat Service Loss	Other	Emit Services
AQUATIC																								
Non Biotic Resources																								
Sediment	X		X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Pore Water	X		X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Surface Water	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Groundwater Discharge	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Flora																								
Phytoplankton				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Periphyton				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Macrophytes				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Invertebrates																								
Benthic macroinvertebrates				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Zooplankton				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Insects				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bivalves				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Crustaceans				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Resident Fish																								
Plankton Feeders				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Bottom Feeders				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Predators				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Migratory Fish																								
Adult Salmon				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Embryo/alevins				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Juvenile Salmon				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Lamprey/leel				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Birds																								
Mammals																								
Amphibians																								
Reptiles																								

Work in Progress