DUWAMISH RIVER CLEANUP COALITION
Technical Advisory Group

Community Advisory Board:

Community Coalition for Environmental Justice

The Duwamish Tribe

Environmental Coalition Of South Seattle

Georgetown Community Council

IM-A-PAL Foundation

People For Puget Sound, a program of the WA Environmental Council

Puget Soundkeeper Alliance

South Park Neighborhood Association

Washington Toxics Coalition

Waste Action Project

Working to ensure a Duwamish River cleanup that is accepted by and benefits the community and protects fish, wildlife and human health.

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June 13, 2013

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Proposed Plan: Lower Duwamish Waterway Superfund Site

The Duwamish River Cleanup Coalition/Technical Advisory Group (DRCC/TAG) has reviewed EPA's Proposed Plan (Plan) for the Lower Duwamish Waterway Superfund Site, and has commissioned an independent review with support from EPA's Technical Assistance Grant program. DRCC/TAG and its technical advisors have also reviewed the appendices to the Plan: the WA Department of Ecology's Draft Lower Duwamish Waterway Source Control Strategy (Appendix A) and EPA's Draft Environmental Justice Analysis for the Lower Duwamish Waterway Cleanup (Appendix B), as well as the underlying Remedial Investigation and Feasibility Study (RI/FS).

To further inform our review, DRCC/TAG has partnered with the University of Washington School of Public Health and Just Health Action to conduct a Health Impact Assessment of EPA's Proposed Plan (sponsored by the Health Impact Project, a partnership of the Pew Charitable Trusts and Robert Wood Johnson Foundation). DRCC/TAG has also provided information about the proposed plan to the lower Duwamish River communities (residents, Tribes, fishing families, businesses, recreational users, and other stakeholders) and solicited their questions, comments and concerns to inform our technical review, assessments and recommendations.

Our comments contained herein compile data, information and conclusions from all of these sources, and make recommendations to strengthen EPA's final cleanup plan and Record of Decision for the lower Duwamish River Superfund Site.

Duwamish River Cleanup Coalition/Technical Advisory Group

The Duwamish River Cleanup Coalition/Technical Advisory Group (DRCC/TAG) was formed by a coalition of ten organizations that have worked together on the site cleanup for over twelve years, demonstrating their commitment to the cleanup process and to working with the regulatory agencies. DRCC/TAG serves as EPA's Community Advisory Group (CAG) for the site, and its founders continue to serve as DRCC/TAG's Advisory Board. The Advisory Board represents community, environmental, tribal and small business stakeholders who are affected by the current state of the river and pending cleanup plans, and includes the Community Coalition for Environmental Justice, the Duwamish Tribe, ECOSS (provides confidential free environmental management services to businesses), the Georgetown Community Council, the IM-A-PAL Foundation, People For Puget Sound (a program of the Washington Environmental Council), Puget Soundkeeper Alliance, the South Park Neighborhood Association, Washington Toxics Coalition, and Waste Action Project.

DRCC/TAG and our Advisory Board members have a long history of working to clean up and restore the Duwamish River, including long before it was designated a Superfund site. This site is the community's backyard, cultural heritage, workplace, recreational area, and source of food. DRCC/TAG has participated in the Duwamish River Superfund cleanup process since 2001, meeting frequently with EPA and the Washington State Department of Ecology, informing and monitoring early action cleanups, reviewing countless pages of technical documents, and navigating the lengthy administrative processes. We have walked the neighborhood streets and met with community members on a regular basis; organized community workshops, public meetings and hearings; and given hundreds of educational presentations and tours of the river to thousands of community members. We have been on the site and involved in the cleanup process every step of the way, and are committed to staying engaged until the cleanup results in a river that meets the community's needs and its long-term vision. In the past three months alone, we have engaged over 1,500 people in reviewing and providing feedback on EPA's Proposed Cleanup Plan.

A healthy Duwamish River is more than simply a positive feature of the city's neighborhoods and of the landscape – it is a basic right and a necessary component of a healthy community. The fact that the community's river is polluted with toxic chemicals creates threats to human health and stress on local residents and river users, resulting in harm to our friends and neighbors, children and grandparents. The environmental, economic, and health damages to the community are painfully real and impart an anxiety that itself contributes to additional adverse effects on our communities' health.

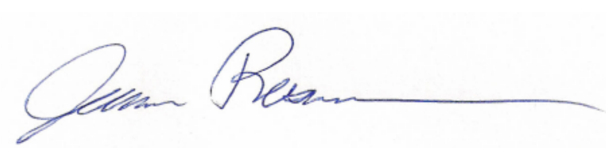
It is our mission to ensure a Duwamish River cleanup that is accepted by and benefits the community, and protects fish, wildlife and human health. It is our long-term vision that Seattle residents and visitors will be able to fish, clam and crab in the river without disproportionate risks to their family's health; that endangered salmon will be able to recover without PCBs or other toxic body burdens; and that the banks of the Duwamish River will be a welcoming and safe place for our children and their children to wade, fish and play.

DRCC/TAG has represented and provided technical support services to the community and stakeholders throughout the cleanup process and has devoted over a decade of our time, energies and resources to the cleanup of this site. We consult with other communities and organizations impacted by Superfund sites around the country, which are also working to improve environmental health and the quality of life in the communities where they live, work and play. DRCC/TAG is particularly concerned with avoiding the failures and shortcomings that plague some of these other communities, many of which struggle with ongoing pollution, recontamination, restrictions on uses of their waterways, and in some cases, repeated and ongoing remedial actions.

To this end, and in consultation with members of our affected communities and stakeholders, our assessment and recommendations are focused on ensuring a cleanup that maximizes **certainty**, **permanence**, and both short- and long-term **protection of the environment and human health**.

We look forward to discussing these comments with you as EPA considers its final cleanup plan for the Duwamish River. If you have any questions or require any additional information or clarification of any of the points contained in these comments, please do not hesitate to let us know.

Sincerely,



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Board of Directors, Duwamish River Cleanup Coalition/Technical Advisory Group

General Comments

DRCC/TAG's review of EPA's Proposed Plan, Remedial Investigation, Feasibility Study, and Environmental Justice Analysis, and the Department of Ecology's Source Control Strategy, has been comprehensive and guided by the priorities defined by the affected communities and stakeholders. As EPA's Community Advisory Group for the site, DRCC/TAG has engaged the community extensively in our review of these documents and related assessments by DRCC/TAG's technical advisors, as well as by researchers at the University of Washington School of Public Health and others. The affected communities' and stakeholders' priorities for strengthening the cleanup plan can generally be characterized as:

- maximize certainty that the selected cleanup action will be effective in meeting the cleanup goals;
- ensure the permanence of the remedy, to prevent recontamination and/or the need for "do-overs";
- minimize future risk and the potential for ongoing liability for tax- and rate-payers and businesses;
- protect the environment and people's health to the greatest degree possible; and
- ensure equity by designing a cleanup that protects all river users.

DRCC/TAG appreciates the magnitude of the task of conducting an investigation and designing a cleanup plan for a site as large and complex as the lower Duwamish River Superfund Site. EPA and the WA Department of Ecology have shown comendable leadership in their efforts and oversight to ensure scientifically robust technical documents and have moved the process forward in a timely manner. We further appreciate the responsiveness of EPA and Ecology to past comments by DRCC/TAG, the Tribes, and Natural Resources Trustees for the site. The improvements resulting from the agency's responsiveness to date is evident in the Proposed Plan. While our comments will necessarily focus on improvements that are still necessary to protect the environment and health, achieve certainty and permanence, and ensure environmental justice and health equity, this does not detract from our recognition of the complexity of the task or diligence of the project managers and staff who have contributed their skill and expertise to developing this Plan.

In particular, DRCC/TAG appreciates and supports the inclusion of Preliminary Remediation Goals (PRGs) for water quality and fish tissue in addition to sediments – these are essential to ensuring that Remedial Action Objectives (RAOs) (a.k.a., cleanup goals) are achieved. We also appreciate the inclusion of the entire waterway in the cleanup plan "footprint," and support EPA's decision to require monitoring throughout the entire 441 square mile area addressed by the Plan. In addition, DRCC/TAG appreciates EPA's revised upriver loading estimates and additional information EPA has provided to clarify the anticipated cancer and non-cancer risks following completion of the cleanup, as well as the clear statement explaining the historical ineffectiveness of Institutional Controls. Finally, DRCC/TAG recognizes and supports EPA's proposal to strengthen the protectiveness of the remedy by requiring a minimum 4-foot thick cap in any potential clamming areas and applying subsurface PCB standards in areas where clamming or scour can be expected to occur.

With regard to the public review and participation process, DRCC/TAG is especially grateful to EPA for providing an easy to understand overview of the Proposed Plan, and for providing information in a variety of languages in order to serve the communities directly affected. We extend our appreciation to EPA for hosting a public meeting in Spanish as the primary language, and for providing simultaneous interpretation in Spanish and Vietnamese at EPA's English-language public meetings.

The following are our **Specific Comments** on the Proposed Cleanup Plan:

A. Reduce Uncertainty

Improving the certainty of the cleanup is one of the community's highest priorities. Both to ensure that the environment and people's health are protected to the greatest degree possible, and to protect our collective investment in cleanup, the public should be confident that the cleanup plan we select has a reasonable expectation of success.

Monitored natural recovery (MNR) is the least certain and effective of the available remedies, but it constitutes the majority of the current Proposed Plan (62%). Another 12% of the site would be subject to enhanced natural recovery[1] (ENR), which is marginally more certain, but still may not prove to be an adequately effective remedy over the long term, especially in areas with relatively high levels of chemical contamination.

DRCC/TAG's recommended changes to EPA's Proposed Plan include reducing uncertainty by treating the areas proposed for monitored and enhanced natural recovery with remedies that provide greater

[1] ENR is natural recovery aided by a "kick-start" of 6–9 inches of clean sand, possibly aided by granular activated carbon (GAC). GAC may reduce the bioavailability of contaminants and thereby make them less harmful to people and species higher up the food chain, but its use as an additive in ENR must be pilot-tested to ensure that it is safe and does not have unanticipated impacts on the Duwamish River's biota. ENR speeds natural recovery, but does not provide a permanent barrier and does not guarantee that natural recovery will be effective in reducing surface concentrations of toxins over the long term.

certainty, i.e., are more likely to work and be effective in meeting cleanup goals and protecting the environment and people's health.

1. Eliminate use of MNR

EPA proposes to use MNR over 62% of the acreage of the Duwamish Superfund site (256 acres). Much of this area does not currently meet the required health standards (health protective levels or natural background), so protecting human health relies on the success and effectiveness of MNR within a reasonable time frame.

Gomes et al. (2013) describe monitored natural recovery as “a technique used to monitor the progress of natural attenuation processes. It may be used with other remediation technologies as a finishing option or as the only remediation technique *if the rate of contaminant degradation is fast enough to protect human health and the environment*.” In the case of the Duwamish River Superfund site, MNR is being proposed for contaminants that either will not degrade at all, or only over unreasonably long periods of time. PCBs and dioxins/furans do not degrade at a rate "fast enough to protect human health and the environment" and therefore are not appropriate for treatment using MNR. Arsenic is an elemental heavy metal does not break down at all. The remaining human health risk driver is carcinogenic PAHs (cPAHs), which do degrade at a faster rate, though still slowly, but rarely if ever are found in Duwamish River sediments without being co-located with PCBs, dioxins/furans, and/or arsenic. In addition, sediments at the Duwamish site are subject to a variety of disturbances, ranging from ship scour, floods, storm surges, and tsunamis. Current climate change models in the Puget Sound region predict stronger and more intense precipitation events, which could lead to more severe and frequent flooding. Local models predict the impact of storm surges to be particularly severe along the lower Duwamish River (Seattle Public Utilities, 2013). Earthquakes also present a possible disturbance to the system that could re-distribute contaminated sediments. With the application of MNR, contaminants that do not degrade and are likely to be disturbed will always remain in the system as a liability.

Another important consideration not discussed in the Proposed Plan is that in areas where contamination is left behind, MNR as a remedy will come with strings attached: "institutional controls" to prevent activities that could disturb underlying contaminated sediments will be attached to areas of the Duwamish with buried contamination. At minimum, notification and approval by the regulatory agencies will be required before any future activities can be undertaken in these areas of the river.

Restrictions on uses or requirements for remediating the underlying sediments may be applied, regardless of whether the use is for public or private benefit (habitat, public access improvements, piers, industrial development). Future river uses will be restricted for decades, and possibly in perpetuity.

MNR is fundamentally not suited for use at the Duwamish Superfund site, and applying it in this case unreasonably risks the health of the river's Tribes and subsistence fishing families, restricts future uses, and extends liability for contaminants remaining at the site.

a. Case studies:

Human health protection levels and benchmarks vary at each cleanup site, making less clear the comparative effectiveness and end results of many different natural recovery projects. Magar et al. (2009) states that long term monitoring is, in almost every case they studied, sufficient to evaluate the MNR remedy (Magar et al 2009, Table 6-4, p. 6-17). However, standardized comparisons of MNR sites, e.g., natural recovery half times, show significant variability in MNR's effectiveness. After analysis of regressions of time series data using the exponential decay function and dated sediment cores, Brown et al. (1999) was able to compare natural attenuation half times at a variety of sites that used MNR as the selected remedy (Brown et al. 1999) (see table on page 8).

Many of these sites took decades to return to background levels of contamination and are still participating in long term monitoring. Monitoring is especially important for MNR sites because the majority of the contaminants are in place and vulnerable to many forms of re-introduction to the environment, as noted by Magar and Wenning (2006):

> "Because contaminants are left in place with MNR, the risks of contaminant breakthrough or resuspension persist. Therefore, sediment stability is often an important component of MNR. Sediment erosion potential should be investigated to ensure that sediments are stable during normal to high-energy conditions, including storms, flood events, other natural events, and human disturbances, especially ship wake, which can be significant near shipping channels and in ports and harbors."

While the Proposed Plan suggests using MNR only in areas that are generally depositional overall, sediments in the Duwamish have not been shown to be stable. The Duwamish is a dynamic and active estuary, with tidal influences, currents and floods, industrial and shipping activity, and many other disturbances. In short, Duwamish River sediments move, even in depositional areas, making MNR less effective at burying contaminated sediments.

Examples of Natural Attenuation Half-Times (Years)

Water Body	COC	Biota[1, 2]	Sediment[1]	Water[1]	Source
Fox River, WI	PCB			4.4	WDNR 1995
	PCB		5.4 (4.8-6.0)		BBL 1999
Fox River, WI (DePere to Green Bay)	PCB	10.4 (7.0-15)			BBL 1999
Fox River, WI (Green Bay)	PCB	7.9 (5.1-13)			BBL 1999
Fox River, WI (Little Lake Butte des Morts)	PCB	9.4 (7.0-17)			BBL 1999
Hudson River, NY	PCB	2.5		1.7	Brown, et al. 1985
	PCB		10.4 (4.4-23)		QEA 1999
James River, VA	Kepone	5.4 (4.9-5.8)			Virginia Department of Health (1990 to 1996; Sheretz 1998)
	Kepone	3 (Blue Crab)			Huggett 1989
Kalamazoo River, MI	PCB	6.2 (3.1-12)	6.7 (3.5-14)	4.3 (3.4-5.2)	BBL[6]
Southern Reservoirs[3]	Chlordane		9.4 (7.7-11)		Van Metre, et al. 1998
	DDT		12 (6.1-19)		Van Metre, et al, 1998
	Lead		9.8 (8.9-11)		Van Metre, et al. 1998
	PCB		9.4 (7-13.4)		Van Metre, et al. 1998
Lake Hartwell, SC[4]	PCB	4.2			USEPA 1994
Lavaca Bay, TX[5]	Mercury		3.2 (1.2-9.3)		Santschi 1999
Nassau Lake, NY[5]	PCB		12 (8.4-17)		BBL 1999

Notes:
1. Numbers in parentheses represent the range of values used to calculate the mean.
2. Biota are fish except as noted.
3. Reservoirs include Lake Anne (VA), Lake Blackshear (GA), Lake Harding (GA), Lake Walter F. George (GA), Lake Seminole (FL/GA), White Rock Lake (TX), Coralville Reservoir (Iowa), Elephant Butte Reservoir (NM), and Lowrence Creek (TX).
4. Based on Food and Gill Exchange of Toxic Substances (FGETS) model results.
5. Intrinsic rates are presented based on sediment mixing layer thickness and sediment deposition rates.
6. Data were collected as part of the remedial investigation conducted by BBL, as well as the Michigan Department of Environmental Quality (MDEQ).

A cautionary example is provided by the James River in Virginia, which experienced a release of Kepone, a chlorinated pesticide, from a manufacturing facility; discovery of the contamination and studies on the site began in 1975 (Luellen 2006). MNR was applied as the selected remedy, and has been woefully ineffective. By 1998, it was determined that few fish contained Kepone concentrations greater than the action limit, but contaminant resuspension and reexposure have occurred since and a fish consumption advisory is still in effect thirty years after the source of contamination was curtailed (Luellen 2006). The most current fish tissue data from 2009 shows that 59% of sampled fish still have Kepone concentrations above the Virginia Department of Health’s level of concern and 80% of fish have concentrations of Kepone above detection limits (VDEQ 2009). Contamination is still present 34 years after the production and release of Kepone at the site was halted, and after 34 years of MNR (Luellen 2006). Two of the zones with the highest concentrations of Kepone are downstream of the site of release, at turbidity maximums where less dense freshwater flows over denser saline water. This condition is present in the Duwamish as well. The turbidity caused by this tidal influence/salt wedge causes sediment resuspension and results in the consistent presence of Kepone in fish tissue (Luellen 2006). Luellen concludes that fish tissue concentrations have plateaued at a steady state caused by the constant resuspension of the contaminant. In the case of the James River and similar dynamic estuarine environments like the Duwamish, reliance on MNR carries the constant threat of resuspension, the continued financial obligation for monitoring in perpetuity, and possibly liability for additional cleanup after years of application and costs associated with an ineffective remedy.

b. MNR costs:

EPA's Proposed Plan for the Duwamish Superfund site states:

> "Areas that are dredged require the least long-term sediment monitoring. Capping and ENR require more sediment monitoring to ensure surface concentrations remain low. MNR requires the most monitoring to determine if surface sediment COC concentrations are reducing over time as projected by the natural recovery model. Alternatives with a larger area of ENR and MNR require more long-term monitoring and maintenance to ensure their effectiveness" (Section 9.2.1).

Long-term monitoring cost projections in the Lower Duwamish Waterway Feasibility Study (October 2012) do not reflect this statement and are probably significantly underestimated. Cost projections in the FS vary for long-term monitoring from $5.2 million for the alternative with the greatest amount of MNR to $4.9 million for the alternative with the greatest amount of removal, with most alternatives projecting $5 million (Appendix I, Table I-50). The disparity between different technology's long term monitoring requirements as summarized by EPA is not properly reflected in the Feasibility Study's projected costs for long term monitoring. In addition, the FS limits the number of years for which costs are considered, whereas MNR will likely require monitoring in perpetuity.

According to the Proposed Plan, "if MNR does not achieve [sediment management standards (SQS)] or progress sufficiently toward achieving it in 10 years, additional cleanup (e.g., dredging, capping, or ENR, following the decision criteria in Figure 19 and Figure 20) will be required" (Section 10.1). Alternatives with more area designated for MNR have a greater chance to require further action, creating "additional administrative burdens" and possibly additional cleanup actions in order to resolve areas that do not meet the SQS levels (Section 9.2.4). Furthermore, monitoring will be conducted in areas where levels are above sediment preliminary remediation goals (PRGs, a.k.a. cleanup goals) but below SQS.

Monitoring results will be considered during 5-year reviews, to evaluate whether the selected remedy is adequately protecting human health and the environment (Feasibility Study Appendix K.6). Where MNR is not achieving the goals, additional cleanup options will be considered and could trigger additional EPA cleanup orders (Section 10.1). All of these factors create more uncertainty in cost projections, the amount of time the area will require monitoring, and how much additional cleanup will ultimately be required (Section 9.2.1).

Finally, MNR has economic externalities such as the cost of PCBs' permanent presence in the sediment, which creates a risk factor of PCBs being resuspended by various weather, geological, or human events. As long as there is a chance of PCBs being resuspended, monitoring must continue. When evaluating MNR, the cost of uncertainty should be considered, making active remediation technologies which offer more permanence and less uncertainty, such as dredging, more cost competitive. At a presentation on MNR at the 2005 Battelle's Third International Conference on the Remediation of Contaminated Sediments, one panel member stated, "it's a question of paying up front or on the back end; monitoring is not cheap. If one wants to show MNR is effective, then you're going to be monitoring for a long time" (Zeller and Cushing, 2006). **A comprehensive national study on MNR stated that the long term monitoring costs of MNR can exceed the cost of capping or dredging (Magar et al., 2009).**

2. Use ENR in areas currently proposed for MNR

While ENR is not a certain or permanent remedy, it is more certain than MNR and is reasonable to consider in areas of relatively low chemical contamination, if there are significant advantages in terms of the cost and timeliness of the remedy. The areas where EPA is currently proposing to use MNR generally have lower chemical concentrations than the rest of the river, posing less risk than areas with more highly contaminated sediments. In such areas, ENR has been shown to be reasonably effective and to achieve health protective standards in a relatively short time frame and at relatively low cost.

ENR is the use of natural construction materials such as sand, gravel, or sediment to accelerate recovery. These materials are sometimes combined with reactive elements such as clay, apatite, activated carbon, and other compounds (US EPA, 2013; Merritt et al., 2010). This process is intended to quickly reduce contamination levels, allow bottom-dwelling organisms to rebound, and assist in additional recovery. Some issues that can impact successful implementation are site stability components, such as resuspension, transport, organically rich sediments prone to gas generation, likely sources of recontamination, and the short- and long-term end goals of remediation (Merritt et al., 2010).

ENR has existed as a remediation technique for a long enough period of time to have several studies produce long-term data. A number of factors affect the success of ENR in achieving RAOs (Merritt et al 2009; US EPA 2013). The dependent factors include the nature and type of sediment conditions and chemical contaminants, hydrology and sedimentation, local faunal populations, and external forces that may alter conditions, such as ship scour. In general, ENR has shown greater success when applied in areas with relatively low level contamination.

There are concerns that a decline in fish tissue concentrations cannot be directly linked or timed to a decline in sediment levels with ENR (Merritt et al., 2010); however, bench-scale testing analyzed by the EPA show reductions in contamination availability in the waters, as well as reduction in PCB concentrations in benthic organisms. The Grasse River, Hunters Point, and the Anacostia River showed results ranging from 63-99% contamination reduction within three years of ENR implementation. The Grasse River site used a thin layer of activated carbon mixed, or layered, over the sediments and showed a 72-94% reduction in PCB levels after one year of implementation, and a 95-100% reduction at the end of three years (US EPA, 2013). The capping layer ranged from 20-60 cm (7.9-23.6 in.), with 30 cm (11.8 in.) as the overall goal (Merritt et al, 2010). A 2004 comparison study of ENR and MNR in the Lower Duwamish Waterway in Seattle, WA showed that the ENR area, which had a 9-12 in. layer of clean sand placed over the studied area, achieved immediate reduction to below pre-dredge PCB levels, whereas the MNR area took an additional year to reach pre-dredge levels. The ENR area remained below background PCB concentrations during the time studied; the MNR are is predicted to take at least 10 years to reach this same background level, with an additional 20 years predicted to meet cleanup goals. This study also suggested the fish tissue concentrations are expected to drop faster and sooner through ENR, although those data are predictive and not yet confirmed (Stern et al., 2009).

The use of amended materials in conjunction with construction materials shows promise in preventing vertical migration of contaminants and protecting bottom-dwelling organisms as they become re-established by reducing the bioavailability of chemical contaminants (Merritt et al., 2010). Amendments such as granular activated carbon act as a "bio-lock" to prevent the uptake of pollutants that they bind to. EPA notes that amendments, especially activated carbon, are particularly promising for contaminants such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dioxins/furans, and chlorinated pesticides. Several laboratory studies evaluated by EPA show that thin, amended caps such as those used in ENR, could mitigate migration of PCBs from sediment to the caps and surrounding waters for extended periods of time. Like all other remedies, the successful application of amended materials is dependent on water movement and depth, potential for gas migration, and sources of recontamination (US EPA, 2013).

DRCC/TAG recommends using ENR in the areas of low-level contamination where MNR is currently proposed, in order to "kick-start" the natural recovery process and increase the likelihood that the remedy will be effective and protect people's health in a reasonable time frame at relatively low cost. However, these areas must be carefully monitored to ensure success.

B. Ensure Permanence

EPA weighs the permanence of the remedy in its selection of a final cleanup plan, and considers removal to be the most and only fully permanent remedy. The Duwamish community and stakeholders highly value permanence (will it last?), as well as certainty (will it work?). One of the most frequent stakeholder comments, across all sectors, is that this cleanup should be "done once, and done right."

1. Remove areas currently proposed for ENR and Capping

In areas with more highly contaminated sediments and correspondingly higher risks, ENR may not provide sufficient protection of the environment and human health. Physical processes and bioturbation mix buried contaminated sediments into the applied (enhanced) surface layer in dynamic environments like the lower Duwamish River, exposing them to the surface where they again become bioavailable and can re-enter the food chain. The higher the chemical concentration, the greater the risks to the environment and people's health from ongoing and future exposure.

EPA has proposed ENR for 12% of the Duwamish site, in areas that are generally more highly contaminated and less certain to "naturally recover" than in the areas proposed for MNR. Removal of this material, however, is the most certain and permanent of the available remedies and is a more suitable approach. Once contaminated sediment is removed from the river, there is no further risk or liability associated with the mass of contamination removed.

Given the higher risks and the relatively small area, DRCC/TAG recommends removing these moderately contaminated sediments rather than relying on ENR and its attendant restrictions and liabilities.

An additional 6% of the river's contaminated sediment area is proposed to be treated by containment – covering and isolating contaminants under an engineered "cap." The sediments proposed for containment (capping) are highly contaminated sediments, which if exposed would pose correspondingly high risks to the environment and people's health. EPA chose to recommend capping of highly contaminated sediments in the river wherever it was determined to be technically feasible to do so, rather than require their removal. However, removal is the only remedy EPA considers to be permanent.

In the Duwamish, highly toxic waste buried in a cap could be disturbed by a number of reasonably likely occurences, most notably an earthquake. The Duwamish River sits directly over the Seattle Fault, a seismically active fault line which has experienced earthquakes in the past and likely will again (Seattle Office of Emergency Management, 2013). The Duwamish area is principally comprised of fill, which is highly subject to liquefaction during an earthquake, in which surface soils and sediments that appear solid are shaken and pressurized to such a degree that they "liquefy" (King County Flood Control District, 2010). This has been observed in the Duwamish area in 1965 and 2001 (Pacific Northwest Seismic Network, 2012). While there are other disturbances that could affect the integrity of a cap containing toxic waste in the Duwamish, the impacts of many of them, such as flood and ship scour, are limited by engineering protective armoring into the cap design. In the case of earthquakes, this same engineering subjects the cap to a higher likelihood of failure and breach, because when the surrounding sediment liquefies, the heavy armoring material sinks, breaching the cap and exposing or releasing the contaminated sediment (Schweizer, 2012).

Given the highly contaminated sediment, associated environmental and health risk, and the small area affected, DRCC/TAG recommends that highly contaminated sediments be removed rather than capped.

2. Use Environmental Dredging

Concerns have been raised about the safety and health effects of dredging to remove contaminated sediments. However, much of the data and experiences these concerns are based on are outdated. Dredging methods and equipment have substantially improved and continue to improve, as seen on the Hudson River, Newark Bay, Delaware River, and the Duwamish. Recent monitoring data for dredging on the Hudson River, Newark Bay, and Slip 4 and Boeing Plant 2 on the Duwamish demonstrate that dredging can be done reasonably cleanly and without significant adverse impacts. In addition, the communities most likely to be affected have weighed the potential impacts and benefits and overwhelmingly support removal of the river's most highly contaminated sediments, even at the risk of some short-term construction-related impacts. Certainty, permanence and long-term health protection are prioritized by the Duwamish River's affected communities. Where necessary, they recommend mitigation measures over avoidance to address any undesirable short-term effects of contaminated sediment removal.

a. Construction effects on traffic and air emissions

Concerns about traffic impacts and air emissions resulting from removal of contaminated sediments have been raised by the Lower Duwamish Waterway Group (LDWG). In consultation with the affected community, researchers at the UW School of Public Health included an evaluation of these potential impacts in the Health Impact Assessment (HIA) of the Proposed Plan (Daniell et al, 2013), the results of which are discussed below. The Feasibility Study (LDWG 2012) also examines potential air emissions, and potential traffic impacts have been raised in public testimony by LDWG members at EPA's public meetings on the Proposed Plan and in associated public outreach materials (LDWG, 2013).

These concerns have been shared with the affected communities (South Park, Georgetown, and other Duwamish Valley neighborhoods) by LDWG and others, and residents have clearly and emphatically voiced their opinion that they value and prioritize the permanent removal of contaminated sediments from the river over the anticipated construction-related impacts, which they view as relatively minor with low attendant risks (see public comments, public testimony, and discussions on the South Park and Georgetown neighborhood listserves). While this view is supported by the construction impacts assessment in the HIA (Daniell et al, 2013), the community's own preferences are important independent of the HIA findings and should be considered on their own merits. Instead, LDWG representatives have repeatedly purported to speak "for the community," over the community's own objections.

i. Traffic: The Duwamish River Superfund Site cleanup is focused on riverbed sediments, rather than upland soils. While not explicitly prohibited by the EPA proposed Cleanup Plan, the Lower Duwamish Waterway Group (LDWG) has repeatedly stated that it does not plan to rely on trucks as the primary transportation mode for transferring contaminated sediments from the river to disposal sites (LDWG Duwamish Health Impact Assessment Liaison Committee representatives; personal communications/ HIA Liaison Committee meetings). Rather, the parties intend to barge contaminated sediments from dredging operations to a transloading facility at one or two locations on the river, which will either have a direct rail connection and/or may require short distance truck transport of material from the transloading facility to an available intermodal rail spur. This strategy has been used successfully for Early Action Area cleanup projects already conducted by LDWG members (Slip 4, Boeing Plant 2). Trains will transport the sediments to landfills in Roosevelt, Washington and/or Arlington, Oregon.

Under the proposed plan, approximately 790,000 cubic yards of sediments will be dredged and transferred to rail cars for delivery to the landfill. A typical rail car can carry 66 cubic yards of waste, for a total of 11,800 rail cars (Hiltner, 2013). Assuming that trains consist of 50–150 cars, this translates to 80–240 train trips. If these are spread evenly over 7 years, this means an extra 11–34 train trips per year. This increase in train traffic is unlikely to have a meaningful effect on the surrounding neighborhoods. Compared to the 65–85 freight trains per day already moving through the area, the magnitude of these additional freight trips is small (1–3 additional trains per month, on average). Moreover, potential rail increases from other activities dwarf the increases associated with remediation. For example, proposed coal transport trains could add 10 extra train trips per day in the region in 2015, and 18 extra trips per day by 2026 (City of Seattle, 2012), and the Port of Seattle's overall expansion goals could significantly increase rail freight traffic (Port of Seattle, 2013).

ii. Air Emissions: The proposed cleanup plan for the Duwamish River will require an estimated seven years of active construction, including dredging, capping and transport of contaminated materials out of the site, as well as of clean capping material into the site. Dredging and capping operations will require the use of barges and construction machinery (e.g., dredgers). Contaminated and clean material will be transported by a combination of barge, truck, and rail. The Lower Duwamish Waterway Group (2012) has predicted that these activities will result in additional air and noise pollution. However, the data used for these predicted impacts do not reflect current EPA fuel regulations or "green remediation" policies, which substantially reduce air emissions (EPA 2010, 2012).

Currently, air pollution is a long-standing and severe problem in the Duwamish Valley and has been identified as an issue of concern by local residents (Gould and Cummings, 2013). Any additional air pollution resulting from the cleanup construction activities is likely to be minor in comparison to existing pollution from other sources, which include manufacturing and industrial sources, two rail lines, two airports, three highways, and maritime activities, among others. Regardless of these concerns and a desire to minimize any additional burdens, the impacts predicted by LDWG (2012) are unreliable, because they are based on outdated data. The Feasibility Study (LDWG 2012) assumed that all cleanup activities will rely only on conventional hydrocarbon fuels. New federal rules now require the use of ultra low sulfur fuel (ULSF) in all highway, locomotive (rail), and marine diesel engines, so the conventional hydrocarbon fuels used in the Feasibility Study analysis are no longer legally permissible (EPA 2013). EPA's has also adopted a "green remediation" policy, which typically requires the use of low emission fuels, no-idling, and other measures which significantly reduce the impact of diesel emissions (EPA 2010). Since the Feasibility Study was conducted, a survey of diesel particulate emissions in the region has shown that since 2005, emissions from shipping have declined 16%, rail traffic emissions have declined 25%, and heavy truck emissions have declined 50% (Seattle Times, 2012). The Port of Seattle, as part of the Northwest Ports Clean Air Strategy, plans to reduce particulate emissions per ton of cargo by 75% of 2005 levels from by 2015, and by 80% by 2020 (Port of Seattle, June 2013). Given the baseline conditions in the area, EPA's new fuel regulations, the agency's use of "green remediation" policies, and the Port of Seattle's own Clean Air Strategy, the air emissions impacts of cleanup construction are expected to be minimal.

b. Construction-related contamination of water, sediment, and fish tissue

Removing contaminated sediments improves the permanence and effectiveness of the remedy by removing more source material from the river, reducing the mass of contamination available to contaminate fish and marine animals. However, removal can also introduce the risk of spreading contaminants to surrounding water, nearby sediments, and fish during dredging.

In recent years, environmental dredging technology, skilled operators, and diligent use of monitoring and best management practices have substantially improved dredging performance at sites around the country. Some of the most recent and relevant projects have been on the Duwamish River itself, at Early Action Areas within the Superfund site. Water quality and sediment data are available from both Slip 4 and Boeing Plant 2, where dredging projects were completed in 2012 and 2013, respectively.

i. Water: The Duwamish River's Slip 4 Early Action Area is located in a side channel off the main waterway. The primary dredging technology used at Slip 4 was an environmental bucket, with a conventional clamshell employed when debris interfered with proper bucket closure.[5] No turbidity or chemical exceedences in the water were recorded during the dredging of Slip 4. Boeing Plant 2 is on the main channel of the Duwamish Waterway, south of Slip 4 and directly across from the South Park residential waterfront. A Cable Arm environmental bucket was used for dredging at Boeing Plant 2, and compliance monitoring recorded just two turbidity exceedences over course of the dredging operation, and no chemical exceedences in the water.

ii. Sediment: The Slip 4 removal project resulted in a small residual footprint just outside of the removal area, which was covered with a thin ENR layer at the completion of project. The Boeing Plant 2 removal resulted in no detectable dredge residuals. Pre- and post-characterization of nearby sediments concentrations were conducted at Boeing Plant 2, with the results indicating only "white noise," or the expected variability in dynamic river environment, with no consistent or significant trend up or down (Arragoni, 2013).

iii. Fish Tissue: No fish tissue data have been collected for the Slip 4 or Boeing Plant 2 sediment removal projects. However, efforts to remediate PCB contaminated sites elsewhere around the country have provided and are providing data on the response of fish tissue PCB levels as a function of removal efforts. As noted by the National Research Council (NRC 2007), when removal is conducted with care to minimizing short-term risks, removal is successful in reducing risks from PCB-contaminated sediments.

The Hudson River PCB Superfund Site has used environmental dredging to remove PCB contaminated sediments since 2009. The initial agreement between General Electric Corp (GE) and EPA called for a two-phase dredging effort. The first phase occurred in 2009, followed by monitoring and evaluation of

[5] Ultrasound or sonar scans are used to detect and pre-emptively remove debris at some sites, but have not been used to detect and minimize interference from debris at any of the Duwamish sites to date.

the effectiveness by EPA, GE and New York State. The results of the evaluation and all of the monitoring data were also submitted to an external peer review panel.

The review panel agreed that the dredging program in Phase I was succeeding in the goals set for that year, and making progress toward the goals for the larger remediation effort. While the review panel recommended ways to improve the project, the overall recommendation was a continuation of the dredging in Phase II.

The monitoring program reported an increase in some fish tissue PCB levels in both Phase I and Phase II, but in small increments and of short duration (transient). Following Phase II removal, EPA reports:

> "We anticipate that short-term, dredging related increases of PCBs in fish will rapidly return to baseline levels, and continue to decline thereafter following remediation... *Tissue concentrations of PCBs in fish have been shown to decrease rapidly following spikes related to exposure events and environmental dredging*" (Greenberg 2013).

In addition, EPA points out that dredging is not the only factor in the system influencing PCB concentrations in fish. Natural variation and flooding, storms, and flow conditions all play a role as well.

The Cumberland Bay Sludge Bed on Lake Champlain in New York state provides more long term results for declining fish tissue PCB levels following dredging remediation of a PCB contaminated sediment site (Greenberg 2013; Montione et al. 2013). Sediment contamination at the site resulted from industrial operations over many decades and left PCB contamination as deep as five meters, with peak concentrations of 13,000 ppm.

Following completion of the removal action in the year 2000, fish tissues were monitored in several species over a range of sites in the lake, both near and farther away from dredging activities and the PCB contamination. Immediately after dredging, fish tissue PCB levels appeared somewhat higher, but the more obvious change was a more than three fold greater range of values in tissues (Greenberg 2013; Montione et al. 2013). Following remediation, average PCB concentrations changed little for the first few years, then declined substantially over the following five years. These results are presented in a summary form by Greenberg (2013) and in some detail by Montione et al. (2013).

The Fox River in Wisconsin is contaminated with PCBs from decades of discharges from a number of pulp and paper mill effluents. The most upriver segment of the Operable Unit 1 completed remediation in 2009 and the fish tissue monitoring effort reported data for 2010 fish tissue (Wisconsin DNR, March 29, 2011). The post-remediation report concluded:

> "The OU1 remedy was implemented from 2004 through 2009 and resulted in a reduction of PCB concentrations in 2010 for the three media of interest: fish, sediment, and water. Natural recovery was occurring in these media pre-remedy, i.e., the PCB concentrations in fish, sediment, and water were declining; *however, the remedy has markedly accelerated the rate of decline for PCB concentrations in all three media.* "

PCB concentrations in walleye fillets, which were selected as the primary indicator species for the long-term monitoring program, decreased an average of 73% as a result of the sediment removal.

3. Revise operational assumptions to shorten construction time

The construction period for EPA's preferred alternative is seven years, and goals (or steady-state) conditions are predicted to be reached in 17 years. DRCC/TAG estimates that its recommendations will result in a longer construction period (13 years), but will result in reaching cleanup goals (or steady-state) more quickly than EPA's proposed plan (13 years). However, the anticipated construction period applies all of the assumptions contained in the Feasibility Study, which includes an assumption that only two dredges will operate on the river at a time. **DRCC/TAG has urged and continues to support cleanup approaches that shorten the construction period without reducing the volume of contaminated sediment removed or the overall quality of the cleanup**. We note, for example, that on the Hudson River contaminated sediments are dredged 24 hours a day using multiple dredging barges during the dredging season. We urge a similar approach on the Duwamish in areas where it will not unduly impact residential riverfront communities, as well as deploying additional barges to speed removal. This could reduce estimated construction times by half or more. We also urge that sequencing be optimized to maximize efficiencies and minimize the potential for recontamination during remedial activities.

C. Protect Health and the Environment

The proposed cleanup plan fails to adequately protect human health. Specifically, the proposed remedy does not achieve Remedial Action Objective #1: Protection of Human Health for Seafood Consumers. Cancer risks to humans that consume resident LDW seafood are predicted to be in the 10^{-4} range, based on Adult Tribal and Asian and Pacific Islander reasonable maximum exposure (RME) scenarios, while lifetime excess cancer risks for the Child Tribal RME scenario are predicted to be in the 10^{-5} range. While EPA policy deems these cancer risks to be “acceptable”, Washington State Model Toxics Control Act (Chapter 70.105D RCW) mandates that remedial level cancer risks not exceed 10^{-6}.

Non-cancer risks predicted after the remedy is implemented are even more troubling: For PCBs alone, which are well established to have hormonal, developmental, immunological, and neurological toxic endpoints, post-remedy non-cancer risks for adults and children will range from 4-8, well above the “acceptable” hazard index of 1, where an adverse effect is likely to occur. We are especially concerned about Tribal and immigrant mothers who eat large amounts of contaminated fish during pregnancy. According to the ATSDR, babies born to women who eat PCB contaminated fish have lower weight babies and have abnormal responses in tests of infant behavior including problems with motor skills and short-term memory.

In short, the proposed remedy fails to adequately protect human health. The remedy must be strengthened to achieve human health protections for seafood consumers to the maximum extent feasible. EPA can improve the remedy and protection of human health by increasing the extent of active remediation through greater use of removal and ENR and including requirements for pollution source controls upriver of the site.

Strengthening the certainty and permanence of the remedy will increase the effectiveness of the cleanup, but only to the extent that the sources of pollutants to the site are controlled. While pollution source control by itself would not be sufficient to maximize the effectiveness of cleanup – because of the uncertainties associated with sedimentation modeling, the long time period required for natural recovery, and the potential for re-exposure – removal alone is not sufficient to maximize the effectiveness of the cleanup, because of the potential for recontamination from ongoing sources. All three "legs of the stool" must be addressed to ensure a cleanup that will work, will last, and will protect the environment and people's health to the greatest extent possible.

1. Integrate control of ongoing pollution sources into the cleanup plan

Ensuring that the areas of the river that have been cleaned up do not become contaminated again is essential to the success of any remedy selected and will protect our financial investment. To achieve this goal, both lateral (along the lower river) and upriver pollution source control is needed to prevemt all sources that pose risks to human health.

Effective pollution source control, including from upriver, is essential to improving the health outcomes currently predicted by EPA. EPA states that it does not anticipate its cleanup plan will protect human health because of current loading of PCBs from upriver. Clearly, upriver sources need to be addressed in order to protect human health. Potentially responsible parties, including Seattle, King County, and Port of Seattle taxpayers, have a vested interest in protecting their investment in cleanup by ensuring that the river is not recontaminated by uncontrolled upriver sources.

The source control efforts that Ecology describes in its draft Source Control Strategy are significant. Source control work already underway by Ecology, King County, Seattle and others is yielding results in the form of reduced pollution and measurably lower levels of PCBs, arsenic, dioxins/furans and cPAHs. EPA needs to ensure that source control work extends upriver in order to further reduce pollutant loading to levels that adequately protect people's health.

The final Record of Decision must support these efforts and share responsibility for source control with the Department of Ecology, by integrating their source control action plans into the cleanup plan, and adding upriver pollution source controls. Shared responsibility is essential to ensure optimal coordination, adequate resources, and ultimate success. Source control is sufficiently important that it must also be legally binding, in order to give all parties on the river some sense of certainty.

Finally, the relationship between source control and natural recovery must be acknowledged. Effective upriver source control for contaminants such as PCBs will undoubtedly involve reducing the load of contaminated sediments from upland and stormwater sources that are currently entering the river. This reduction in sediment loading could significantly impact the rate of sedimentation downriver, including in the areas where EPA plans to rely on natural recovery. Source control to reduce PCBs and improve health outcomes and predicted natural recovery models are antithetical, reinforcing the need to minimize reliance on monitored natural recovery.

2. Comply with all legally-required environmental and health standards

Superfund cleanup decisions must comply with all applicable federal laws as well as the laws, regulations and policies of the state in which the action is being taken, called ARARs (applicable or relevant and appropriate requirements). Where there are different standards, the more stringent of the state or federal standard generally applies, ensuring the most protective remedy.

In Washington State, the Model Toxics Control Act (MTCA) is an ARAR for Superfund cleanup actions. MTCA requires final cleanup actions to be health protective, or meet "natural background" conditions. Natural background is defined as "the concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities" (Ecology 2009). Cleanup actions that do not achieve natural background conditions are considered interim actions under state law, and such sites will remain on the WA State Contaminated Sites List.

Natural background levels for the health-risk driver chemicals at the Duwamish Superfund site have been established based on pollution levels in sediments in areas of Puget Sound not influenced by localized human activities. Natural background in Puget Sound is not pristine, and carries some health risks to people who consume unlimited amounts of local seafood, either because some chemicals are naturally occurring (arsenic) or because of widespread contamination deposited from a variety of non-localized sources, such as long-distance air deposition (PCBs).

The Lower Duwamish Waterway Group has argued that it is unreasonable to set cleanup goals at natural background levels because they view these goals as unattainable for an urban/industrial sediment site, primarily because of loading from ongoing sources of pollution. However, ARARs may be waived if they are determined by EPA to be "technically impracticable," providing an avenue for a determination that the goals are unattainable and alleviating the responsible parties from the obligation to achieve them. However, LDWG's Feasibility Study asserts that existing data on past pollution loading from the upper Duwamish and Green Rivers should be considered the attainable goal, prior to the application of any targeted pollution source control efforts in those areas. This is not consistent with state or federal law. A "Technical Impracticability" (TI) waiver may only be granted when no additional remedial measures are available to meet applicable standards. Pollution source control is required by Superfund (CERCLA), and any determination that source control measures have been exhausted must follow the development and implementation of a source control program. TI waivers should not be considered pre-emptively, and may not replace legally-mandated establishment of the MTCA-based cleanup goals. None of the LDWG members (Boeing, Seattle, King County, Port of Seattle) are exempt from state law.

3. Remove institutional control language from Remedial Action Objective (RAO) 1

The Remedial Action Objectives (RAOs) for the site were established in the Remedial Investigation (EPA 2010). However, RAO 1, attainment of human health for people who consume Duwamish River seafood, has been modified in the Proposed Plan to include "institutional controls" as an acceptable part of the remedy for attainment of the RAO. Institutional controls are not a remedy – they are controls on human behavior to address risks from incomplete or unsuccessful application of a remedy, and are intended to be temporary. Further, they are not health protective, so cannot be part of an RAO to protect human health. Institutional controls may cause nutritional deficiencies or cultural disruptions that have health impacts that may pose equivalent or greater risks than that presented by the chemical exposures the controls are meant to prevent. EPA should restore the original RAO language and not rely on institutional controls as part of a long-term or permanent remedy to protect health.

4. Address cumulative health impacts

The EPA Proposed Plan states "[w]hether ARARs are attained or not, implementation of the Preferred Alternative, along with the [Early Action Areas] and source control, will substantially improve the quality of [Lower Duwamish Waterway (LDW)] sediments and surface water, reduce [chemical] concentrations in waterway organisms, and result in an estimated 90% or greater reduction in seafood consumption risk." While this is a commendable effort, the residual risks for the Tribes and non-tribal subsistence populations may be much higher than predicted by the risk assessment.

Cumulative health impacts were not evaluated in developing cleanup levels for the site. Under Executive Order 12898, EPA has the responsibility to address cumulative exposures to Environmental Justice populations. Specifically, under 3-3 *(b):*

> *Environmental human health analyses, whenever practicable and appropriate, shall identify multiple and cumulative exposures.*

The LDW risk assessment and therefore the expression of risk reduction failed to regard the most current science on how low-income, minority populations are more vulnerable to toxics as a result of social, economic, and other non-chemical stressors. The science on this vulnerability is no longer in dispute and has been explicitly discussed in three major EPA documents (EPA, 2003; CA EPA, 2010; Science of Disproportionate Impacts Analysis Symposium, 2010). Cumulative exposures to multiple contaminants (air, water, soil, fish consumption, etc), combined with non-chemical stressors (poverty, unemployment, unsafe housing, underserved transportation, higher obesity rates, higher dropout rates, etc) result in more negative health outcomes than a single exposure (i.e., fish consumption). In other words, a health effect that could occur from consumption of PCB contaminated fish may be much worse if the same child or adult is also exposed to cumulative chemical and non-chemical stressors.

Risk assessment outdated

The Proposed Plan's conventional risk assessment approach for both justifying and explaining the decisions in the Preferred Alternative is outdated. This is despite the fact that the EPA has acknowledged that its current risk assessment approach is inadequate (US EPA, 1997) and that under Executive Order 12898, EPA has the responsibility to address cumulative exposures. There are five common assumptions made in the typical risk assessment that explain why the conventional risk assessment is inadequate: 1. *Risk independence* – the assumption that pollutants act independently and additively; 2. *Risk averaging* – the overall population risk that is estimated does not address that some populations are differentially exposed; 3. *Risk nontransferability* – the risk is not transgenerational and/or hereditable; 4. *Risk synchrony* – risk relies on a snapshot of exposure time without paying attention to periods of vulnerability; and 5. *Risk Accumulation* – the risk estimate does not account for skewed distributions of other underlying risk factors in a population (Schwartz et al, 2011).

Risk assessments now address cumulative effects, especially for vulnerable populations

More simply said, the conventional risk assessment used in the Remedial Investigation does not account for cumulative risks and the fact that some populations are more vulnerable to contamination than others. In May 2003, EPA published its Framework for Cumulative Risk Assessment. Cumulative risk is defined as "the combined threats from exposures via all relevant routes to multiple environmental stressors, including biological, chemical, physical, and psychosocial entities" (US EPA, 2003). Cumulative risk assessments incorporate both chemical and nonchemical stressors that can influence population vulnerability.

Vulnerability is defined as "the propensity of social or ecological systems to suffer harm from external stresses and perturbations." In cumulative risk assessment, vulnerability acknowledges that disadvantaged, underserved, and overburdened communities come to the table with pre-existing deficits of both a physical and social nature that make the effects of environmental pollution worse than for the general population (NEJAC 2004). The 2003 framework for cumulative risk assessment states that a subpopulation is vulnerable if it is more likely to be adversely affected by a stressor than the general population in four basic ways: 1. *Susceptibility/sensitivity*: some populations (pregnant, young, old, impaired immune system, asthma) have an increased likelihood of sustaining an adverse effect of equal chemical concentrations in equal duration compared to the general population; 2. *Differential exposure*: prior historical exposure, background exposure, or body burden may mean that an incremental exposure may produce a more adverse effect; 3. *Differential preparedness:* Some populations may be less able to handle environmental insults due to poverty, nutrition, psychosocial stress, access to health care, etc; and 4. *Differential ability to recover*: Some populations coping mechanisms and resources to withstand and recover from environmental stressors are reduced due to economic, racial, linguistic isolation (EPA 2003).

<u>Tribal exposure and cumulative risks</u>

We are concerned that residual non-cancer risks for PCBs, known to exhibit hormonal, developmental, immunological, and neurological effects are predicted to be a Hazard Index (HI) of 8 for Tribal children (LDWG, 2012), well above the acceptable Hazard Index of 1, but this information was left out of the Proposed Plan. Further, a cumulative risk assessment would show that risks are much higher than predicted by the risk models used to justify the preferred alternative. The HIA and associated Tribal Technical Report describe Tribal disparities relative to the general population (Table 1) and how cumulative exposures including historical trauma, change of cultural traditions, loss of food security, and a different way of viewing health has adversely affected health (Daniell et al, 2013).

<u>Duwamish Valley cumulative risks</u>

Cumulative risk assessment methods have been developed and used all over the US including California EPA's *Cumulative Impacts: Building a Scientific Foundation* (December, 2010). A Cumulative Health Impacts Analysis (CHIA) was conducted in Seattle in order to determine whether residents of the Duwamish Valley bear disproportionately high environmental health burdens and risks and fewer positive environmental benefits than the rest of Seattle (Gould & Cummings, 2013). The results of this cumulative analysis demonstrate that the 98108 ZIP code is an area that is more vulnerable to the effects of pollution than other areas of Seattle and King County.

Duwamish Valley residents, including the South Park and Georgetown communities live in close proximity to the Duwamish River Superfund Site. Comparing the Duwamish Valley to King County residents, Duwamish Valley residents are also more likely to live in poverty, be foreign born, not attend high school, have no health insurance, no leisure time activity, have low birth weight babies, and be sick. Georgetown and South Park inhabitants have an eight year shorter life expectancy and a heart disease death rate 1.5 times higher than both Seattle and King County (Gould & Cummings, 2013).

<u>Duwamish Valley residents – beach play: traditional risk assessment vs. cumulative risks</u>

Remedial Action Objectives (RAOs) specify goals for protecting human health and the environment. RAO 2 calls for "reducing to protective levels the human health risks from direct contact (skin contact and incidental ingestion) to contaminated sediments during netfishing, clamming, and beach play." For beach play areas, preliminary remediation goals (acceptable contaminant levels) must be met at all beaches.   According to the Proposed Plan, direct contact with sediments in netfishing, clamming, and beach play areas are predicted to result in risks within the CERCLA risk range and meet the minimum Model Toxics Control Act requirements for risk reduction: 1) a total excess cancer risk of less than 1 in 100,000 cumulatively for all COCs; 2) excess cancer risks for individual COCs less than or equal to 1 in 1,000,000 (except for arsenic), and 3) non-cancer HI less than or equal to 1. The natural recovery model predicts arsenic will reach an excess cancer risk range below 1 in 100,000 but above 1 in 1,000,000.

While it is understood that the Proposed Plan intends to meet preliminary remediation goals for beach play for Duwamish Valley residents, the pre-existing vulnerabilities as described above suggest that resident risks from exposure to beach sediments are likely to be higher than the estimates calculated from the conventional risk assessment. Furthermore, there is discussion in the scientific community regarding increasing the current arsenic toxic value, which would in turn decrease current arsenic cleanup levels. However, it is not considered feasible to provide remedies that are more protective than Puget Sound background, which would most likely be the cleanup standard in this case.

In order to address these risks, washing stations should be provided along with information to help residents make informed decisions to protect their health from exposure to toxic chemicals until health protective goals are met on Duwamish River beaches and shorelines.

The final remedy and decision documents need to acknowledge and account for the latest science on cumulative exposures and the potential for more negative health effects than predicted by the conventional risk assessment for Tribes and subsistence fishers in order to adequately protect their health until cleanup objectives are achieved.

5. Implement recommendations of Duwamish Health Impact Assessment

Researchers at the UW School of Public Health have conducted a Health Impact Assessment (HIA) of EPA's Proposed Cleanup Plan, in partnership with Just Health Action and DRCC/TAG (Daniell et al, 2013). While the scope of the HIA was limited to the preferred alternative proposed by EPA, many of the resulting recommendations will be transferable to the cleanup plan EPA ultimately selects. In fact, elements of the recommendations described as necessary to protect health may support implementing changes to the plan to minimize the impacts and associated mitigations identified by the HIA.

DRCC/TAG supports the recommendations for maximizing health benefits, minimizing health impacts, and ensuring health equity that are identified in the Duwamish Cleanup Plan Health Impact Assessment, submitted separately to EPA as formal comments on the proposed plan by Dr. Bill Daniell, UW School of Public Health.

See Institutional Controls and Mitigation sections below for additional comments and recommendations to ensure that people's health is protected prior to, during and after cleanup of the Duwamish River.

D. Ensure that Institutional Controls are Fair, Healthy, and Temporary.

The proposed plan repeatedly states that “the preferred alternative is recommended because it is protective of human health and the environment….and minimizes reliance on institutional controls.” This statement is disingenuous and inaccurate, as both the Proposed Plan and the Environmental Justice Analysis acknowledge that institutional controls are ineffective, i.e., do not adequately protect the health of the targeted population.

There are at least three populations disproportionately exposed to contamination from the site:

1. Residents of South Park and Georgetown, predominantly low-income and minority neighborhoods adjacent to the LDW site and surrounded by Seattle’s Industrial District;
2. Native American tribes that have cultural resources, treaty rights, and/or actively fish in the LDW;

3. Immigrant and low-income subsistence fishers.

Since residual cancer and non-cancer risks are expected to remain after remediation for several decades, these three populations will remain disproportionately exposed to contamination, and additional measures must be taken to protect their health. In addition to health risks from the river, these communities are exposed to cumulative stressors including poverty, air pollution, lack of health insurance, proximity to contaminated sites, limited environmental amenities and services, and food insecurity, all of which make them more susceptible to disease (Gould and Cummings, 2013; Daniell et al, 2013). EPA's decisions about institutional controls need to appropriately account for these cumulative impacts.

DRCC/TAG agrees that Institutional Controls (ICs) will be critically important in the short term, before and during cleanup activities. However, it is equally critical that the remedy minimize the need for ICs over the long term. We understand that there are natural (global) levels of some risk-driver chemicals in Puget Sound and Duwamish River sediments that do not currently allow for unrestricted risk-free fishing for some seafood species. However, any contaminants remaining in Duwamish River sediments above this background level will disproportionately impact Duwamish River fishing communities, comprised primarily of tribal, low-income and immigrant subsistence fishing families. Therefore, long term ICs should be limited to those needed to protect fishermen's health from natural background levels of contaminants. All contaminants above this level should be cleaned up as part of the Duwamish site remedy.

In the immediate and short term, ICs must not be limited to fishing advisories and education. While both advisories and education will need to be part of the IC program, must be designed in consultation with the affected community, and be both multilingual and culturally-competent, much more is needed for an effective, equitable, and enforceable IC program for the site. To date, no details of the ICs to be included as part of the remedy have been provided by EPA – it is at this stage simply a plan to develop a plan. However, EPA's Environmental Justice Analysis and Daniell et al's (2013) Health Impact Assessment of the Proposed Plan provide ideas for temporary fishing and seafood consumption substitutes and alternatives, as opposed to simply advisories and education, that should be considered as a starting point for consultations and IC development with the affected fishing communities. **It is of paramount importance that ICs that do not themselves cause heath risks, such as food insecurity, nutritional**

deficiencies, erosion of health cultural and family practices, etc. be developed for the site. ICs that simply substitute one health risk for another are not health protective.

EPA Institutional Control Guidance

Both the EPA Environmental Justice (EJ) Analysis and the Health Impact Assessment (HIA) conducted by Daniell et al (2013) reports that EPA has not followed its IC guidance or the Government Accountability Office's recommendations regarding ICs (GAO, 2005). For example, EPA is not following recommended approaches in EPA's *Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites,* which provides guidance for site managers, site attorneys, and other interested parties to plan, implement, maintain, and enforce ICs at contaminated sites. Specifically, EPA's IC guidance cites three important principles: (1) understand the strengths, weaknesses, and costs for planning, implementing, maintaining, and enforcing ICs, (2) evaluate ICs as rigorously as any other remedial alternative, and (3) develop procedures to coordinate with implementing entities early and often throughout the cleanup process (US EPA/OSWER, 2012).

EPA's (2000) site manager guidance on ICs states:

> *…how important it is for site managers to evaluate ICs as thoroughly as the other remedy components in the Feasibility Study (FS)… when looking for the best ICs to address site-specific circumstances. Adding ICs on as an afterthought without carefully thinking about their objectives, how the ICs fit into the overall remedy, and whether the ICs can be realistically implemented in a reliable and enforceable manner, could jeopardize the effectiveness of the entire remedy.*

Some of the key elements of the EPA guidance are:

(1) if the cleanup does not result in unrestricted use and unlimited exposure at a site, an IC is likely appropriate;
(2) understand the life-cycles, strengths, weaknesses and costs for implementation, monitoring and enforcement before choosing an IC;
(3) coordinate early with all state and local governments that have responsibilities for the ICs;
(4) evaluate ICs as rigorously as you would any other remedial alternative;
(5) layer and/or place ICs in a series to increase their reliability;
(6) when writing decision documents, make sure that the objective(s) of the ICs are clear;

(7) get assurances (in writing) from entities that will be responsible for implementing, monitoring and enforcing ICs; and

(8) remember that since all ICs have weaknesses, the role of the decision maker is to select the best ICs to protect human health and the environment.

In addition, other federal Environmental Justice guidance is valuable for developing IC approaches with the capacity to address risks in a context as complex as the LDW site, such as NEPA guidance which calls for:

a. Reducing pollutant loadings through changes in processes or technologies
b. Reducing or eliminating other sources of pollutants or impacts to reduce cumulative effects
c. Planning for and addressing indirect impacts prior to project initiation
d. Providing assistance to affected community to ensure that it receives at least is fair share of benefits from action (jobs, community infrastructure improvements)
e. Establishment of community oversight committee
f. Conducting medical monitoring… etc.

Finally, EPA guidance states that ICs must be enforceable. The IC component of the remedy must clearly state who is responsible for implementation and how the program will be enforced. It is not sufficient to assign responsibility for ICs to the Department of Health, for example, which has no regulatory or enforcement authority. It should also be understood that enforcement efforts need to hold the responsible parties accountable, rather than focus on the consumers of Duwamish River seafood.

<u>Fishing Advisories are inequitable and harm health</u>

We are deeply concerned that Proposed Plan predicts that the river's fishing communities EJ will have to live with the residual contamination burden for the next 40+ years. At the same time, they will be asked to change their behavior (eg, stop/limit eating seafood or learn new ways to cook seafood, etc.) as a result of pollution that they are not responsible for creating. To place this burden on the impacted communities suggests a troubling lack of understanding, concern, and cultural competence regarding the subsistence and cultural significance of seafood consumption to Duwamish River fishing communities. Relying on behavior change by the affected community should be understood as an unacceptable long-term solution to the threats posed by contaminated fish, as it has potentially serious implications for cultural, community and family stability and health. The majority of Duwamish River seafood consumers harvest seafood because it is deeply rooted in cultural traditions that are important both to subsistence and to community and family cohesion.

Evidence is available in the scientific literature on how this type of "behavior change" increases health inequities in impacted populations, including increases in obesity, diabetes, depression, and more (NEJAC 2002). Some people fish either because of a lack of financial resources or a desire to continue cultural traditions to fish from the river. Many of the people commonly observed fishing from the river are children and/or adults harvesting fish for consumption by their families, including children and women of childbearing age. O'Neill (2009) states that risk avoidance strategies fail to actually protect human health, are unjust, and more expensive in the long run than just cleaning up the contamination in the first place. Daniell et al (2013) have detailed the numerous ways in which disrupting the fishing behavior and practices of the Duwamish River's fishing communities can lead to a host of adverse health impacts. These impacts and their related costs are not given due consideration in Proposed Plan.

Social marketing as an Institutional Control

We do not support long-term reliance on ICs for the reasons already stated. However, we do acknowledge that some ICs are necessary temporarily, during cleanup, and for some period of time until the risk burden is reduced. If ICs are going to be implemented, each affected community must be served in a culturally competent and fair manner.

We understand that EPA is considering employing social marketing or "community based participatory marketing" as an IC tool for the LDW. The term "social marketing" has been used for the past several years in reference to an approach to solving social and health related issues, specifically to change people's behavior. However, social marketing campaigns are credited with only a 10% rate of behavior change (Noble and Camit, 2005). Noble and Camit (2005) posit that the reason why these campaigns fail to change behavior is because "we" of the mainstream society are trying to change the least accessible and hardest to reach sections of our society. "We" directly translate mainstream messages without thinking about differences in cultures and how they might react to them. In contrast, IC messaging needs to:

- Target the appropriate culture
- Develop a message that fits the culture

- Establish source credibility – some cultures do not trust the government, others do
- Contain consistent messaging with the mainstream campaign

Community based social marketing means entering communities to uncover the barriers for behavior change. It is important to emphasize that there are multiple cultural communities that are harvesting seafood from the Superfund Site. We foresee that there would have to be multiple cultural campaigns targeted at a minimum of 10 different geographic areas of Seattle and 15 distinct cultures. Based on our limited knowledge of which populations are eating fish from the Duwamish River, we do know that the following populations are consuming contaminated fish at levels that exceed acceptable cancer and non-cancer risks to varying degrees:

1. Residents of South Park and Georgetown (Latino, Asian/Pacific Islander, low-income populations)
2. Muckleshoot and Suquamish Tribes
3. Immigrant subsistence fishers (Laotian, Cambodian, Filipino, Chinese, Vietnamese, Ethiopian, Somali, Russian, Eastern European)

To add to the complexity of directed community based social marketing campaigns for subsistence fishers on the Duwamish, we currently don't have any information documenting where immigrant subsistence fishers live, but do know that many do not live in the immediate riverfront neighborhoods.

We highlight this complexity to emphasize that **substantial** funding must be set aside to adequately develop, implement, and monitor the effectiveness of ICs. ICs must address the needs of multiple communities and must be implemented consistently and continuously until cleanup goals are met.

<u>Types of Institutional Controls and community empowerment</u>

A good IC program is one that is designed by and run by the affected community. An empowering process means that community members are involved in the development, implementation, and evaluation of the interventions; work with the IC administrators as coequal partners; and create opportunities for community members to develop skills around the interventions (Zimmerman, 1995). Each of the affected communities should have a choice in which ICs will best serve their culture and needs. Each community will be different and will require a different type of outreach effort. Some examples of ICs that different cultures/communities may choose are:

- Education about fish contamination and health risks designed to reach multiple communities who fish or buy fish in culturally-appropriate and easily accessible locations (schools, community centers, churches, etc) and formats;
- Services that effectively and equitably provide access to alternative/replacement seafood resources and culturally-based fishing activities, potentially including transportation to healthy fishing locations, delivery of healthy seafood, vouchers for fish/seafood at local markets, etc.
- Training community health clinics of the dangers of eating contaminated seafood, especially for children and women during pregnancy and breastfeeding;
- Culturally appropriate signage, advisories, and messaging.

To improve community capacity, the members of the community should receive compensation as outreach experts. In addition, yearly evaluations in all communities to reassess and respond to changing needs over time should be conducted by community members and used to adapt the IC program. Again, these efforts require substantially greater funding than EPA and the responsible parties have currently estimated for institutional controls.

Costs of Institutional Controls

EPA's Draft FS and Appendix I (Institutional Control Plan) grossly underestimates the efforts and costs required for an effective and equitable Institutional Control Program. Daniell et al (2013) report that only 3 pages in the 82 page Appendix I (Detailed Cost Estimates) covered ICs. In the 3 page "detailed cost estimate," ICs were calculated to cost approximately $15 million over a 50 year period for seafood consumption advisories, public outreach and education, which is approximately 5% of the total $305 million cleanup. A $15 million price tag (or $300,000/year) is small (and clearly more desirable to potentially responsible parties) relative to the cost of cleaning up more contamination from both the LDW and from upriver sources, and biases the selection of an alternative that will need to rely heavily on ICs.

The cost of institutional controls requires detailed analysis and should be accurately captured, based on similar costs of ICs at comparable sites. The most closely related site is the Palos Verdes Shelf in California, where IC costs have averaged $1.43 million/year (Table 12-1, Palos Verdes Interim Record of Decision, 2009). A 50 year period of ICs at this estimate in the Lower Duwamish Waterway would approximate $72 million. This estimate is most likely conservative for the LDW because there are at least 15 different vulnerable populations/communities that need to participate in an IC program as long as ICs are in effect. If cleanup goals are not met following implementation of the remedy, these costs may persist as a liability in perpetuity.

E. Mitigate Impacts Until Cleanup Goals Are Met and Ensure Equity

The Duwamish Valley Cumulative Health Impacts Analysis (Gould and Cummings, 2013) and Duwamish Cleanup Health Impact Assessment (Daniell et al, 2013) provide a firm foundation for understanding site-related and cumulative health risks beyond those captured by the conventional Human Health Risk Assessment conducted for the site. EPA guidance calls for consideration of cumulative risks, and EPA's Environmental Justice and Institutional Controls guidance provide additional considerations for managing site-related and cumulative risks, as discussed above. The evidence of cumulative risks, environmental injustices, and health inequities among Duwamish Valley residents and river users (Tribes, non-tribal subsistence fishers) point clearly to the need to mitigate health impacts on the community until cleanup goals are met.

1. Establish Pollution Prevention and Mitigation Fund

In order to account for cumulative exposures and health impacts and offset the health disparities resulting, in part, from exposure to the Superfund site, EPA should require the establishment of a mitigation fund, to be funded by the responsible parties and managed by or in consultation with the affected communities until the cleanup goals have been met and the site no longer contributes to cumulative risks to people's health.

Based on historical and ongoing cumulative impacts, a health revitalization fund could be employed to remedy health disparities by addressing impacts contributing to cumulative impacts (such as lack of parks, poor housing, transportation, jobs) until environmental exposures are reduced or eliminated. One model for a health revitalization fund is that established for the Harbor Community Benefit Foundation (http://hcbf.org). The foundation was established through an agreement between the Port of Los Angeles, and community, environmental, health, and labor organizations, and implemented in a Memorandum of Understanding (MOA). The foundation is funded by the Port of Los Angeles to improve community health, access to open space, and economic opportunities until cumulative health impacts on the community from Port operations are reduced.

In the case of the Duwamish, we recommend that funding be secured from responsible parties to form a community "task force" to protect and revitalize the Duwamish Valley by addressing historical and ongoing cumulative health impacts. The revitalization fund would be used to improve the health of the community through actions identified by the community, potentially including but not limited to housing, transportation, recreational opportunities, etc., with the purpose of reducing existing health disparities.

2. Hire Local

Jobs are an important benefit that can accrue to local Superfund communities. Given the contribution of the Duwamish Superfund site to the cumulative impacts and risks described above, EPA should ensure that local residents be given the tools and opportunity to benefit from jobs associated with the cleanup. Employment is one of the strongest favorable determinants of health, and has the potential to mitigate or offset the cumulative health impacts burdening the local community (Daniell et al, 2013). Employment, job training, and skill development generate personal income and increase the likelihood of future employment and income stability. These can contribute to personal and family adaptive capacity, improved healthful practices, better access to and ability to pay for health care, reduced risk for cardiovascular and other major diseases, and extended lifespan.

The Superfund cleanup underway on the Hudson River provides useful information regarding job creation at Superfund sites. In 2012, that year's cleanup activities on the Hudson River created 350 jobs, 210 of which were filled by local residents. In addition, 285 regional businesses won contracts to provide supplies and services to the dredging operation there, resulting in additional indirect job creation and boosting the local economy (PostStar.com, 2012). King County commissioned a study of the number of jobs expected to be created by the various Duwamish cleanup alternatives evaluated in the Feasibility Study. The alternative closest to the Proposed Plan (5C) was projected to create 270 full-time full-year jobs annually, and an additional 680 full-time part-year jobs annually, during the construction season (ECONorthwest, 2010a).

EPA's Superfund Jobs Training Initiative has recently begun a program to train and help place local residents in cleanup-related jobs related to the Duwamish Early Action Area cleanup projects. This program should be continued throughout life of the Duwamish River Superfund cleanup.

It should also be noted that the economic benefits of cleanup are expected to be broader than individual job creation. Firms in King County and Seattle are expected to receive the majority of cleanup dollars spent, and a companion analysis to the jobs study concluded that the principal economic argument for cleaning up the Lower Duwamish Waterway is to promote long-term economic growth for King County and the City of Seattle, with job creation being a secondary benefit (ECONorthwest, 2010b). The study concluded that cleanup of the Superfund site is important to business investment, and that "efforts to cleanup the Superfund site that businesses perceive as timely and having a high probability of success will likely be rewarded with increased investment in the affected area, resulting in increased economic output and jobs." In contrast, "failure to act efficiently and effectively to cleanup the Superfund site could result in a decline in economic activity with the affected area and throughout the County."

3. Ensure Equity

A *health inequity* is a disparity that is not only unnecessary and avoidable but, in addition, is considered unfair and unjust (Whitehead, 1992). Achieving *health equity* means the elimination of disparities and "valuing everyone equally with focused and ongoing societal efforts to address avoidable *inequalities*, historical and contemporary injustices" (US Department of Health and Human Services, Office of Minority Health, 2010).

In order to address health inequities that are caused or contributed to by the Superfund site, differences in health impacts between exposure to the Duwamish River and the rest of the region need to be remedied. While the entire Puget Sound region suffers from ubiquitous pollution, including in sediments and fish in areas of Puget Sound not impacted by the Duwamish River or any other local urban/industrial pollution sources. While pollutants in these areas include anthropogenic ("man-made) chemicals, such as PCBs, the ubiquitous pollution levels are referred to as "natural background" levels by WA State law (the Model Toxics Control Act) and are used to set required state standards for cleanup. EPA has correctly applied these standard as the goals of the proposed cleanup plan. However, attainment of the goals is considered unlikely, and EPA balances cost against certainty and other factors in its selection of a cleanup action.

The Proposed Plan has been represented as a reasonable balance of cost, health protectiveness, and certainty that the cleanup will be effective. However, this analysis views investment in cleanup through a lens that interprets increasing investments as having diminishing returns. This analysis fails to recognize the inequity of this lens, as the people who will not be protected by the proposed cleanup plan are those who already have the greatest health disparities *and* are most exposed and vulnerable to contamination that will remain in the river's sediments. Rather than a lens that says, for example, ""$300 million gets us 90% removal; another $300 million will only get us %10 cleaner – its not worth it," a health equity lens would see the first $300 million as protecting environmental receptors and recreational river users, and the second $300 million as protecting Tribal members and subsistence fishermen. The investments needed to attain the greater level of protection would be made in upriver pollution source control and removal of more contaminated sediments from the river, which together would result in a more certain, permanent and health protective cleanup.

F. Monitor Before, During and After Cleanup

The Proposed Plan does not describe the monitoring that will be required as part of the cleanup operations and performance measures, but monitoring should begin now. Now is the time to collect data on the levels of contaminants in fish and shellfish as a baseline, as has been done at other sites. During the remediation, conditions should be measured in the vicinity of the dredging and the reports posted online so that modifications to the process can improve the cleanup and results can inform the community of progress.

1. Monitor and adapt process as necessary to optimize cleanup performance

Monitoring environmental and quality of life conditions before, during and following the remedial action will provide valuable information on the operating conditions and progress toward the goals. The following conditions should be measured and reported to the public:

- Water quality- contaminant levels
- water turbidity
- sedimentation in areas proposed for ENR
- air quality
- sound/noise- reported via hot line to EPA or Ecology
- odor- reported via hot line to EPA or Ecology
- river ship traffic/vessel movement

These conditions should be measured on a daily basis and reported as frequently as is reasonably possible. Daily reporting of turbidity, noise/sound, odor and river traffic movement should not be a technical challenge and the data can be posted on a public web site. Contaminant levels in water and air may require lab processing time and therefore not technically feasible for daily reporting. These data can be collected daily and reported on the same web site with a delay to allow time for lab processing.

Monitoring data are important for several reasons. First, the public will remain informed and able to follow the activities on the river and how the remediation is proceeding. Second, monitoring conditions during remediation operations will allow modifications of operational procedures in order to improve the quality and efficiency of the remediation. Finally, the monitoring data will provide a picture of conditions before and following the remediation, usable to assess the success of the remediation.

Monitoring operational conditions and processes during dredging remediation on the upper Hudson River in NY has provided valuable information for the communities, the agencies and the PRP (GE Corp.). The monitoring has allowed confirmation that PCB levels and turbidity have not been elevated above water quality standards. The monitoring also demonstrated the impact of spring storms on river conditions when PCB levels and turbidity were elevated prior to dredging in spring. One conclusion from those data are that high flow (spring in this case) conditions are sufficient to scour the contamination and cause water quality problems in the absence of remediation. Remedial dredging and capping can prevent such events in the future.

2. Measure progress in attaining cleanup goals in sediments, water and fish

Substantial efforts and sampling design need to be included in the Record of Decision to closely track the progress of the clean up. As noted elsewhere in these comments, the removal efforts are intended to address in-water sources of contamination over the long term. Short term changes in contaminant levels may occur during certain operations, such as dredging and capping, when sediment disturbance is unavoidable.

These monitoring efforts are designed with several goals, as with the Hudson River and Fox River and other remediation programs:

1) establish long term changes in sediments, fish tissues and water quality;
2) monitor fish tissue and sediment conditions during the remedial operations.

Fish tissue monitoring needs to assess both short term and long term trends, the formed assessed by collecting young of the year animals, the latter by collecting larger and mature fish.

In the Duwamish, the following marine animals should be monitored:

- Dungeness crabs, both mature and juvenile
- Soft clams
- Young of the year fish for current conditions
- Mature fish to assess long term trends

The April 2013 EPA update to the Hudson River PCB Superfund Site CAG (Greenberg, 2013) on fish tissue monitoring on the Upper Hudson River PCB remediation project reported:

> "Since 2003: Baseline, remedial action, and post-remedy monitoring that was designed to provide statistical power to address both short- and long-term needs
>
> - Allows evaluation of annual (short term) changes and establishment of long-term trends
> - Allows documentation of interim risk reduction following the remedial action
> - We need to demonstrate that the remedy is moving toward, or achieving RAOs (remedy effectiveness)."

G. Comments on the Department of Ecology's Source Control Strategy for the Lower Duwamish (Appendix A)

DRCC/TAG appreciates the Department of Ecology's (Ecology) inclusion of a study of potential upriver sources to determine if there are contaminants of concern at levels that pose a threat to attainment of lower Duwamish River cleanup goals that can be identified and controlled. DRCC/TAG also recommends that Ecology's concurrence with the EPA remedy for the site be contingent on EPA meeting its statutory obligations under CERCLA to control ongoing sources of pollution to the site, including from upriver, by sharing responsibility for pollution source control with Ecology. Ecology's Source Control Strategy and Source Control Action Plans should be an integral and enforceable part of EPA's Record of Decision for the Lower Duwamish Waterway Superfund Site.

H. Comments on EPA's Environmental Justice Analysis of the Proposed Plan (Appendix B)

Environmental Justice (EJ) is defined by both the EPA and the Washington State Department of Ecology (Ecology) as:

> *The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of*

environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.

DRCC/TAG understands that this EJ analysis is the first of its kind for a Superfund remedial decision, and we appreciate the significant effort. However, because it is the first, there are predictable shortcomings of the analysis which should be addressed in the final document.

- The report should include an Executive Summary.
- It is difficult to understand how the EJ analysis is informing the Proposed Plan. In fact, it leads to a great deal of interpretation. For example, the Proposed Plan "determined" a finding from the EJ Analysis which does not appear in the report (see below).
- The analysis mixes of several EJ analysis methods. It is difficult to follow how the analysis determined which communities have EJ concerns. The document repeatedly refers to "the community," although there are a minimum of three and most likely up to 15 different communities using the river in some capacity. Without this information, it is very hard to understand how disproportionality was determined. This highlights how important it is for EPA to develop some guidance for the development of EJ analyses.
- The "assessment of impacts" for the Tribal and subsistence fishing communities limits itself to the conventional risk assessment without acknowledging that the significant disparities (health and socioeconomic) that these two populations face result in cumulative and disproportionate impacts far larger than predicted risks and could affect choice of remedy. It does not appear that Table 2-1 (comparative evaluation and relative ranking of remedial alternatives) was examined through this lens. For example, the application of ICs and the length of time they are in effect has profound health implications. Despite this shortcoming, the majority of the final EJ recommendations are for the Tribes and subsistence fishers.
- In contrast, the "assessment of impacts" for the residential community showed substantial cumulative effects but the recommendations made in the EJ analysis are few and voluntary. Surprisingly, no ICs are recommended for beach play, although cumulative impacts were shown.
- Page 52 of the EJ analysis clearly states that the GAO has found that EPA has failed to follow its own IC guidance, but makes no recommendation that EPA should do so. This implies that that EPA's preferred remedy was not influenced by the EJ analysis.

While we are extremely thankful that an EJ Analysis was conducted, we strongly recommend that EJ analyses are conducted in the future concurrent with the Remedial Investigation. It does not appear that the EJ Analysis influenced the selection of the preferred remedy. However, we acknowledge that EPA is demonstrating greater sensitive to the community's with EJ concerns than it has in the past.

For the most part, we agree with the EJ Analysis summary of impacts and recommendations, however:

- The recommendations are focused on the consumption of contaminated seafood and have neglected to recommend measures to protect the residents who are exposed to the site via direct contact with shoreline sediments. Residents have cumulative impacts from soils, air, water, seafood as well as other issues (stress, poverty, hc needs, food insecurity, lack of employment,etc) which affect their health. Advisory groups are recommended in both Georgetown and South Park to address these issues.
- Recommendations that are currently suggested as "voluntarily" should be reconsidered for incorporation into the remedy. Voluntary measures are not enforceable, and would not meet the enforceability requirements for institutional controls.
- The analysis neglects to discuss how the preferred alternative will affect source control, green space enhancement, funding training for local workers, and traffic and safety coordination. For example, the first bullet "coordination around source control and environmental justice concerns," implicitly acknowledges that source control is an EJ problem but vaguely leaves the problem to Ecology and King County to address. Similarly, the third bullet "traffic, health, and safety coordination" is a significant problem in the Georgetown and South Park and the subject of many neighborhood complaints, but is not discussed in terms of alternative selection.

Risk communication is important for both transparency and trust. We are concerned that the public has been misinformed about the full risks at the site and may be making decisions without full information. Many of the tables and figures in the Proposed Plan only model risks for PCBs and neglect to discuss other important contaminants of concern: arsenic, dioxins/furans and PAHs. In addition, several figures (e.g., Figure 17) document non-cancer risks for tribal adults but fail to mention risks for tribal children who are more than twice as vulnerable to the effects of PCBs than adults. This also applies to children who may eat resident seafood once a week. These issues should be fully addressed in the EJ Analysis.

Most troubling, Section 9.3.3 of the Proposed Plan (pp 86–87) summarizes the finding of the Environmental Justice analysis as: "EPA's Environmental Justice analysis determined that the Preferred Alternative balances the need to reduce human health risks quickly while providing certainty that the methods used in the cleanup will be effective and will remain effective in the future." There is no reference to this determination in the EJ analysis. It appears that the Proposed Plan has inappropriately used the EJ analysis to justify its preferred remedy. This statement should be deleted from the document.

I. Comments on the Remedial Investigation and Feasibility Study

While we recognize that EPA has amended some data and assumptions in its Proposed Plan, some of the underlying RI/FS documents that are intended to inform both the Plan and the public still need to be revised to reflect the updated data sets and rationales guiding EPA's cleanup decisions. These corrections are important as the basis for EPA's pending Record of Decision.

1. Loading data

The upriver loading data in the Feasibility Study should be updated to reflect loading estimates contained in EPA's Proposed Plan. During the coming year, EPA should continue to evaluate new loading data and revise its estimates to reflect continuing declines in upriver contaminant concentrations entering the lower Duwamish River. Finally, it should be recognized that upriver loading is not static and can be reduced with appropriate investigation and pollution source control efforts, as discussed in our comments above.

2. Construction Impacts

Appendix L of the Feasibility Study uses outdated and inapplicable data to estimate short-term construction impacts, which in turn influence the Feasibility Study and EPA's ratings of the cleanup alternatives. Using the data presented is misleading and biases the evaluation of alternatives. The data on air emissions in particular needs to reflect current EPA fuel regulations and EPA's "green remediation" policies, instead of applying emissions estimates based on the use of conventional hydrocarbon fuels that are either not legally-permissible to use or would not be permitted for use under policies applicable to the site.

3. Cost Analysis

A detailed cost analysis should be provided for EPA's (final) selected alternative. Uncertainties should be factored into or acknowledged in the cost estimates, and where costs may continue beyond the number of years represented, this should be clearly noted and recognized as representing potential additional costs.

The cost of institutional controls requires detailed analysis and should be accurately captured, based on similar costs of ICs at comparable sites. The most closely related site is the Palos Verdes Shelf in California, where IC costs have averaged nearly $1.5 million/year. Again, if cleanup goals are not expected by attained by the final cleanup plan, these costs need to be recognized as potentially applying as a liability in perpetuity.

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