Skagit County Creosote Inventory and Removal Project: Phase I

Skagit County Marine Resources Committee

Final Report -- June 2005

Creosote Subcommittee

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Introduction

A large number of docks, trestles, marina structures, floats and bulkheads have been built in the waters of Puget Sound. Most of these structures have been built using a variety of treated woods, although the vast majority has used pressure-treated creosote pilings and timbers.

The term "creosote" as used in this report refers to a variety of products that are mixtures of many chemicals including wood creosote, coal tar creosote, coal tar and coal tar pitch. The most common form of creosote used in the U.S. is coal tar creosote. It is a thick, oily liquid that is typically amber to black in color and is a distillation of coal tar. Creosote pilings and timbers can contain almost 300 chemicals, many of which can be toxic to marine life and can cause abnormalities and death. Up to about 60% of the compounds in creosote solutions are polycyclic aromatic hydrocarbons (PAHs). Creosote-associated compounds can cause human health problems including skin rashes, chemical burns, eye irritation, mental confusion, and kidney and liver problems, even with relatively brief exposures. Longer exposures can cause unconsciousness and death, and some creosote compounds are known to be human carcinogens (http://www.nsc.org/library/chemical/Creosote.htm).

Research with Pacific herring (*Clupea pallasi*) has shown that egg hatching success is reduced by 50% at creosote concentrations of 50 parts per billion (ppb) and that hatching success is significantly reduced when embryos were exposed to 3 ppb (Vines et al. 2000). Fish studies summarized by Weis and Weis (1989) indicate that hatching success of several other fish species is adversely affected in pentachlorophenol (PCP – a primary ingredient in creosote) concentrations in the range of 10 to 200 ppb. Other authors have described the effects of a plethora of creosote-related contaminants in marine sediments and sea-surface microlayers to both adult fish and developing eggs (e.g., see Malins et al. 1984; Kocan et al. 1987; Hardy et al. 1987; PTI Environmental Services 1990; Misitano et al. 1994).

The newer generation of treated woods is primarily of two types: Ammoniacal copper zinc arsenate (ACZA) and chromated copper arsenate (CCA). These treated woods mostly contain metals that can be toxic to marine life in certain situations but these compounds do not generally pose bioaccumulation hazards that some creosote-related compounds might.

Creosote compounds and other wood preservatives continually drip or leach from treated wood used in marine and aquatic situations (Figs. 1 and 2). Treated wood is often eroded into smaller particles due to the abrasive action of boat traffic, storms and contact with shorelines when pilings break off. Some of these compounds can accumulate in marine

sediments where they can cause direct toxicity or they may be mobilized into higher trophic levels via the food chain. Other compounds can be leached into the surface microlayer where they can adversely affect floating fish eggs, invertebrate larvae and plankton. Forage fish feeding on these organisms may then accumulate some compounds from the microlayer and pass them to higher trophic levels (marine fish, sea birds, marine mammals, and humans). Contaminants found in the surface microlayer eventually are deposited on shorelines (the bath tub ring effect), which are rich in marine life, including surf smelt and sand lance eggs, molluscan shellfish, juvenile fish, and crustaceans of many species.

Given the hundreds of thousands of creosote-treated pilings and timbers used in Puget Sound waters, there is little doubt that this is one of many significant sources of non-point source pollution. Several Washington State agencies (e.g., WDFW, WDOE, WDNR, WDOT) now encourage the use of non-creosote containing pilings and timbers for both new and replacement purposes. WDOT is now in the process of replacing creosote pilings at most of its ferry terminals with concrete or steel pilings (see: http://www.wsdot.wa.gov/ferries/yourwsf/corporatecommunications/creosote).
Additionally, many creosote-treated wood products have ceased to function as they were intended but still leach toxic compounds into Puget Sound waters. These include rogue logs and timbers (those that have broken free and now reside on beaches) and derelict pilings (those still standing in place but that no longer serve a constructive function).

The fact that treated wood products contribute toxic compounds to sensitive parts of our marine environment (bottom sediments, surface microlayer, upper beaches important as spawning areas for forage fish) means that their removal improves estuarine habitats in two ways: 1) net gain in high value habitat and 2) increase in key marine indicator species (i.e., forage fish whose eggs may be adversely affected by toxic contaminants in spawning sand and gravel or in the surface microlayer).

Whatcom County, under the direction of Ms. Joni Cameron, has already accomplished removal of a substantial amount of treated wood products from their beaches in recent years. Skagit MRC's inventory and removal project was modeled after their successful efforts.

Methods

Treated Wood Inventory

Approximately 1/3 to 1/2 of Skagit County shorelines were surveyed by volunteers for treated wood products. Three volunteer recruitment and training meetings were held during the summer of 2004 on Samish Island, Guemes Island and in Anacortes. Volunteers were provided with information on the identification of various types of treated wood (creosote, ACZA, CCA) and given color shoreline maps (printed from the WDOE shoreline aerial photos web site [http://apps.ecy.wa.gov/shorephotos/]) for their respective portions of the county shorelines. The volunteers were instructed to survey

their beaches and record the locations, types and sizes of all treated wood products including wood lying on beaches or still in use. All photos and the resulting survey data were returned to Paul Dinnel for collation and analysis.

Treated Wood Removal Operations

Inventory data collected by the volunteers were used to prioritize locations for removal of treated wood products. The inventory data clearly showed locations where treated wood accumulated in high densities as a result of currents and proximity to sources. These sites were given highest priority for removal operations, which took place from November 2004 through June 2005. Prior to initiating any removal operations, a Joint Aquatic Resources Permit Application Form (JARPA) was completed and submitted to the appropiate regulatory agencies. Removal operations were subsequently conducted under the auspices of Hydraulic Project Approval (HPA) permit No. ST-G2735-01 issued by the Washington Department of Fish and Wildlife.

Two methods were used to remove treated wood from county beaches in 2004 and 2005. The first method used a small tug/barge/work skiff combination (Fig. 3) provided by a hired contractor (Dunlap Towing of La Conner, WA). Recovery operations targeted the highest daytime fall and winter high tides so that the tug could best approach the treated wood and pull it off the beaches. Removal was accomplished in the following way: two to five volunteers surveyed the beach ahead of the tug crew and marked each piece with a red flag or fluorescent orange paint (Fig. 4). The tug crew then fixed chokers around each piece and pulled it from the beach with the tug (Fig. 5). Once a dozen or so pieces were gathered by the tug, the pieces were then loaded onto the barge (Fig. 6). This operation was repeated until the barge was full (about 7-8 tons) upon which time the tug and barge returned to Dunlap Towing's log yard in La Conner to offload. Volunteers also assisted recovery by picking up smaller pieces of treated wood and carrying these to the barge or work skiff. Additionally, volunteers filled plastic bags with beach debris (mostly plastics) and recovered old tires for disposal (Fig. 7).

The second treated wood removal method relied on volunteers that hand-carried treated wood to a pick-up truck (Fig. 8). This method was used along the new Anacortes Thommy Thompson shoreline trail where pieces of old railroad ties remained following construction of the trail in 2004, and at Snee-osh Beach where someone had dumped many creosote log pieces on the beach. Some treated wood products were also removed from beaches adjacent to the Thommy Thompson Trail. These removal efforts required use of a truck to pull the pieces from the beach or cutting to manageable sizes with a chain saw (sawdust was collected with an underlying tarp).

All recovered treated wood products and old tires were stored at Dunlap Towing's log yard until disposal (Fig. 9). Disposal was accomplished by loading the treated wood and tires into large cargo containers (Fig. 10), which were then trucked to Bellingham. From Bellingham, the containers were transported by rail to the hazardous waste landfill site located at Roosevelt, WA.

Results

Volunteers and Community Education/Outreach

A total of 34 MRC and community volunteers assisted with the shorelines inventory and/or the treated wood removal operations. These volunteers accounted for a total of 532 hours (Table 1). This is in addition to the approximately 300 hours expended by the project contractor, Dunlap Towing. A Power Point presentation on treated wood products and the goals of the Skagit MRC creosote project was prepared and presented at various gathering (e.g., volunteer training meetings, Sound Waters Conference in Coupeville, Island Beach Watchers, Northwest Straits Commission) (Appendix 2). In addition, the project received media coverage in the Skagit Valley Herald, Anacortes American, Guemes Island Evening Star and the San Juan Preservation Trust newsletter (Appendix 3).

Treated Wood Inventory

Approximately ½ of Skagit County shorelines were surveyed for treated wood products in 2004-2005. Volunteers surveyed most of Samish Bay, Padilla Bay (in conjunction with Sharon Riggs of the Padilla Bay Reserve), all of the Swinomish Channel, Guemes, Hat, Saddlebag, Dot, and Huckleberry Islands, and the north end of Burrows Bay (Fig. 11).

The total number of treated wood pieces or structures observed within the 2004-2005 Skagit MRC inventory area (Table 2) was 40,478, which amounted to approximately 1,236,411 cubic feet. Approximately 62 %, in terms of number of pieces observed, were pilings, most of these still in use. However, the pilings amounted to approximately 91 % of the total in terms of cubic feet of treated wood. The number of logs (i.e., rogue pilings) washed up on beaches was 715, which equaled almost 10,000 cubic feet of treated wood (almost all creosote). The second most frequently observed form of treated wood was dimensional timbers, which accounted for 34 % and 6 % in terms of number of pieces and cubic feet, respectively. Most of these timbers were still in use on dock and trestle structures, although some were also found washed up on beaches. All inventory activities were conducted at essentially no cost using community volunteers. Detailed summaries of log, piling, timber and structure sizes may be found in Tables 3-5. A copy of the entire Phase 1 inventory on a beach-by-beach basis may be found in Appendix 4.

Treated Wood Removal Operations

Treated wood removal operations were conducted on 14 different days, although one day's operations had to be cancelled due to thick fog (Table 6). The project's contractor, Dunlap Towing, conducted tug/barge operations on 11 of those days and the other 3 days were spent cleaning up the Thommy Thompson Trail and Snee-osh Beach. The total number of hours spent on cleanup activities was 64 during which time multiple volunteers were involved.

Table 1. Creosote project volunteer names and hours.

Name	Hours
Paul Dinnel, Project Lead	
• Inventory	40
• Meetings	10
• Presentations	10
• Removal operations	64
• Data entry and analysis	56
• Final report preparation	45
Lisa Kaufman	11
Margaret Schwertner	14
Becky Jahnke	8
Dixon Elder	10
Will Stevens	8
Nate Schwark	6
Dean Doughtry	4
Melissa Blackburn	6
Robert Knowles	10
Paul Sund	12
Erica Pickett	19
Mary Brower	6
Vicki McNeil	5
Gordon James	16
Rick Haley	6
Lyndon Greene	6
Victor Garcia	9
Joost Businger	8
Russel Barsh	8
Charlie Look	3
Jean Baily	5
Cathy & Pat Tolman	10
Ivar Dolph	4
Neil Borman	8
Christine Woodward	12
Jim Carver	8
Charlie O'Hara	4
Jim Ramaliga & friend	6
Sherri Stites	8
Swinomish Tribal members	6
Dave from Los Alamos	1
Total volunteers hours =	**532**

Table 2. Summary of the number and cubic feet of treated wood inventoried on Skagit County shorelines in 2004-2005.

Wood Form	Number Observed	Total Cubic Feet
Beached logs	715	9,454
Pilings	25,219	1,131,642**
Piling stubs*	669	10,503
Dimensional timbers	13,860	78,922
Derelict structures	15	5,890
Total =	40,478	1,236,411

* Pilings cut off at the sediment surface. The number of cubic feet was derived by assuming that the average remaining piling depth in the sediment is 20 feet.

** Inventoried piling lengths were measured from the sediment surface upward. This amount corrects for the sub-sediment portion of the pilings and assumes the average piling depth is 20 feet.

Table 3. Lineal feet and volumes of treated wood logs on beaches and standing pilings inventoried along Skagit County shorelines during 2004 and 2005.

Logs on Beaches:

Diameter (inches)	Lineal Feet	Cubic Feet
6	122	24
8	314	110
10	226	124
12	2,231	1,753
14	1,465	1,566
16	509	711
18	532	941
20	110	239
24	512	1,610
30	426	2,091
36	40	286
	Total	9,455

Pilings:

Diameter (inches)	Lineal Feet	Cubic Feet
6	91	18
8	670	234
10	25,996	14,179
12	473,135	376,547
14	171,763	185,608
16	9,980	13,935
18	116,758	206,328
20	332	723
24	3,278	10,298
	Total	807,870

Table 4. Lineal feet and volumes of treated dimensional timbers on beaches and in use along Skagit County shorelines during 2004 and 2005.

Timber Dimensions (inches)	Lineal Feet	Cubic Feet
1 x 12	10	1
2 x 4	33	2
2 x 6	54	4
2 x 8	56,682	6,298
2 x 10	6,075	844
2 x 12	1,297	216
4 x 4	145	16
4 x 6	102	17
4 x 8	1,549	344
4 x 10	8,034	2,232
1 x 12	4,200	1,400
4 x 16	12	5
5 x 5	300	52
6 x 6	99	25
6 x 8	81,680	28,227
6 x 10	25	10
6 x 12	25	12
8 x 8	1,609	715
8 x 10	1,908	1,449
8 x 12	24,061	16,040
8 x 16	19	17
10 x 10	5,445	3,781
10 x 16	20	22
10 x 40	60	167
12 x 12	5,885	5,885
12 x 16	27	36
12 x 18	7	10
12 x 24	6	12
16 x 16	6,147	10,928
16 x 32	120	427
18 x 18	3	7
18 x 24	36	108
	Total	79,309

Table 5. Lineal feet and volumes of derelict structures lying on beaches and in use along Skagit County shorelines during 2004 and 2005.

Structure #	Dimensions	Cubic Feet
1	20' x 60' x 2"	200
2	18' x 6' x 2"	18
3	10' x 8" dia.	4
4	11.5' x 1' x 4"	4
5	300' x 16' x 2"	800
6	132' x 8' x 3'	3,168
7	12' x 6' x 2"	12
8	10' x 10' x 2"	17
9	~1,000 pounds	25
10	19' x 6' x 5'	570
11	~1,000 pounds	25
12	45' x 3' x 1'	135
13	1,730 square feet	288
14	3,750 square feet	625
15	Unknown	Unknown
	Total	5,891

Table 6. Summary of wood removal operation's dates, hours and locations.

Date	Location	Number of Hours*
11-3-04	Southwast shore Guemes Island	6
11-4-04	Southwast shore of Guemes Island	5
11-5-04	Fidalgo Bay	6
11-8-04	Cancelled – fog too thick	1
11-9-04	South shore Guemes Island	5
11-18-04	Southeast shore Guemes Island	4
11-19-04	Swinomish Channel	6
12-21-04	Swinomish Channel	4
3-7-05	East Guemes Island, Huckleberry Island, Hat Island	5
3-8-05	Hat Island, Saddlebag Island and East Guemes Island	5
3-9-05	North Guemes Island	7
3-17-05	Thommy Thompson Trail	3
3-25-05	Thommy Thompson Trail	3
6-21-05	Thommy Thompson Trail	3
6-21-05	Snee-osh Beach	1
	Total field hours =	**64**

* Number of field hours for volunteers. The number of contractor hours is greater due to running and unloading times.

Table 7. Summary of treated wood products removed along Skagit County shorelines in 2004-2005.

Project	Treated Wood Removed
Cap Sante Marina (Port of Anacortes)	145.5 tons
Guemes Island Ferry Docks (Skagit County)	About 60 pilings
Thommy Thompson Trail (City of Anacortes)	About 3,700 railroad ties
Skagit Marine Resources Committee	75.1 tons
Swinomish Spit (Padilla Bay Reserve)*	19.9 tons
Sullivan Minor Marsh (Padilla Bay Reserve)**	???

*Riggs 2004
**Riggs 2005

The total amount of treated wood removed by the Skagit MRC project was 75.1 tons. About ten tons of treated wood was recovered from the Tommy Thompson trail and from one location at Snee-osh Beach. The remainder (~65 tons) was removed from the shorelines of Guemes Island, Hat Island, Saddlebag Island, Huckleberry Island, Fidalgo Bay and Swinomish Spit. The cost to remove the treated wood was in the $400 to $500/ton range, which included actual removal, trucking, rail transport and all disposal fees. In addition to treated wood removal, volunteers also recovered approximately 100 large bags of beach debris (mostly plastics) and about 50 tires.

Discussion

This project successfully used community volunteers to inventory treated wood products on county shorelines and a local contractor to remove beached logs and timbers. The use of a small tug/barge/work skiff combination during periods of high daytime tides proved to be very efficient. This is especially true since most of shorelines had very little access from uplands and we targeted the beaches with the highest densities of treated wood products. The cost of recovery by this method will increase somewhat as the density of treated wood decreases, but most county shorelines have little access other than by boat. Removal of treated wood from some areas (e.g., extensive marsh areas more than about 100 meters from a navigation channel) will require removal by hand or by helicopter, as was accomplished by Riggs (2004) at two locations in Padilla Bay.

Five other projects in Skagit County were responsible for additional removals of treated wood in or near county shorelines in 2004-2005 (Table 7). However, a vast amount of treated wood is still in use in county marine waters, primarily in the form of docks, trestles, bulkheads and marina structures. Some of these pilings/structures are derelict (standing but no longer in use) and could be removed. Most other pilings and structures are still in use and should eventually be replaced with non-toxic alternatives such as steel, concrete or plastics (e.g., plastic pilings, lumber and railroad ties made from recycled plastic – see http://www.plasticpilings.com/ for examples).

Washington State might wish to consider a legislative ban on the manufacture and use of creosote, or at least a tax on the industry to assist with public cleanup efforts. Such a ban now exists in about 40 countries around the world, including all of the European Union countries that banned the sale and use of creosote in June 2003. A substantial number of alternatives to using creosote-treated wood now exist and the overall costs of using non-toxic alternatives (steel, concrete, plastics) is considered to be less than for creosote because of greater material life expectancies.

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APPENDIX 1

Commitment to Excellence Certificate
From Washington Department of Natural Resources

APPENDIX 2

Creosote Project Power Point Presentation

APPENDIX 3

Project Media Coverage

APPENDIX 4

Phase I Treated Wood Inventory

(See Figure 11 – The inventory starts at the Skagit-Whatcom County line and proceeds southward)