FINAL REPORT ON PROJECT NWIFC 09 EPA PSP 408

PROJECT TITLE:

The pollution sources of Cape Flattery: possible interactions between atmosphere, ocean, and local dump

(7/1/2009 - 5/31/2011)

By

MAKAH TRIBE

June 28, 2011

Makah's project is an inter-departmental collaboration between Makah Fisheries Management, Environmental Program, and Office of Marine Affairs. Based on the amendment Makah's project started on July 1, 2009, and will be extended to May 31, 2011 because Makah received the award five months later than other Puget Sound tribes. This report will reflect the complete project through three separate tasks as proposed.

TASK 1: *Conduct literature review and site investigations for waste dumps in the Makah reservation, and prepare for initiating a multiple-year environmental assessment project as EPA suggested. The task will include three elements such as review of the references on historical dump closure since the establishment of US Army Air Force Station in the Makah reservation in 1942; evaluation of the feasibility to use local labs for heavy metal analyses; and field investigation on Warmhouse Beach dump site.*

A) Introduction

The Makah Indian Reservation has a land area of 121.451 km² (47 sq mi), with a 2000 census resident population of 1,356 persons. It is bordered on the west by the Pacific Ocean and on the north by the Strait of Juan de Fuca. Archaeological research suggests that the Makah people have inhabited the area now known as Neah Bay for more than 3,800 years (Renker and Gunther, 1990). The Makah culture is fundamentally that of the Pacific Northwest Coast area. The Makah are the southernmost of the Wakashan group, being the only member of the Wakashan group within the United States. Today, Neah Bay is a commercial fishing and timber community, as well as a tourist and sport fishing destination.

During the World War II until 1988, the US Air Force Station used part of the Reservation to dispose of household waste and various hazardous wastes (White Shield, 1995; Tecumseh, 1998). Four dump sites were used by the military, of which the 200-Line Dump, the Koitlah Point Dump, and the Cape Flattery Dump were inactive and partially covered. Only the Warmhouse Beach Open Dump has been used by the Makah people, about 1,350 people or 492 households, used the dump for solid waste disposal since 1988.

The Warmhouse Beach Open Dump is located on the edge of a small valley overlooking the Strait of Juan de Fuca, about 2 miles west of Neah Bay. The shape of the dump is oval, covering about 500 feet in width by 250 feet in length by up to 40 feet in depth (Figure 1). The initial waste delineation and site characterization were performed by White Shield (1995). Ridolfi Inc. (2003) estimated that the waste volume at the dump was within a range of 55,000 to 65,000 cubic yards.

The Puget Sound Action Agenda, a strategy to clean-up, restore, and protect Puget Sound by 2020 and the Comprehensive Conservation and Management Plan (CCMP) for Puget Sound, has listed "Reduce the sources of water pollution" as one of the five priorities. "The Action Agenda identifies a coordinated, regional approach to reducing the sources of water pollution in Puget Sound that reflects several primary objectives. Particular to the Strait of Juan de Fuca, the Priority Action Area Strategies required to "close and remediate the Makah Tribe Warmhouse Beach Open Dump and develop a solid waste transfer and reuse facility".

B) Summary of the reference check

The historical references on the former military dumps can be gathered from federal repositories, such as the National Archives at Sandpoint in Seattle; the Fort Lewis Museum; and the USACE (the U.S. Army Corps of Engineers) office in Seattle. Over the last several years, the Ridolfi Inc. has made copies and photos on these historical documents and presented to the Makah Tribal Council, the Tribal members, the USACE, and other stakeholders. The major references that summarize the site surveys, hydrogeological investigation, surface water and groundwater

sampling, monitoring well repair and sampling, sediment sampling, and chemical analyses by the Ridolfi Inc. are listed as follows:

Ridolfi. 2008. Native American Lands Environmental Mitigation Program 2006-2007, December 2007 Semi-annual Monitoring: Analytical results summary and trend analysis 2001-2007.

Ridolfi. 2007c. Field Sampling Plan, December 2007 Semi-Annual Monitoring. Prepared for the Makah Indian Tribe. November.

Ridolfi. 2007b. Field Sampling Plan for Sites 1, 4, 8, and 11. Prepared for the Makah Indian Tribe. May.

Ridolfi. 2007a. Cantonment Area (Site 11) Semi-Annual Ground Water and Creek Monitoring Report. Prepared for the Makah Indian Tribe. April.

Ridolfi. 2006c. Field Sampling Plan for Sites 1, 4, 8, and 11. Prepared for the Makah Indian Tribe. November 27.

Ridolfi. 2006b. 2006 Strategic Project Implementation Plan. August.

Ridolfi. 2006a. Analytical Results from Ground Water Samples Collected at the Cantonment Area (Site 11). RIDOLFI Inc. Memorandum to Steve Pendleton, Makah Environmental Division. July 31.

Ridolfi. 2004b. Limited Remedial Investigation Sampling and Analysis Plan. Prepared for the Makah Indian Tribe. July 30.

Ridolfi. 2004a. Warmhouse Beach Open Dump Ground Water and Stream Sampling Plan. Prepared for the Makah Indian Tribe. March 8.

Ridolfi. 2001. Makah Indian Reservation Warmhouse Beach Open Dump Hydrogeologic Investigation. Prepared for the Makah Tribal Council. September.

C) Evaluation of laboratories for heavy metal analyses

Currently, the most popular laboratory equipment for heavy metal analyses is the Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The history of ICP-MS instrument can be classified into three generations, from 4500 series, 7500 series, to 7700 series. All these are manufactured by the Agilent Technologies. Since July of 2009, the company has provided 7700x system based on four factors: (1) sensitivity; (2) matrix tolerance; (3) interference removal; and (4) linear dynamic range.

There are about 15 ICP-MS laboratories around the Northwest Pacific region, of which most are using the 7500cx instrument, including the University of Victoria ICP-MS Laboratory and the ACME Analytical Laboratory in Vancouver, British Columbia. A few labs in Canada are currently using the 7700x systems with two modes, the Normal (no-gas) and Helium (collision) mode. The general procedures are using no-gas first, and then using Helium mode. During the EPA PSP 408 funding period, MFM also checked several local ICP-MS labs in the Washington State, particularly the USEPA Region-10 lab in Manchester, the TestAmerica lab in Tacoma, and the Analytical Resources Inc. lab in Tukwila.

The USEPA Manchester Laboratory is a well-equipped environmental laboratory, capable of analyzing both the organic and inorganic forms of heavy metal concentrations. The laboratory is under the Region 10 Office of Environmental Assessment (OEA). The Laboratory comprises small teams representing different disciplines and functions. The three teams responsible for environmental chemistry are managed by the Chemistry Supervisor. The staff in

the lab has their own work load, however, through collaboration the lab may take on some test or pilot project on clam shell carbonate analyses.

The TestAmerica ICP-MS Laboratory in Tacoma (Figure 2) provides additional options for analyzing the heavy metal concentrations in both organic and inorganic forms. The lab charges for both shellfish tissue and seawater analyses (metals plus mercury) are $120 per sample, which is quite reasonable in today's commercial analysis. The Analytical Resources Inc. ICP-MS laboratory was just established a new instrument in 7700 series (cf. Figure 2).

D) Field inspection on Warmhouse Beach Open Dump

This site is an active open dump (Figure 3) located at the head of two unnamed creeks: drainage is to the east and west via these creeks. According to Ridolfi (2003) metals and benzene are present in ground water, and lead and arsenic were detected at concentrations above screening levels. Metals and diesel-range hydrocarbons are present in surface water, and arsenic was detected at a concentration above the screening level. The concentrations of lead, nickel, and zinc in the upstream sediment samples (nearest to the waste) from both creeks exceeded screening levels.

Site survey and waste characterization were conducted since 1995 (Ridolfi, 2001). Thanks to the assistance of U.S. Department of Agriculture, Makah Tribal Council has been able to construct a Transfer Station in Neah Bay to handle all the waste. The latest field inspection was conducted at nine sites. Data of the latitude, longitude and elevation for each site (cf. Figure 1) are listed below:

Site	1:	N48 23.336	W124 39.393	265 ft
	2:	N48 23.305	W124 39.354	259 ft
	3:	N48 23.308	W124 39.391	265 ft
	4:	N48 23.324	W124 39.421	273 ft
	5:	N48 23.336	W124 39.422	271 ft
	6:	N48 23.351	W124 39.441	262 ft
	7:	N48 23.317	W124 39.480	231 ft
	8:	N48 23.293	W124 39.447	211 ft
	9:	N48 23.284	W124 39.415	213 ft

E) References

Renker, A. M., and Gunther, E. 1990. Makah. *In* Handbook of North American Indians, Sturtevant, W. C. (ed). Washington DC, Smithsonian Institution, 429 pp.

Ridolfi. 2001. Makah Indian Reservation Warmhouse Beach Open Dump Hydrogeologic Investigation. Prepared for the Makah Tribal Council. September.

Ridolfi. 2003. Makah Indian Reservation solid waste management plan. Prepared for the Makah Tribal Council.

Tecumseh Professional Associates, Inc. (Tecumseh). 1998. Makah Indian Reservation site assessment report. Prepared for EG&G Technical Services, Inc.

White Shield Environmental, Inc. (White Shield), 1995. Waste delineation and characterization, Makah Landfill, Neah Bay, Washington.

Figure 1. A bird's-eye review of the Warmhouse Beach Open Dump (top) and the inspection sites (bottom) during the report period.

Figure 2. The ICP-MS facilities in the TestAmerica Laboratory at Tacoma (top) and the newly-established ICP-MS in the Analytical Resources Inc. (bottom), Washington.

Figure 3. Photo showing a general view of the Warmhouse Beach Open Dump.

F) A Multiple-year Environmental Monitoring and Assessment Project

As a result of the amendment on TASK 1, MFM has completed a multiple-year environmental monitoring and assessment project proposal as EPA suggested.

PROJECT TITLE:

Geochemical Analysis on Heavy Metal Pollution Flowing From the Warmhouse Beach Open Dump in Makah Reservation

By

Yongwen Gao (*Makah Fisheries Management*)
Steve Pendleton (*Makah Environment Program*)
Kathryn Foster (*Ridolfi Inc.*)
Eric Steig (*University of Washington*)

1. Need for Proposed Work

The Makah Indian Reservation is located at the northwest tip of the continental United States in Washington State. It is bordered on the west by the Pacific Ocean and on the north by the Strait of Juan de Fuca, an important gateway for Puget Sound water input and high volume shipping. Neah Bay is the only town within the Reservation, with a population of about 1,350 in 2000 census.

Makah Tribe is traditionally known as a fishing village. Fishing is the dominant income sources for the Makah people, currently with 75 boats in total for harvesting groundfish, Pacific salmon, and shellfish. It is vulnerable for Makah people to encounter environmental pollutions in waters and aquatic lands within its usual and accustomed fishing areas.

During the World War II until 1988, the US Air Force Station used part of the Reservation to dispose of household waste and various hazardous wastes (White Shield, 1995; Tecumseh, 1998). Four dump sites were used by the military, of which the 200-Line Dump, the Koitlah Point Dump, and the Cape Flattery Dump were inactive and partially covered. Only the Warmhouse Beach Open Dump has been used by the Makah people, about 1,350 people or 492 households, used the dump for solid waste disposal since 1988.

The Puget Sound Action Agenda, a strategy to clean-up, restore, and protect Puget Sound by 2020 and the Comprehensive Conservation and Management Plan (CCMP) for Puget Sound, has listed "Reduce the sources of water pollution" as one of the five priorities. "The Action Agenda identifies a coordinated, regional approach to reducing the sources of water pollution in Puget Sound that reflects six primary objectives:

C.1 Prevent pollutants from being introduced into the Puget Sound ecosystem to decrease the loadings from toxics, nutrients, and pathogens.

C.2 *Use a comprehensive, integrated approach to managing urban stormwater and rural surface water runoff to reduce stormwater volumes and pollutant loadings.*

C.3 *Prioritize and complete upgrades to wastewater treatment facilities to reduce pollutant loading.*

C.4 *Establish and maintain locally coordinated, effective on-site sewage system management to reduce pollutant loading to vulnerable surface waters.*

C.5 *Prioritize and continue to implement toxic cleanup programs for contaminated waterways and sediments.*

C.6 *Continue to monitor swimming beaches as well as conduct shellfish and fish advisory programs to reduce human exposure to health hazards".*

Particular to the Strait of Juan de Fuca, the Priority Action Area Strategies required to "close and remediate the Makah Tribe Warmhouse Beach Open Dump and develop a solid waste transfer and reuse facility".

Makah Tribal Council is seeking to create opportunities for economic development, including tourism, in a manner that enhances the ecology of the Reservation and the culture of its people. Consolidation and closure of the Warmhouse Beach Open Dump is considered to be the number one priority to the Council. Makah Tribal Council's primary objectives for cleaning and closing the former military dump sites are:

- To protect, provide for, and enhance the health, safety, and well-being of the Makah people.
- To ensure that the development of the Makah Nation's human and natural resources is in harmony with the environment.
- To protect and enhance the environment and preserve the Makah culture.

Makah Tribal Council has established a solid plan to close the Warmhouse Beach Open Dump and will build a Solid Waste Transfer Station as the first step toward closing the dump. The construction for building the Transfer Station will be started in 2010 and completed in 2011.

We propose to conduct geochemical analysis on heavy metal pollution flowing from the Warmhouse Beach Open Dump. The project will cover the rebuilding process before and after the dump closure. Based on the Resources Conservation and Recovery Act (RCRA), it requires 30-years of post-closure maintenance and monitoring at a landfill (Ridolfi, 2006). Groundwater and surface water sampling and analysis will be conducted regularly; and the landfill gas control system will also be monitored. Thus the proposed work will be a part of the process for the Warmhouse Beach Open Dump closure, and is of the highest priority as well.

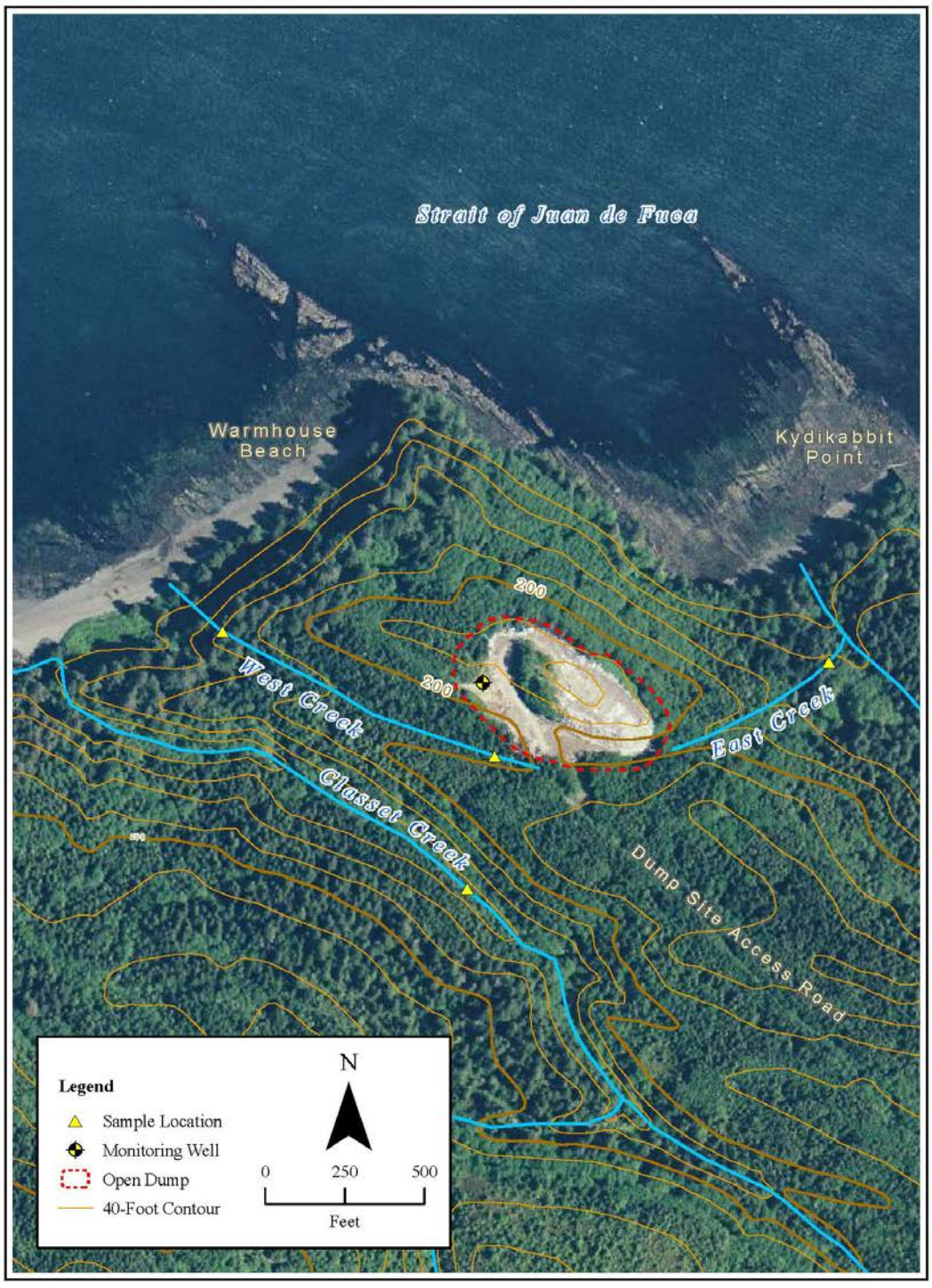
2. Project Design

The Warmhouse Beach Open Dump is located on the edge of a small valley overlooking the Strait of Juan de Fuca, about 2 miles west of Neah Bay (Fig.1). The shape of the dump is oval, covering about 500 feet in width by 250 feet in length by up to 40 feet in depth (Ridolfi, 2003). The initial waste delineation and site characterization were performed by White Shield (1995). In 2003, Ridolfi estimated that the waste volume at the dump was within a range of 55,000 to 65,000 cubic yards.

The Warmhouse Beach Open Dump reportedly began in a deep ravine between two creeks that drain to the east and west (cf. Fig. 1). The "West Creek" outfalls to the Warmhouse Beach approximately 1,000 feet west of the site, whereas the "East Creek" outfalls west of the

Kydikabbit Point. The majority of the waste at the site has been dumped into the upper portions of the East Creek and West Creek drainages (Ridolfi, 2006).

Fig. 1. Location map showing the Warmhouse Beach Open Dump site (Ridolfi, 2006).



In the proposed project, we plan to systematically collect water samples from the "summer dry season" (generally June-August) and "winter wet season" (December to the next February) and clam shell samples from the adjacent Neah Bay Beach over two years, and analyze the heavy metal pollution flowing from the Warmhouse Beach Open Dump.

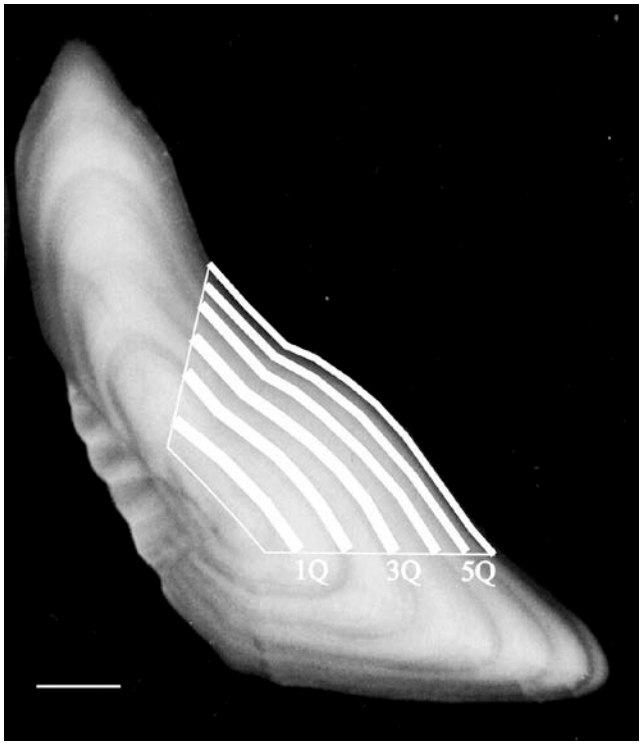
Water samples will consist of freshwater and seawater. Freshwater samples will be collected from five stations around the dump: two stations from the West Creek and one station from the East Creek; one station from the monitoring wells (either from MW-01, MW-02, or MW-03) and the other from the Classet Creek as a reference station (cf. Figure 1). Seawater samples will be collected from the adjacent Neah Bay aquaculture beds. Because it is very hard to sample clams in the Warmhouse Beach (Makah Seafood Study, 2007), shell samples will be collected from the geoduck clams (*Panopea abrupta*) already planted in the Neah Bay Beach, about 2 miles on the east of Kydikabbit Point. Since 2006 Makah Fisheries Management has been installing 300 tubes for planting geoduck seeds per year, and the feasibility tests will continue until 2012. Because there are clear growth increments precipitated in geoduck shells as annual records and geoduck clams are good proxies for environmental studies (Noakes and Campbell, 1992), we are able to select the known-aged shell samples (Fig. 2) over the two-year seawater sampling to detect the possible pollution.

Fig. 2. Photo showing the geoduck size and growth at different ages (from 12-24 months from the bottom to the top). Please note the growth rings from the shells.

Water samples will be collected on a weekly basis, covering both the dry and the wet season (about 2 month sampling and 8 samples from each station) per year up to two years. Clam shell samples will be collected from the known-aged geoducks (15 animals per year) from the Neah Bay Aquaculture beds. All the samples will be first subjected to heavy metal content analyses. The major heavy metals will include, but not limited to, cadmium (Cd), copper (Cu), lead (Pb), zinc (Zn), Calcium (Ca), Magnesium (Mg), Strontium (Sr), and mercury (Hg). The list of the heavy metals is based primarily on research results from the Puget Sound samples (Puget Sound Action Team, 2007), and on geochemical applications that Sr/Ca, Mg/Ca ratios are useful tracers for environmental changes. In addition, 40 water samples (20 from the well sampling station and 20 from the Classet Creek reference station) will be collected for stable hydrogen ($^{2}H/^{1}H$ or $\delta^{2}H$) and oxygen ($^{18}O/^{16}O$ or $\delta^{18}O$) isotope analyses. Overall 192 water samples (160 freshwater and 32 seawater samples) and 60 geoduck shell samples (15 animals per year for seasonal sampling) will be analyzed for heavy metal contents, plus 40 freshwater samples for $\delta^{2}H$ and $\delta^{18}O$ ratios.

The heavy metal samples will be collected in 150-200 ml glass bottles, while isotope samples will be collected in an amber narrow-mouth glass bottles (40-60 ml) to avoid photosynthesis and evaporation. All water sample bottles must be filled in completely full. Background information, such as sampling date and time, location, weather, tide (and water current), and personnel, etc. should also be recorded. The shell samples will be micro-milled through the Dremel method (Gao , 1999), with a separation of sequential samples at about 4-6 months (Fig. 3).

Fig. 3. Microsampling of a 6-yr otolith of Atlantic cod in seasonal resolution, showing the milling paths of opaque (Q) and translucent zones. Scale bar ≈ 1 mm.



The heavy metal analyses of water and shell samples will be performed in the Analytical Resources Inc. of Tukwila, WA, using an inductively coupled plasma mass spectrometry (ICP-MS). The detection limits for the targeted heavy metals will be better than: Cd (0.05 ppb), Cu (0.1 ppb), Pb (0.1 ppb), Zn (0.5 ppb), and Hg (0.1 ppb), respectively. Stable $^{2}H/^{1}H$ and $^{18}O/^{16}H$ ratio measurements will be conducted in the University of Washington Laboratory in Seattle. Values of $\delta^{2}H$ and $\delta^{18}O$ as reported by the UW lab are of high quality and consistent with the internationally accepted values for SMOW (Standard Mean Ocean Water) and SLAP (Standard Light Antarctic Precipitation).

The details of the project tasks and timelines are summarized below, with the number of samples in parenthesis:

Tasks	2010-11	2012	2013	2014
Site investigation; sampling supplies	July-Aug, 2010 Sep-Oct, 10			
Winter water sampling & shipping	Dec-Feb, 2011 (48)	Dec-Feb, 2012 (48+20)		
Summer water sampling & shipping	June-Aug, 11 (48+20)	June-Aug, 12 (48)		
Shell sampling	Aug-Sep, 11 (15)	Aug-Sep, 12 (15)		
micro-sampling & shipping		Sep-Dec, 12 (60)		
Checking if more samples needed			Dec-Feb, 2013 June-Aug, 13	
Data compiling			Mar-May, 13 Sep-Dec, 13	
Final report				Jan-May, 2014

3. Anticipated Outcomes and Importance

(1) The combination of water samples from the dump drainage with shell samples from the geoduck aquaculture beds will be beyond monitoring wastewater pathways from the dump. The shell analyses will ultimately provide a terminus that will connect the heavy metal contaminants flowing from the Warmhouse Beach Open Dump to the final deposition on shellfish in the Reservation beaches. No investigations have depicted the whole picture before.

The chemical composition of geoduck shells is calcium carbonate ($CaCO_3$). In the subsequent shellfish sampling prior and after the dump closure it is anticipated that there will be chemical signatures corresponding to the timing of the Warmhouse Beach Open Dump closure, which allow us to evaluate the magnitude and impact on shellfish resources. Heavy metals will substitute the $\underline{Ca^{2+}}$ during the shell carbonate precipitation, so the investigator will be able to characterize the pathway and distinct composite of heavy metals that originated from the dump. Thus our proposal may establish the foundation of a larger investigation, where other past events (such as historically closed military dumps) that may have lead to environmental degraded can be evaluated.

Seawater sampling is a crucial link to the ultimate objective of the project to examine the source of pollutants in shellfish through the geoduck beds. It will allow the investigator to connect the seawater heavy metal values (proportional to those in shellfish) with the shell calcium carbonate analyses, and pinpoint pollutant sources that have contributed to specific toxins and when the pollution occurred over time. That is, upon having the geochemical signatures corresponding to the timing of a dump closure the investigator will be able to identify the event and impact on shellfish and the surrounding environment. This information will ultimately allow the Tribe to be able to assess the effectiveness of its efforts to stem the flow of toxins into marine environment.

(2) The geochemical analysis, which will target the inorganic forms of heavy metal contents, will provide new and direct information for assessment of environmental pollution and wastewater pathways. Heavy metals such as cadmium (Cd), copper (Cu), lead (Pb), zinc (Zn), and mercury (Hg) generally have two forms: the organic form will be distributed in the soft part of an organism such as blood, meat tissues and skins; whereas the inorganic form will be deposited in the hard part such as shells, bones, and fish ear stones (otoliths). There are different applications for the two forms of elements. For Hg, for instance, the more toxic form is the organic mercury or methylmercury (Makah Seafood Study, 2007). For most heavy metals such as Cd, Cu, Pb, and Zn, their inorganic forms are more useful indicators in detecting the environmental variations that the animal was exposed (Klein et al., 1996).

We did not propose to analyze organic components due to two reasons: a) The geoduck shells are composed of calcium carbonate ($CaCO_3$) which has too little organic matter to be collected and analyzed, and b) Makah Fisheries Management currently has water quality monitoring programs which are funded by EPA and will analyze organic pollutants (e.g., chlorinated pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, etc.) over the funding period.

(3) The geochemical analyses will be able to discriminate the origin of well water (e.g., MW-01, MW-02, and MW-03) in the Warmhouse Beach Open Dump and its relationship with surface water. Previous site investigations indicated that the monitoring wells were damaged after being installed in 2001, and it was not clear whether the water in the wells was originated from rain or groundwater (Ridolfi, 2006). Geological data suggest that there are no potential aquifers exist in the geological formations beneath the dump site. Thus it is of paramount importance to verify if the monitoring wells consist of rainwater or groundwater, either for monitoring the dump closure or for post-closure maintenance.

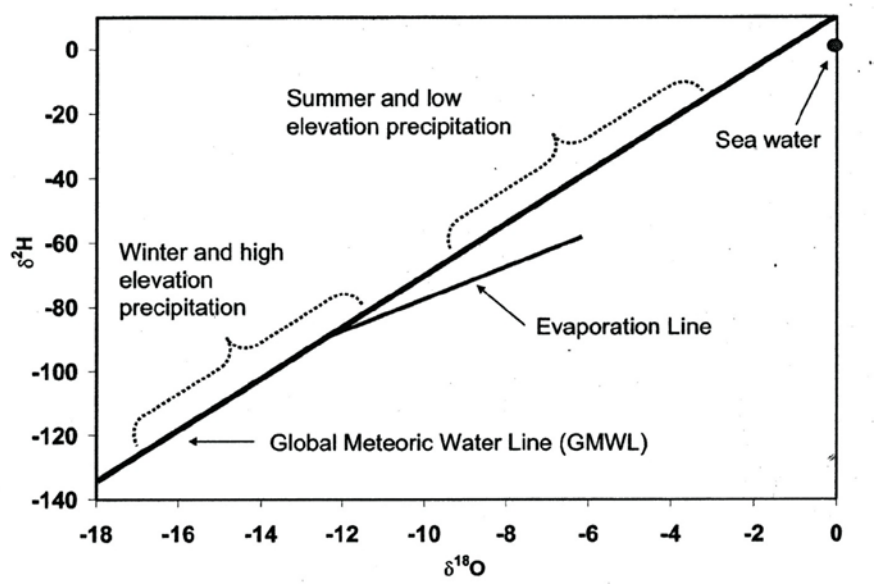
Hydrological studies indicated that the constituent of water can be detected by stable hydrogen ($^2H/^1H$ or δ^2H) and oxygen isotope ratios ($^{18}O/^{16}O$ or $\delta^{18}O$). Isotopic fractionation during evaporation of water from the oceans and subsequent condensation of vapor in clouds results in depletion in ^{18}O and ^2H in freshwater as compared to seawater (Siegenthaler, 1979). Based on a large number of analyses of meteoric waters collected from different latitudes, Craig (1961) showed that the δ^2H and $\delta^{18}O$ values of meteoric water are linearly related and can be represented as:

$$\delta^2H = 8\delta^{18}O + 10$$

This Global Meteoric Water Line (GMWL) can be explained by the factor that at equilibrium the concentration difference between water and its vapor is about 8 times larger for δ^2H than for

$\delta^{18}O$ (Fig. 4). The origin of well water and its relationship with surface in the dump can be easily distinguished by $\delta^{2}H$ and $\delta^{18}O$ analyses. The results will be helpful either for the trend analysis on previously collected data (Ridolfi, 2008), or for the long-term monitoring after the dump closure.

Fig. 4. Schematic diagram showing the $\delta^{18}O$ and $\delta^{2}H$ of seasonal precipitation and evaporated waters (Kendall, 2009).



(4) The proposed project will systematically collect water samples from different seasons (dry and wet) up to two years, to get better representative values for water samples. Previous site investigations and sampling have done fairly-good job in wastewater monitoring, but the number of water specimens is too small and the sampling is fragmentary (Nicholls and Hilgart, 2006; Ridolfi, 2006; 2008). As the Action Agenda pointed out, "Although we have done a good job of cleaning up contaminated sites, we have not stopped the onslaught of new contamination from entering our waters. We allow pollutants such as synthetic hormones and persistent bio-accumulative toxics to enter the water, many of which we know very little about or have few standards and testing methods to evaluate". We believe the flaws can be rectifiable through the geochemical approach.

4. Partnerships and Information Transfer

This will be an inter-departmental project between Makah Fisheries Management and Makah Environment Program within the Tribe. The collaboration has been beginning since an joint Puget Sound Partnership project (NWIFC 09 EPA PSP 408) between Makah Fisheries, Environment, and Office of Marine Affairs was established in 2009. We will be continuing to work together to fulfill all the project tasks as proposed. The Ridolfi Inc. has been working with the Makah Tribe for cleaning up and closing the former military sites since 2001, and generated

a series of program reports on site investigation and sampling for the Warmhouse Beach Open Dump. Ridolfi will be continuing to provide consulting information for the project, particularly in establishing a new Quality Assurance Project Plan (QAPP) and reviewing the final report. The University of Washington will provide services for $^{2/}H/^{1}H$ and $^{18}/^{16}O$ ratio measurements.

In the near term, the outcomes of the project will provide direct information for the closure of the Warmhouse Beach Open Dump. In the long term, the geochemical data will be helpful for the post-closure maintenance and monitoring. Along with the dump closure, progress reports and a final report will be submitted to both EPA Region 10 and Makah Tribal Council for review. The geochemical data and results will also be presented to the Makah people in Neah Bay, the public, the scientific community, and other stakeholders through meetings, group discussions, and journal publications.

5. Budget and Justification

We request 9-month support (salary $15x1560 plus 37% fringe benefits =**$32,058**) for Mr. Andrew Winck up to three years. He will be responsible for water sampling in the Warmhouse Beach Open Dump and the adjacent Neah Bay geoduck aquaculture beds, and collect relevant environmental data over the sampling period. He will be also in charge of sample shipping and data entering as needed.

The Makah Tribal Council will provide 2-month support for Yongwen Gao and one-month support for Steve Pendleton up to 4 years (salary plus benefit =$68,392 +$23,744 =$92,136) as in-kind. Dr. Gao will be responsible for overseeing the project, collaborating with different chemical laboratories for sample analyses, and drafting progress and final reports as required. Mr. Pendleton will direct Mr. Winck for all the field sampling tasks, and manage the project budget to meet the EPA and Tribal requirements.

Laboratory charges for processing 192 water samples ($420x192 =$80,640), 60 carbonate shell samples ($100x60 =$6,000), and 40 isotope samples ($30x40 =$1,200) will be **$87,840** in total. We request operation support ($5000 for the first 2-yrs, $3,000 for the 3rd and $500 for the 4th yr **=$13,500**), which will include operation supplies and micro-mill supplies for shell sampling; local travel and meeting and conference costs ($4,500 for the first 3-yrs, and $6,000 for the 4th yr **=$19,500**); and a light pick-up truck purchase (**$15,000**), which will be used for field sampling and delivery. We also request consulting costs for Ridolfi Inc. ($15,000 for the first year, and $5,000 for the 4th yr **=$20,000**).

The Direct Cost will be **$252,014** in four years.

The current Indirect Cost of Makah Tribe is 47.79%, which is **$61,733** in the project budget. The total federal funds requested for the proposed 4-yr project will be **$313,747**.

6. Past Performance and Programmatic Capability

The Makah Fisheries Management and Makah Environment Program have been successfully completing and managing projects funded by federal and state agencies, and satisfying all the requirements as documented in the Agreements (e.g., progress reports, final reports in a timely manner). Four of the latest agreements/grants are listed as follows:

1) Project:	Environmental mitigation of impacts
Agreement No:	CA 06-09
Funding Agency:	US Department of Defense
Award Amount:	$ 1,057,000
Project Period:	8/11/2006 - 10/31/2008

2) Project:	Solid waste management plan
Agreement No:	X1-97014501-1
Funding Agency:	US Environmental Protection Agency
Award Amount:	$147,000
Project Period:	8/1/01 - 7/31/02

3) Project:	The pollution sources of Cape Flattery
Agreement No:	NWIFC 09 EPA PSP 408
Funding Agency:	US Environmental Protection Agency
Award Amount:	$105,000
Project Period:	1/1/2009 - 12/31/2010

4) Project:	Geoduck shell studies in Hood Canal of Puget Sound
Agreement Number:	IAA 06-258
Funding Agency:	WA Department of Natural Resources
Award Amount:	$49,940
Project Period:	9/15/2006 - 3/31/2008

The Makah Tribe has extensive experience in managing federal programs under the Indian Self-Determination and Education Assistance Act, 25 U.S.C. §§ 450 *et seq*. The Makah Tribal Council currently operates with an annual budget of approximately $14 million, of which $3-4 million is derived from grants and contracts.

Staff in Makah Fisheries Management and Makah Environment Program has extensive experience to achieve the project goals. Dr. Yongwen Gao, a Research Scientist specialized in Fisheries and Environmental Sciences, has completed a dozen federal/state funded projects and published about 30 papers since 2000. Mr. Steve Pendleton, the Manager of Makah Environmental Program, has been working with the Tribe on health and environmental issues over 25 years. He currently manages 3 federal funded projects with a total award amount of $1.94 million. Overall staff in our team has good record on project performing in the past, and will be confident to achieve the project tasks in the future.

7. References Cited

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TASK 2: *Reduce the volume of materials going to the Warmhouse Beach Open Dump site between now and when the dump is finally closed, and conduct community outreach through a survey and pamphlets that will help the community to reduce the waste-stream volume. This survey and outreach will also help to finalize the size and design of a new waste transfer station.*

The Community Recycling Questioner was developed that focused on current disposal practices in Neah Bay and included questions to gauge the interest in recycling and reuse within the community. The Tribal Environmental Program hired a tribal member to conduct the survey. A target of 150 of the 300 plus households here in the Neah Bay village community was set and would be a representative number of households to survey.

We completed about 71 surveys. When these surveys were completed, the numbers and the comments were compiled. A memorandum was developed that summarizes the results of a survey conducted on behalf of the Makah Tribal Council concerning waste reduction, recycling, and disposal of wastes. The results of this survey are being used to guide public outreach efforts directed at reducing waste and promoting diversion of waste from disposal. As it turns out the results have shown from the community survey that most all of the community is in favor some kind of Recycling. The results were also presented to the community at a dinner meeting.

As part of the outreach efforts, we worked with the schools to involve students. During summer the Neah Bay High School students were hired (under another program) to assist the Environmental Program by hand painting a large sign promoting Recycling. This sign was placed at the local Recycling Drop Box located here in the community (Figure 1). A power point presentation was developed by the same students promoting composting.

In early December 2009, Helen Frelich, the Port Angeles City Recycling Coordinator, came to the Neah Bay Elementary School and gave recycling presentations to the first through fifth grade classes. These presentations were very well received by the kids and also school staff. We are planning another round of activities at the Neah Bay schools this year.

The task of reducing the amount of waste at the Warmhouse Beach Dump has been an ongoing concern with the Makah Tribal Council (MTC). With the assistance of the U.S. Department of Agriculture, the MTC has been awarded a Grant/Loan to finish design and construct a Waste Handling Facility or Transfer Station at Neah Bay. On completion of the Transfer Station all solid waste will be handled there and shipped off reservation. The information gathered in the survey was used to guide design of recycling facilities at the new facility.

Three community outreach recycling posters focusing on the 3 R's (Reduce, Reuse, and Recycle) were created using tribal art work and photographs (Figure 2).

We developed three storyboards that emphasize the impacts from the Warmhouse Beach Open Dump to Puget Sound and presented ways to reduce these impacts. Two of the storyboard used themes and characters from traditional Makah stories and focused on outcomes from improper dumping practices. The third storyboard focused on the impacts from the Warmhouse Beach Open Dump and way community members could reduce those impacts. A fact sheet that summarizes the status of the dump closure and transfer station development projects was also produced for the community.

On December 2, 2010 the Makah Environmental Program with support from the Puget Sound Partnership and the US Environmental Protection Agency, hosted a community outreach dinner. We had 80 plus community members attend (very good for out here). Steve Pendleton, the Manager of Makah Environmental Program, hosted the event.

The recycling poster and storyboards were on display. Handouts on the results of the survey and status of the dump closure and transfer station development were available. The posters, storyboards and handouts were well received and many questions were heard and answered.

Following the community meeting, a summary of questions and comments from the community meeting was compiled.

Figure 1. A large sign placed at the local Recycling Drop Box in the Neah Bay community.

Figure 2. The example of poster: Preserving our heritage and protecting our future.

TASK 3: *For oil spill protection, a harbor master will monitor and enhance response efforts through coordinating activities with the Marine Spill Response Corporation (MSRC) and assist in their Vessel of Opportunity program to train part of the Makah tribal fishing fleet in oil spill response strategies, which includes deployment of oil spill boom in coordination with MSRC spill response personnel and equipment stationed in Neah Bay. A schedule of spill drills and exercises will be developed with MSRC during the funding period. The Harbor Master will conduct a daily check through the Neah Bay marina to log the availability of Vessels of Opportunity.*

This funding was instrumental in providing the Makah Tribe and Port of Neah Bay the capacity to greatly enhance local response knowledge and capabilities. The Makah Marina Harbor Master worked with the local Oil Spill Response Organizations (OSRO), Washington Department of Ecology (DOE), US Coast Guard, US Navy Sup/Salv, and the Regional Response Team 10/Northwest Area Committee (RRT/NWAC) in building local spill response requirements and capacities. The attached draft Makah Fishing Vessel Response Program document is a result of work with the above partners (Appendix 1).

The Harbor Master attended the RRT/NWAC in Portland, OR on October 14-15, 2009 and in Wenatchee, WA on March 10-11, 2011. He met in Seattle with the Regional Response Team Coordinator on October 30, 2009. The Harbor Master met with NRCES in Seattle, WA on February 9-10, 2011 and MSRC in Port Angeles, WA on March 26, 2011 to develop training for Makah Vessels of Opportunities and local responders.

The Makah Office of Marine Affairs (OMA) was able to conduct several types of local oil spill response trainings and drills with Marine Spill Response Corporation (MSRC) and National Response Corporation, Environmental Services (NRCES). These trainings include: Vessel of Opportunity; Geographic Response Plans (GRP) on local rives and bays; shoreline cleanup; First Responder with air monitoring capability; skimming equipment operations; and working decks of various response boats. The list of participants include the Port of Neah Bay, Makah volunteer oil spill response pool and four vessels from the Makah fishing fleet, one vessel from Quillayute fishing fleet in LaPush, WA and two fishing vessels from Port Angeles.

On the week of October 19, 2009, the US Coast guard, DOE, MSRC and OMA held a 24-hour Oil Spill HASWOPER class at the Makah Marina. Upon completion of this class six new local oil spill responders were recertified and six current local responders we were able to be certified. The Neah Bay Harbor Master coordinated with the US Coast Guard, DOE, ExxonMobil, MSRC, Global Diving, Blue Water, and Makah Employment Rights Office to provide an 8-hour HAZWOPPER refresher course in January 2010 (Appendix 2). The Harbor Master also coordinated with these groups to provide a 24-hour HAZWOPER class on April 19-21, 2011 (Appendix 3).

On August 16, 2009, MSRC, Port of Neah Bay and Vessels of Opportunity from the Makah Fishing fleet conducted an enhanced oil spill skimming exercise in the Strait of Juan de Fuca near the entrance to the Neah Bay Harbor. On October 14, 2010, an oil spill response training course for Vessels of Opportunity was offered in Neah Bay harbor (Figure 1). Three Makah Tribal fishing boats and crews were trained on the proper techniques of deploying booms and recovering oil with MSRC. Another Vessel of Opportunity Training for Makah fishing boats and crew is scheduled to take place in the Straits of Juan de Fuca on June 22, 2011. MSRC currently has five vessels from the Neah Bay fishing fleet under contract as "Vessels of Opportunity".

In addition the above Vessel of Opportunity training the Makah Harbor Master coordinated with MSRC and NRCES to provide oil spill response training for Makah Tribal members on 28 occasions over the period of this funding. During the Deepwater Horizon oil spill when spill response organizations were focusing on responding to the oil spill in the Gulf of Mexico, the Neah Bay Harbor Master and the Office of Marine Affairs worked closely with the NRCES, MSRC and DOE to assure that equipment and personnel were available for protection of the Cape Flattery area. The Harbor Master provided MSRC with trained responders to backfill local positions (Neah Bay & Port Angeles) vacated to the Deepwater Horizon response. This also provided local responders valuable on the job training.

Working with MSRC and the Environmental Services of National Spill Response Corporation (NRC), the Harbormaster continued providing training to local vessel operators and Tribal members. In addition to four tribal members responding with MSRC to DOE's oil spill preparedness drill of Tesoro's Port Angeles facilities, we coordinated training with MSRC on 12 occasions during January through June, 2010. We coordinated with NRC for four local responders to receive training of the OSRV NRC Cape Flattery oil spill response equipment on June 22, 2010.

The Harbor Master has also worked with the Makah Tribal Employment Office to host an annual Captain's License Training for local fishermen community members since 2008 (Figure 2). Three community members that are graduates of this class are now full time employees for MSRC in Neah Bay.

The Makah Marina currently completes daily reports that identify all vessels within the marina. This information is reviewed by the Harbor Master and is logged into documents to be used for identifying the availability of Vessels of Opportunity for spill response.

Figure 1. Photo showing the oil spill response training in Neah Bay harbor.

Figure 2. Annual Captain's License Training for local fishermen and community members.

Captain's License Training

USCG-Approved Professional Grade Instruction for your Six-Pack and Master 100 Ton Licenses

Makah Marina
Neah Bay, Washington

★ **Operator of Uninspected Passenger Vessel (6-Pack)**

November 9th - 18th, 2009 (except the weekend)
0800-1700 daily / $799 *

★ **Upgrade to Master 100 Ton Class**

November 19th - 21st, 2009
0800-1700 each day / $299 *

These courses thoroughly prepare mariners for all of the required USCG examinations. The tuition includes all study materials, supplies, and charts. All official exams are administered in class, so no further testing with the Coast Guard is required. The instructor is Captain Skip Anderson, USCG Licensed Master 1171259.

** For more information, call:*

Rosalee Jimmicum
Makah Employment & Contracting Rights Office
Makah Tribe
(360) 645-3101
mtctero@centurytel.net

** For more information or to register, call:*

CAPT Skip Anderson
Flagship Maritime Training
(253) 227-2003
info@flagshipmaritimetraining.com

www.flagshipmaritimetraining.com

Appendix-1:

Makah Tribal Fishing Vessel Response Program

Makah Office of Marine Affairs will develop and maintain a two tier Tribal Fishing Vessel Response Program (FVRP.) FVRP resources will be available to Federal, State, and Industry partners during oil spill responses or drills.

VESSELS

The FVRP will focus on identifying vessels meeting the following guidelines:

- Workboats (WB - 2 per WRRL) of a size capable of supporting a skimming system (due to size 50' – 75' these would therefore also be capable of GRP logistics support and ocean class boom towing).
- Workboats (WB-3 per WRRL) capable of towing boom for medium and smaller skimmers (due to size 26' - 35' would therefore also be capable of GRP support).
- Skiffs or beachable workboats (WB-4 per WRRL) for GRP work (may come with the larger workboats).

The FVRP will not include any vessels owned/operated by another WADOE approved Primary Response Contractor (PRC).

TIER 1 RESOURCES

Initially FVRP will recruit, contract with, and train (on an annually recurring basis) a Tier 1 "core" strike team of Non-dedicated Response Vessels (NRV) capable of deployment within 1 hour upon notification of a spill. These assets will be primarily available for oil spill responses or drills upon State & Federal waters from which Neah Bay would be the logical primary staging area.

Because these Tier 1 vessels may arrive in the early stages of a spill, their crews will be initially trained to a 24-hour HAZWOPER level and maintain a current 8 hour annual HAZWOPER refresher. Crews will be cleared for respirator use and participate in a medical monitoring program.

TIER 2 RESOURCES

FVRP will additionally recruit, contract with, and train a Tier 2 team of NRV capable of deployment within 24-48 hours of spill notification. These assets can serve as back-up resources for larger spills in the Tier 1 Area of Interest (AOI), or be deployed to assist in oil spills outside the Tier 1 AOI.

Tier 2 vessels are intended to arrive and work after the spill area has been approved for workers without respiratory protection. Crews will be initially trained to an 8-hour HAZWOPER level and may need an 8 hour annual HAZWOPER refresher prior to deployment. These crews will not participate in a medical monitoring program.

MANAGEMENT

A Response Coordinator will oversee day-to-day management of the FVRP, including vessel recruitment, operational/training aspects, and database management. During response operations, the Response Coordinator will manage FVRP assets. Duties include:

- Serving as the primary contact for entities requiring the services of, or participating in the FVRP;
- Overseeing and coordinating training activities with response partner organizations.
- Working with vessel owner/operators on contracts -both new contracts as well as routinely reviewing and updating NRV contracts for database updates;
- Performing initial and recurring surveys and documenting condition of NRV's participating in the program;
- Maintaining program records.

TRAINING

Per OSHA " Training Marine Oil Spill Response Workers Under OSHA'S Hazardous Waste Operations and Emergency Response Standard (2001)" Non-dedicated Response Vessel crews need a minimum 8-hour Hazwoper training, including those for "hot zone" work without respirators provided that site characterization has determined that respirators are not needed, and that the NRV's are at a safe distance from the source zone. Without respirators there is no requirement for medical monitoring.

Original and refresher training will be accomplished with the aid of response partner organizations, and will include classroom and hands-on training elements. FVRP will provide an 8-hour training prior to deployment if necessary for Tier 2 vessel crews.

AIR MONITORING EQUIPMENT

FVRP will maintain a cache of air monitoring instruments suitable for conducting initial spill site characterization by Tier 1 vessel crews if necessary.

PERSONAL PROTECTIVE EQUIPMENT

FVRP will maintain a PPE cache and additional PPE source methodology to support both Tier 1 and Tier 2 vessel crews.

Appendix-2:

8 HOUR HAZWOPER SCHEDULE
2010
Neah Bay 28 January
Forks 29 January

REFRESHER COURSE

0800	**Morning Session – Location:**	
0800	Check In, Introductions, Safety Brief & Course Summary	Scott Knutson/USCG
0810	Hazardous Communication	MST1 Michel Carreon/USCG
0910	Hazardous Recognition	MST2 Todd Manow /USCG
1010	Responder Health and Safety	Craig Cornell/MSRC
1040	Incident Command System (ICS) Overview	Terry Joslin/BlueWater
1110	OC National Marine Sanctuary Response Perspective	Liam Antrim/OCNMS
1140	Site Assessment and Air Monitoring	Jim Haugen/MSRC
1215	Lunch Break	
1300	Personal Protective Equipment	Jasmine Gonzales/Global Diving
1330	Decontamination Procedures	Jasmine Gonzales/Global Diving
1400	Response Trailer Overview & Inspection `	Dave Byers/Ecology
1500	Alternate Technologies	Tom Coolbaugh/ExxonMobil
1530	Spill Assessment	MST2 Kevin Mallick
1600	NW Response Community	Heather Parker/USCG
1630	Certificate Presentation	Craig Cornell/Scott Knutson

10 minute breaks will occur approximately hourly
Lunch break will occur from 1200 - 1300

Appendix-3:

24 Hour Oil Spill Responder Course Schedule

0800-1630 April 19-21, 2011

Day One GDS/MSRC (Classroom) 8 Hour Refresher

0800	Check In, Introductions, Safety Brief & Course Summary	MSRC
0810	Responder Health and Safety	MSRC
0900	Personal Protective Equipment	GDS, Gonzalez
1010	Hazardous Recognition	MSRC
1110	Shoreline Cleanup Overview	GDS, Gonzalez
1200-1230	Lunch Break	
1230	Decontamination Procedures	GDS, Gonzalez
1330	Boom & Sorbents	MSRC
1430	Shoreline Survey & Cleanup	Movie
1500	On Water Recovery	MSRC
1530	Incident Command System (ICS) Forms	MSRC

Day Two MSRC / NRC (Classroom & Field Activities)

0800-1630 FIELD ACTIVITIES **(APPROPRIATE Outdoor Clothing Needed)**

- Skimming Vessels & Workboats
  - Cape Flattery — NRC
  - FRV — NRC
  - Arctic Tern — MSRC
  - Loon — MSRC
- Portable Skimmers
  - Aquaguard RBS 5 — NRC
  - Drum Skimmer — NRC
  - Desmi 250 — NRC
  - Auklet — MSRC
- Boom Vane — USCG/MSRC
- Oil Snare Deployment — NRC
- Decontamination Station Set-up — NRC
- WADOE Trailer — MSRC
- Anchoring Systems — MSRC
- Boom Deployment — MSRC

Day Three USCG/WADOE/XOM/MSRC (Classroom)

0800	Site Assessment and Air Monitoring	MSRC
0900	Oil Chemistry	Exxonmobil, Coolbaugh

1000	Incident Command System	USCG
1100	Geographic Response Plans	WADOE, Byers
1200-1230	Lunch Break	
1230	Dispersants & In-Situ Burn	Exxonmobil, Coolbaugh
1330	Methamphetamine Awareness	WADOE
1430	NWACP	USCG
1500	State & Federal Regulations	WADOE/USCG
1600	Deepwater Horizon Overview	USCG
1630	Certificate Presentation	USCG