Creosote Evaluation: Phase II
Sooke Basin Study - Baseline to 535 Days Post Construction
1995-1996

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ABSTRACT

A jointly sponsored study by Environment Canada, Fisheries and Oceans, the Province of British Columbia and the wood treatment industry was undertaken in Sooke Basin, Vancouver Island to evaluate the impact of creosote treated wood on the marine environment. The primary purpose of this study was to provide a scientific basis for establishing guidelines on the use and placement of creosote treated wood in sensitive marine aquatic habitats under 'worst case' conditions. The study focused on the chemical and biological effects from newly installed six-piling dolphins constructed with used pilings treated by conventional methods and pilings freshly treated with techniques designed to produce a cleaner and more environmentally sensitive product by placing them in a natural undisturbed location, free from outside sources of contamination.

After careful site selection and thorough examination of the baseline conditions, a series of precisely spaced benthic sediment samples were collected by divers to determine spatial and temporal changes in PAH chemistry, sediment toxicity and benthic infaunal community structure following piling installation. Observations on growth, survival, tissue PAH concentration, spawning success and larval development in caged mussels, along with the mechanism behind creosote transport were also conducted.

This report presents results obtained over a one year period followed by additional limited sampling 535 days after piling construction. During this period, significant PAH contamination occurred within an area of 7.5 metres downstream from the creosote treated structure. Significant biological effects were confined to a distance of 0.65 metres from the perimeter of the dolphin structure. Slight adverse effects were observed to a distance of 2.0 metres in laboratory sediment toxicity tests, but not to the benthic infaunal community structure. Observed sediment PAH concentrations are predicted to increase by an additional 18% before reaching their maximum at about three years post construction. Contamination of the benthic sediment occurred mainly as minute creosote droplets which appeared shortly after piling installation and present throughout the study resulting in a variable and uneven distribution pattern. This patchy distribution pattern has a direct bearing on sampling techniques and understanding the 'real world' impact of creosote on the marine environment.

The information contained in this report is being used to develop regional guidelines on the use of creosote treated wood and providing input into developing strategic options for the use of heavy duty wood preservatives under the Canadian Environmental Protection Act.

Keywords: Creosote Evaluation; creosote; polycyclic aromatic hydrocarbons; PAH, Sooke Basin, Vancouver Island, B.C.

RESUME

Une étude conjointement parrainée par le Ministère de l'Environnement du Canada, le Ministère des Pêcheries et des Océans, la Province de la Colombie Britannique et l'industrie de traitement du bois a été entreprise à Sooke Basin sur Vancouver Island, pour évaluer l'impact du traitement du bois à la créosote sur l'environnement marin. Le but principal de cet étude est de fournir une base scientifique pour établir des directives quant à l'usage et au placement du bois traité à la créosote dans des habitats aquatiques marins sensibles dans les pires conditions. L'étude s'est concentrée sur les effets chimiques et biologiques de piles de six dauphins nouvellement installées construites d'une part avec du bois usagé traité de la manière conventionelle et d'autre part avec du bois récemment traité avec des techniques qui produisent un produit plus propre et non polluant. Ces piles ont été placées dans un lieu naturel et tranquille qui ne contient pas de sources de contaminations de l'extérieur.

Le site ayant été soigneusement choisi et les conditions de base ayant été minutieusement examinées, une série d'échantillons sédimentaires espacés de manière précise, ont été prélevés pour déterminer les changements spatiaux et temporels de la chimie du *PAH*, de la toxicité du sédiment et la structure communautaire du *benthic infaunal* à la suite de l'installation des piles. Nous avons également dirigé des observations de la croissance, de la survie, de la concentration *PAH* des tissus, du succés de la ponte des œufs et du developpement des larves de moules en cages, ainsi que du mécanisme du transport de la créosote.

Ce rapport présente les résultats obtenus durant une période d'un an suivi d'échantillons limités supplémentaires relevés pendant les 535 jours suivant la construction des piles. Pendant cette période, une contamination *PAH* considérable s'est produite sur une surface de 7.5 mètres en aval de la structure traitée à la créosote. Les effets biologiques considérables étaient confinés à un espace de 0.65 mètres du périmètre de la structure du dauphin. De légers effets défavorables ont été observés jusqu'à une distance de 2.0 mètres dans les tests de laboratoire de la toxicité des sédiments, mais pas dans les tests du *bethnic infaunal* de la structure communautaire. La concentration sédimentaire du *PAH* est prévue d'augmenter de 18% de plus avant d'atteindre son maximum environ trois ans aprés la construction. La contamination du sédiment *benthic* s'est produit principalement sous forme de minuscules gouttelettes de créosote qui sont apparues peu aprés l'installation des piles et sont restées présentes pendant la durée de l'étude ce qui a eu pour résultat un motif de la distribution variable et irrégulier. Le motif de distribution inégal a un effet direct sur la technique d'échantillonage et sur la compréhention de l'impact réel de la créosote sur l'environnement marin.

Les informations contenues dans ce rapport sont utilisées pour élaborer des directives/politiques concernant l'utilisation du bois traité à la créosote dans les milieux aquatiques et des stratégies nationales possibles pour l'utilisation d'agents conservateurs du bois haute performance dans le cadre de la loi canadienne sur la protection de l'environnement.

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TABLE OF CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

Creosote, a distillate of coal tar, has been used for over a century as a wood preservative. It is widely used throughout North America in the construction of piers, wharves and other maritime structures for protection against attack by marine borers, greatly extending their service life, up to 75 years or more. Growing evidence on the environmental effects of certain chemical constituents in creosote, particularly the PAHs has led to the need for guidelines and policies governing the use and placement of creosote treated wood in sensitive aquatic habitats along the British Columbia coast. These recommendations must be based on sound scientific data. Despite it's long term use, very little field information is available in the open literature on the release and environmental impacts associated with creosote treated wood.

The major constituents of creosote are the polycyclic aromatic hydrocarbons or PAHs. Estimates of the PAH composition in creosote range from 45 to 85%. The high molecular weight PAHs can be very persistent in the environment and are known to produce both acute and chronic toxicity in aquatic species at sufficiently high concentrations. Low molecular weight PAH compounds are generally the more acutely toxic form, but, certain high molecular weight compounds, or more specifically their metabolites, can be carcinogenic. Other chronic effects, such as impaired immune function, lower survival and reproductive rates and certain biochemical responses have also been demonstrated in juvenile Chinook salmon and other marine fish species exposed to PAH contaminated environments.

In 1994, preliminary studies (Phase I) were undertaken at a marine location in the Lower Mainland, Belcarra Bay at the eastern end of Burrard Inlet (Vancouver Harbour) and an estuarine site in the lower Fraser River estuary on Westham Island, each with existing creosote treated structures. The purpose was to determine the effects of these structures on surrounding sediments and provide a measure of biological effect using sediment toxicity. Results from Belcarra Bay showed the presence of elevated PAH concentrations in the vicinity of the wharf pilings and a mixture of toxic responses. Some sampling locations exceeded toxic thresholds for PAHs and Sediment Quality Objectives previously established for Burrard Inlet. Nearby sources of PAHs and variations in the sediment physical/chemical characteristics, however, precluded making any direct link between creosote treated wood and it's contribution to the total chemical and toxicological conditions at the site. Significantly elevated concentrations of PAH were not detected at the Westham Island site and toxicity was not observed in laboratory bioassays.

In 1995, a second field study was undertaken in a relatively undisturbed location in Sooke Basin, Vancouver Island. This site was carefully chosen to meet a number of site selection criteria to ensure low background PAH levels, minimal exposure to external sources of contamination and uniformity in sediment and oceanographic conditions throughout the test area. An artificial source of creosote was provided by installing two six-piling dolphins. One was constructed with freshly treated pilings using the industry sponsored Best Management Practices (BMPs) developed to minimize potential adverse effects on aquatic environments and, one was constructed with weathered or used pilings which are often used as an alternative to reduce environmental risk. A third dolphin constructed with untreated Douglas fir pilings and an open control with no structure present were used for controls. Sampling was conducted by divers to

ensure precise measurements over time and distance. The focus of this study was directed primarily on determining effects from BMP treated wood in the biologically active upper two centimetres.

Key endpoints in the study were spatial and temporal changes in:

a) surficial (0-2 cm) sediment chemistry using parental PAH concentrations and to a lesser extent, the alkylated PAH and dibenzofuran concentrations as chemical markers,

b) surface sediment toxicity using 10-day amphipod bioassays, liquid and solid phase Microtox™ and pore water echinoid fertilization inhibition tests,

c) *in situ* mussel assays using growth, survival, spawning success, larval development, condition and tissue PAH body burden,

d) benthic infaunal community structure.

Highlights of the study after an exposure period of 535 days were:

- creosote contamination likely occurs as minute tar droplets or microsheens within surface and subsurface layers in the benthic sediments and surface water with no observable impact on the remainder of the water column. The apparent particulate nature of creosote transport leads to a patchy distribution and a high degree of intra sample variability,

- elevated PAH levels appeared shortly after piling installation due, in part, to pile driving operations and continued to increase in concentration and distance with time,

- observed and predicted total sedimented PAH concentration after 384 days post construction were significantly elevated to a distance of 7.5 metres downstream from the BMP treatment site, but not 10 metres and beyond. Small, but not biologically significant increases occurred downstream to a distance of 50 metres,

- observed sediment PAH concentrations are estimated to increase by an additional 18% before reaching their maximum at about three years post construction,

- the proportion of PAH compounds in the benthic sediment consisted initially of equal portions of low molecular weight PAH (LPAH) and high molecular weight PAH (HPAH) compounds, changing to 80% HPAH and 20% LPAH after 384 days exposure, consistent with their physiochemical properties and degradation rates. No substantive differences in the chemical and biological impact between the BMP and the Weathered pilings dolphins were observed,

- multi-tiered toxicity tests and infaunal community assessment indicated that toxic responses can be anticipated at distances of 0.65 metres or less from the piling dolphins after 384 days, with equivocal evidence marginal toxicity to a distance of 2.0 metres,

- since creosote contamination in the bottom sediments occurs unevenly and PAH concentrations decline exponentially with core depth, when matching chemistry to toxicity samples should be thoroughly mixed beforehand and extracted from exactly the same sample, preferably using material only from the top 2 centimetre layer,

- no adverse effects on mussel, *Mytilus edulis edulis* survival, spawning success or larval development were observed. Only minimal responses were observed in total body burden PAH levels and growth,

- significant responses were not observed in the benthic community structure, probably due, in part, to the patchy distribution pattern of creosote in the bottom sediments, allowing for the coexistence with elevated PAH concentrations and toxic sediments as determined by laboratory bioassays,

- management of creosote treated wood in marine environments and relationships to various toxic thresholds and Canadian and US sediment quality criteria are discussed. Since results indicate that, within the time frame of this study, adverse effects can occur in the near field under worst case conditions, site specific risk assessments based on the specific mass of creosote treated wood under consideration are recommended.

While the chemical effects observed during this study were confined to a distance of 7.5 metres or less and biological effects were confirmed only at distances less than 0.65 metres, it is important to note that detailed measurements were taken over a period of slightly more than one year, with limited additional sampling on Day 535. Sedimented PAH levels are predicted to increase an additional 18 percent at their peak in approximately 1,000 days following construction, after which time they are predicted to decline. Additional chemical and biological sampling is strongly recommended to determine when the maximum PAH concentrations are reached, over what area they occur, and their relationship to model predictions. Further evaluation of the mechanism behind the release of creosote from treated wood and follow-up studies upon removal of the pilings are also warranted. The site is available for additional studies to determine the chronic or sublethal effects associated with exposure to creosote treated wood which were not fully examined during the present study.

This study has shown that under worst case conditions, significant PAH contamination was restricted to an area within 7.5 metres from the perimeter of a significant structure over a 384 day exposure period. The response of an extensive infaunal community analysis and laboratory bioassays indicates that significant adverse biological effects were found within a

distance of approximately 0.65 metres from the perimeter of the structure. Slight adverse effects were observed to a distance of 2.0 metres in laboratory bioassays but not in the infaunal community.

Although this study was designed to represent ‘worst case’ conditions as closely as possible, site specific characteristics and the quantity of creosote treated wood present need to be considered when applying these data to other situations. It appears that existing models are somewhat conservative from the environmental viewpoint. These risk assessment models provide a means of evaluating site specific projects and should be undertaken.

The information contained in this report is being used to develop regional guidelines on the use of creosote treated wood and providing input into developing strategic options for the use of heavy duty wood preservatives under the Canadian Environmental Protection Act.

1.0 Introduction

Creosote treated piling has been used for centuries in the construction of piers, wharves and docks. In marine environments, if left untreated, wood is rapidly destroyed by marine borers. Two principal borers on the B.C. coast are molluscan teredos (e.g. *Bankia setacea*) and the isopod crustacean (*Limnoria sp.*), commonly known as gribbles (Quayle, 1992). One of the most common methods of protection against marine borer attack is to impregnate wood with creosote, a practice that has been used for over a century.

Creosote, a distillate of coal tar obtained after high temperature carbonization of bituminous coal, has been widely used throughout North America. In marine environments, creosote treated wood is the preferred preservative used for pilings, timbers, and decking in piers and floating wharves. Use of creosote greatly extends wood's service life (up to 75 years or more) and is the most common form of protection against marine borers. Piles and timbers are generally treated with a 100% creosote solution. In 1990, the annual production volume in Canada for marine pilings and timbers was estimated at 34,000 m^3 (Konasewich *et al.*, 1992; EVS, 1994a). The total volume 'in service' in Canada in 1990 was estimated at 2.33×10^6 m^3. The predominant use of creosote treated wood in Canada between 1989 and 1990 included railway ties (60.8%); marine pilings/timbers and bridge timber/decking (35.3%) and other uses (e.g. utility poles) at 3.9%. A 1995 survey of pesticide use in British Columbia shows an increase in the use of creosote from 2.2×10^6 kg in 1991 to 5.9×10^6 kg in 1995 (FRAP, 1997). Large year to year fluctuations in usage, however, are not unusual. In 1995, creosote accounted for 67.7% of the top 20 pesticides (excluding domestic pesticides) sold or used in B.C.

Widespread use of creosote treated wood in coastal regions throughout B.C., and increasing knowledge of the environmental effects of various chemical constituents found in creosote, have raised concern regarding the potential environmental impacts, particularly when placed in sensitive marine habitats.

Creosote contains a complex mixture of chemical compounds and its composition can vary depending upon such factors as the kind of coal used, the initial coking temperature and the amount of exposure received by the treated wood. Polycyclic aromatic hydrocarbons (PAH) are a major constituent of creosote. Neff (1979) found that coal tar contained 44.4% PAH. Ingram *et al.*, 1982 estimated that 50 to 65% of creosote was composed of PAH. Mueller *et al.*, (1989) estimated that creosote consists of approximately 85% PAH, 10% phenolic compounds and 5% N-,S-, and O-heterocyclics. More recently, Environment Canada (1992) reported a comprehensive analysis of the composition of creosote and estimated that marine grade creosote has a total PAH content of 80.2%. The biological effects from PAHs in the marine environment have been documented by Malins *et al.*, (1985); Varanasi *et al.*, (1989) and Johnson *et al.*, (1994). Their initial research was conducted on creosote contaminated sediments associated with Eagle Harbor, Washington, site of a creosote treatment plant. Polycyclic aromatic hydrocarbons can be acutely toxic, as well as associated with altered immune function and biochemical changes in juvenile Chinook salmon (Varanasi *et al.*, 1993), impaired reproduction, biochemical changes, and presence of hepatic lesions in flatfish (Myers *et al.*, 1987).

Polycyclic aromatic hydrocarbons are generally classified into two groups: low molecular weight compounds (LPAH) with three or fewer benzene rings (e.g. naphthalene, phenanthrene,

acenaphthene), and high molecular weight compounds (HPAH) with four or more rings. Polycyclic aromatic hydrocarbons are hydrophobic in nature and their water solubility varies inversely with their molecular weight (Neff, 1979). The LPAH compounds tend to be less persistent in aquatic environments. Because of their higher solubility, LPAH are more bioavailable than the heavier weight compounds and therefore more acutely toxic than the HPAH. The HPAH compounds have very low solubility and are more resistant to degradation (Neff, 1979). Several of the high molecular weight compounds, such as benzo(a)pyrene, have carcinogenic intermediate metabolites, which can cause various biochemical and pathological responses in aquatic organisms, particularly fish. Exposure to PAH can be assessed by analysis of bile for intermediate metabolites. The presence of preneoplastic and neoplastic lesions in the liver of fish exposed to high concentrations of PAH has been demonstrated by Myers *et al.,* (1987) and Johnson *et al*., (1994). Neoplastic lesions appear well correlated with PAH concentrations in heavily contaminated sediments. Prevalences of pre-neoplastic and neoplastic liver lesions ranging between 59% and 75% were found in adult English sole from Port Moody Arm, an area of Vancouver Harbour, British Columbia exposed to refinery and various other urban/industrial discharges (Goyette *et al*., 1987). Sedimented PAH concentrations in Port Moody Arm during that period were between 2.9 µg/g and 37 µg/g, dry weight total PAH (Goyette and Boyd, 1989). Johnson, *et al.,* (1997) reported early sexual maturation in English sole exposed to both chlorinated hydrocarbons and PAHs. Vines *et al.* (1997), in both laboratory and natural settings, report degenerative effects and delays in overall development of herring larvae exposed to creosote treated wood. Biochemical changes, PAH metabolizing enzyme induction and the presence of pre-neoplastic lesions and cellular irregularities have been observed in fish collected in areas with total PAH levels as low as 1 µg/g sediment (dry weight). However, these same effects are not seen in other areas where PAH levels are higher, at several µg/g (dry sediment weight). Positive correlations tend to break down at PAH levels less than 10 to 15 µg/g (dry sediment weight). To summarize, the presence of lesions in the livers of fish are well correlated with concentrations of sedimented PAH at levels exceeding 10 to 15 µg/g. Enzyme response to PAH levels of one to two µg/g are well documented, but the correlation between liver disease and sedimented PAH is generally not significant at less than 10 to 15 µg/g.

Concern over the use of creosote impregnated wood for marine applications throughout B.C. prompted the need for development of policy guidelines for the placement and use of creosote treated wood, particularly in sensitive marine habitats. In 1994, the Canadian government established a *Creosote Evaluation Steering Committee* with the following participation:

Environment Canada (DOE), Commercial Chemicals Division, Environmental Protection Branch, Pacific & Yukon Region, (D. Goyette).
Department of Fisheries and Oceans (DFO)
Habitat & Enhancement Branch, (K. Hutton).
Small Craft Harbours Branch, (T. Appleton).
B.C. Ministry of Environment, Lands and Parks (BCMELP)
Water Management Branch, Standards and Protocol Unit, (N. Nagpal).
Canadian Institute of Treated Wood (CITW), Ottawa, Ontario, (H. Walthert).
Aquatic Environmental Sciences (AES) Consultant to CITW, (K. Brooks).

An initial review (EVS, 1994a) indicated that, despite its long use, information on the fate and effects of creosote treated wood on aquatic environments was limited. The committee then

determined that it required a better understanding of the spatial and temporal effects associated with the use of treated wood before appropriate policy could be developed. In particular, these early deliberations indicated a need to examine the effects of creosote directly in the field where as many of the physical and chemical characteristics could be selected or determined beforehand, without interference from external sources of PAH contamination.

To minimize the amount of wood preservative lost to aquatic environments, the Canadian and U.S. wood treating industry have developed a set of Best Management Practices (BMP's) for a number of wood preservatives, including creosote (CITW and WWPI, 1997). The goal of the BMP's is to reduce the environmental risks associated with these products. A copy of the Canadian version (January, 1997) of the creosote BMP's is located in Appendix I, for reference. The BMP's require the use of "clean" creosote in a process designed to reduce surface residues of tar and creosote and to reduce the amount of creosote available to migrate from the interior wood cells to the surface of the wood where it is available to the environment.

1.1 Phase I Studies

Following the literature review in 1994, Environment Canada and the Department of Fisheries and Oceans, through the Fraser River Estuary Management Program, undertook a field sampling program (Phase I) to investigate the level of PAH contamination and sediment toxicity at two coastal sites with existing creosote treated structures (EVS, 1994b). A marine site in Belcarra Bay, at the eastern end of Burrard Inlet (Vancouver Harbour) and an estuarine site on Westham Island in the lower Fraser River were selected as test sites. Ages of the pilings were estimated to be less than five years old at the Belcarra Bay site and greater than eight years old at the Westham Island site.

Results from the Phase I studies indicated that surface sediment total PAH[1] concentrations (sum of 16 EPA priority PAH) in the immediate vicinity of the piling at the Westham Island site were low, ranging from 0.2 to 0.51 μg/g (dry sediment weight). At the Belcarra Bay site, total PAH concentrations in the top two centimetres of the sediment surface ranged from <0.02 μg/g at a distance of 40 m from a creosote treated pier, to a maximum of 19.7 $\pm$ 12.9 μg/g within 3 metres of the pilings. The highest of these concentrations exceeded the Puget Sound Apparent Effects Thresholds, and total PAH at five of the eight stations exceeded the Water Quality Objectives established for Burrard Inlet at 1.7 μg/g total PAH (BC Environment, 1990).

Sediments from all of the Westham Island stations were judged nontoxic using either pore water or solid phase Microtox™ tests on whole grab samples taken by a petite ponar grab. Mean percent survival of *Eohaustorius estuarius* in toxicity tests at the eight Westham Island Bridge stations was 94 to 99%. No toxic responses were observed. Of the eight Belcarra Bay stations, station BB-3, closest to the pilings, was considered toxic by the Microtox™ pore water test. The solid phase Microtox™ test at this station suggested moderate toxicity (0.11%

[1] EPA Priority PAHs
Naphthelene Acenaphthylene Acenapthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Benz(a)anthracene Chrysene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Dibenz(a,h)anthracene Benzo(ghi)perylene Indeno(1,2,3-cd)pyrene

sediment). Survival of *Eohaustorius estuarius* at station BB-3 was significantly lower (72 ± 11%) but not toxic when compared to the control sediment survival (96 ±4%). Sediments from Belcarra Bay station BB-2A-E were toxic (49±22% survival) to the amphipod (*Eohaustorius estuarius*). The pore water test at this station was not toxic and the solid phase test showed moderate toxicity (0.479% sediment). The six other stations at Belcarra Bay were not toxic in any bioassay (EVS, 1994b). In summary, toxicity was not demonstrated in any of the Westham Island sample stations. Sediment from two stations at Belcarra Bay created mixed toxic responses. Pore water from BB-3 was toxic to the bacterium *Vibrio fischeri* (formerly *Photobacterium phosphoreum*) and the solid phase test was moderately toxic. The amphipod test was non-toxic at this station giving mixed results. Sediments at all stations in Belcarra Bay, including the reference station, exceeded British Columbia sediment quality criteria (Nagpal, 1994) for benzo(a)pyrene, chrysene and naphthalene. In addition, the mean fluoranthene concentration in sediments from Belcarra Bay station BB-3 (4.77 µg/g) exceeded the B.C. sediment quality criteria. All other compounds were below B.C. criteria at all other stations. Only fluoranthene at Belcarra Bay station BB-3 exceeded Washington State Sediment Quality Criteria (WAC 173-204).

The test results from Westham Island suggested no adverse effects associated with the presence of a large number of creosote treated wood piling. The effect of river currents and shifting sediments were not evaluated. However, much higher levels of PAH were observed at Belcarra with mixed toxicity results at those stations with highest PAH concentrations. The results at Belcarra Bay are confounded by highly variable total organic carbon in the sediments (0.15 to 3.07%), the presence of several nearby petroleum refineries and the popularity of this site for recreational boaters. An unscheduled QA/QC check on two replicate samples from one station in Belcarra Bay also produced significantly lower results (6.5 µg/g sediment dry weight versus an original evaluation of 37.6 µg/g). This may have been due to poor sample homogeneity or possible differences in the laboratory technique (HPLC vs. GC/MS). However, this result raised questions concerning the exact nature and source of the PAH contamination.

1.2 Phase II Studies.

Phase I studies indicated that, under some circumstances, the use of creosote treated wood in sensitive marine environments could lead to accumulations of PAH in sediments that exceed regulatory thresholds (e.g. fluoranthene at BB-3) and could result in mixed evidence of toxicity. In addition, the lack of literature or data describing the environmental effects associated with the use of creosote treated wood products, particularly from direct field measurements, indicated the need for further study to quantify, under carefully controlled field conditions, the environmental response to the use of this product.

In 1995, Environment Canada (EC), the Department of Fisheries and Oceans (DFO), the provincial Ministry of Environment (BCE), with support from the Canadian Institute of Treated Wood (CITW) and the U.S. Creosote Council II, initiated a Phase II study to examine the temporal and spatial effects of creosote treated wood. A BACT design (Before-After-Control-Treatment) was chosen (Appendix II). The study relies on careful selection of a worst case study site characterized by relatively low sediment TOC, minimal tidal currents and a diverse and abundant infaunal community. In addition, a requirement for low background and minimal other

sources of PAH was imposed. Specific criteria were developed to optimize the potential for observing the biological and chemical effects associated with creosote treated wood.

Treatments included the use of new pilings, freshly treated using industry developed *Best Management Practices* (BMP's), weathered piling (WP) previously immersed for a minimum of five years, and untreated piling serving as a mechanical control (MC) for benthic infaunal community analysis. Six of each piling type were driven in a small area to produce a dense cluster of pilings typical of commercial dolphins.

1.3 Purpose and Scope.

The purpose of the Phase II studies was to measure the spatial and temporal chemical and biological changes in benthic sediments and the water column surrounding each of the three dolphins previously described over a period of one or more years. This information is considered essential to the development of scientifically defensible guidelines and protocols for the installation and use of creosote treated wood in sensitive marine environments. This study evaluated the following endpoints:

- Baseline site characterization including measurement of sediment total organic carbon, grain size, background PAH, benthic infauna and water temperature, salinity, current profile, total suspended solids and total volatile solids,
- Sedimented parental and alkylated PAH on upstream and downstream transects as a function of time and distance from the various treatments,
- Water column concentrations of parental PAH as a function of distance from the various treatments,
- Infaunal community response as a function of time and distance from the treatments
- Mussel (*Mytilus edulis edulis*) survival, growth, PAH accumulation, PAH partitioning in gonadal and non-gonadal tissues and reproductive bioassays as a function of treatment and distance from the dolphin,
- A suite of laboratory bioassays using pore water and solid phase Microtox™, echinoid fertilization inhibition and amphipod survival using *Rhepoxynius abronius* and *Eohaustorius washingtonianus*.

This report presents the results of the baseline survey and data collected over a period of 535 days between October 1995 and April 1997 following installation of three individual, six piling, dolphins constructed of:

a. freshly treated BMP Douglas fir pilings (**BMP site**)
b. weathered Douglas fir pilings treated using 'conventional' procedures (**WP site**) and;
c. untreated Douglas fir pilings serving as a mechanical control for the infaunal community analyses and bioassay tests (**MC site**).
d. an open control, lacking any piling structure, for comparing the physical effects of the structures and/or chemical treatments (**OC site**).

2.0 SITE SELECTION.

Site selection was accomplished during the winter of 1995. The following site selection criteria were evaluated at 21 sampling sites located in 13 areas within the lower Georgia Strait, along Vancouver Island and in the Gulf Islands:

- background sum of 16 priority parental or unsubstituted PAH < 1.0 μg/g (dry sediment weight),
- minimum of 40% sediment grain size <63 microns (silt, clay),
- uniform sediment grain size distribution throughout a test area and sufficient size to accommodate all three test dolphins and an open control with minimal interference between sites,
- current speeds < 5 cm/sec,
- no significant intrusions of fresh water and minimal salinity variation (26 – 32 ppt maximum range),
- sediment total organic carbon <1.0%,
- water depth sufficient to immerse piling a minimum of 3 metres during low tide,
- redox potential discontinuity >3.0 cm,
- diverse and abundant benthic infaunal/epifaunal invertebrate community,
- accessible and secure with minimal recreational or commercial use of the surrounding area.

Sediment samples from Howe Sound (Port Graves and Center Bay, Gambier Island) and Sechelt Inlet (Storm Bay, Snake Bay and Rivtow site) were collected between January and March 1995 using a small boat. For the other areas, sampling was done from a float plane in March 1995, using a small hand held petite ponar grab. Chemical and physical data for each of the candidate sites are described in Goyette (1995). Although not meeting every criteria exactly (mainly diversity of the benthic infaunal community), the eastern shore of Sooke Basin, Vancouver Island was selected as the preferred test site for Phase II studies.

3.0 SOOKE BASIN STUDY SITE CHARACTERIZATION.

Sooke Basin is located near the southern end of Vancouver Island adjacent to Juan de Fuca Strait and about 30 km west of Victoria, B.C. (Figure 1). The basin is 4 km long and 3 km wide with an average depth of 17 metres. It is poorly flushed with a narrow opening to Juan de Fuca Strait. The deepest portion (37 m) lies near the mouth of the basin (Krauel *et al.*, 1984). Development is centered on the northern shore of the basin at the Village of Sooke where several marinas, docks, and a public pier exist. The area also supports a sport and commercial fishing industry along with floating aquaculture operations. Apart from an abandoned lumber mill situated on the north shore of the basin, no major industrial activity has operated in Sooke Basin in recent years. The site selected for the Phase II study is a relatively well protected area located near Pim Head on the southern shore of the basin away from any intense human activity or potential sources of PAH contamination (Figure 1). The shoreline consists of tracts of farm land, a few residential houses and is only occasionally used by recreational boaters. The chosen site also offered enough room for installation of all three sets of test pilings, each having the same degree of exposure to sunlight, wind and tidal currents. Tidal currents are weak and no significant freshwater input or runoff from the adjacent uplands affected the test area. Sediment along the chosen depth contour (12 metres MLLW) selected for dolphin construction was reasonably uniform throughout the area with a tendency toward a higher percentage fines at the extreme southern end of the test site and areas further offshore. The top two cm of the sediment column consists mainly of loosely packed fine mud overlying a more compact mixture of coarser sediment, shell debris, gravel, cobble and occasional rock.

The site selection process considered this site to be representative of a 'worst case' condition for observing the accumulation of chemical contaminants associated with creosote treated wood. This area met most of the site selection criteria:

- Background sediment total PAH levels (sum 16 EPA priority PAH) averaging 0.134 µg/g, dry weight,
- Surface sediment (top 2 cm) total organic carbon averaging 0.90 percent and a total volatile solids range of 1.04% to 4.23%,
- Percent silt-clay ranging from 9.03% at the north end of the area to 36.8% at the southern end. The proportion silt-clay within the proposed OC, MC and BMP sites was very uniform at ca. 9.5%,
- No organoleptic evidence of H_2S,
- Winter salinity profile ranging from 25 ppt at the surface to 32 ppt at a depth 0.3 metres above the bottom,

- Very slow current speeds averaging 2.31 cm/sec at a depth of two metres declining to 1.90 cm/sec at depths of four to eight metres. Currents were dominantly unidirectional (~250^{o} True),

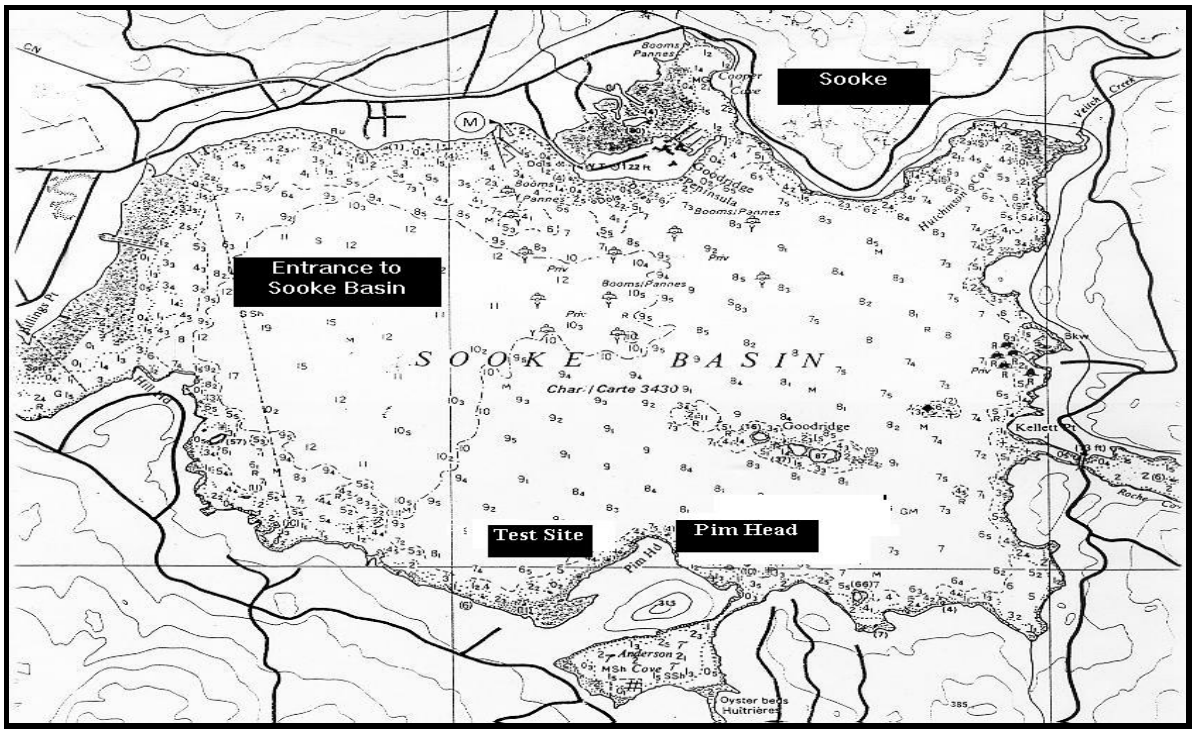


Figure 1. Sooke Basin Study Area

- Biologically insignificant levels of sedimented metals which generally are <25% of the respective Washington State apparent effects threshold based sediment quality criteria,

- The study site is readily accessible by boat, across Sooke Basin, from suitable marinas. This is a little used area of the Basin adjacent to a church camp and is considered reasonably secure from anthropogenic interference.

4.0 MATERIALS AND METHODS

4.1 Sample station selection and piling installation.

Underwater surveys were carried out along the shoreline south of Pim Head (Figure 1) between depths of 7.5 and 12.2 metres (MLLW) prior to selection of the exact location for each treatment site using divers and an underwater sled. This was accomplished to ensure that conditions were generally consistent throughout the area with no unforeseen hazards. The texture of the surface sediments (top 2 cm) along the 12.2 m contour was generally uniform and consisted mainly of silt-clay, sand, mixed with cobble and shell debris. Inshore areas tended to be coarser with more gravel and cobble. Offshore sediments, deeper than 12 metres (MLLW) were finer in texture with higher silt-clay content.

In October, 1995, three treatment sites and an open control site were positioned along the 12.2 m contour, approximately 60 metres from shore. Each site was marked with a surface buoy for positioning the pile driver. Three sets of pilings, each consisting of six pilings tied together at the top to form a small dolphin, were installed along the western shoreline of Pim Head in a line bearing 065^{o} magnetic. Piling installation was accomplished by Gary Gibson Consulting, Shawnigan Lake, British Columbia, who also provided the weathered pilings from a recent pier demolition. These weathered pilings (**WP**), treated by 'conventional' creosote treatment methods, were placed at the southernmost end of the test site (Figure 2).

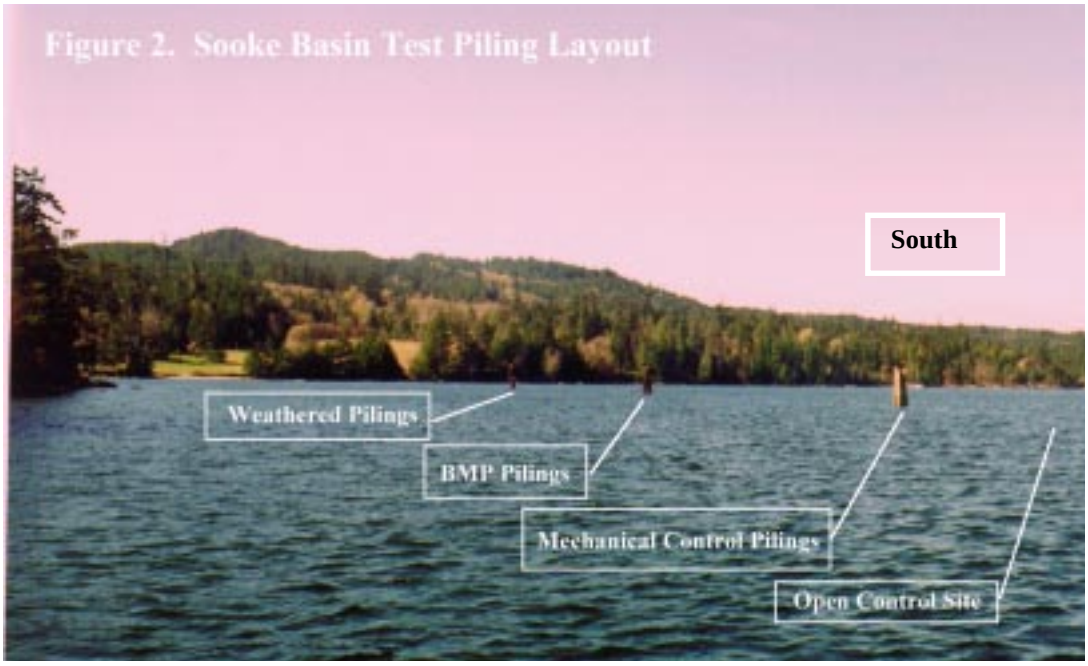


Figure 2. Sooke Basin Test Piling Layout - Creosote Evaluation Study.

The **BMP** dolphin, constructed of freshly treated pilings and produced using CITW *Best Management Practices*, was positioned in the middle of the test area, separated from the used pilings by a distance of about 78 metres. Untreated pilings serving as a mechanical control (**MC**) were installed toward the northern end of the test site (Figure 2). The MC dolphin was separated from the BMP dolphin by a distance of 70 metres. An open control (**OC**) station, the northernmost piling, was located 21 metres north of the mechanical control site.

All pilings were Class A, Douglas fir (*Pseudotsuga menziesii*), with an average diameter of ca. 30 cm. The experimental design called for the placement of a single piling in the center of each treatment, surrounded by five pilings equally spaced, giving a dolphin diameter of at least 2.5 to 3.0 metres at the base. This would allow sufficient area for positioning the downstream sampling transects and give the structure enough mass to ensure chemical contamination of bottom sediments. Final position of the dolphins, open control and mudline dimensions between each piling are shown in Figure 3. Although attempts were made to maintain a consistent distance between pilings, it was not always possible to position each piling exactly. This was not considered to be a significant factor in the study. The pile driver was kept on the seaward side of each treatment site at all times during installation.

The BMP pilings were provided by Stella Jones and treated according to Best Management Practices outlined in WWPI and CITW (1994). The target retention was 17 pounds of creosote per cubic foot of wood in the treated zone (the outer 6 cm shell of the piling). The actual retention was 27 pcf (Stella Jones, personal communication). This retention is 158% of that required to protect piling in temperate waters – further emphasizing the worst case methodology used in this analysis.

4.2 Sampling schedule.

Physical and chemical baseline sampling was accomplished on September 14-15, 1995. The baseline infaunal inventory was accomplished on October 2, just prior to piling installation which took place on October 3, 1995. Post installation sampling was conducted on October 17-19, 1995 (**Day14**) to assess the immediate effects following construction; on April 1-3, 1996 (**Day185**) as a mid-point and on October 21-25, 1996 (**Day384**). Limited additional sampling was accomplished on June 18, 1996 (Day270) to compare differences in amphipod toxicity using the entire contents of the benthic grab (10cm deep) against samples taken from the top 2cm only. Additional sampling was also done on April 22, 1997 (Day535). The results of those samples taken outside the original study design, including Day535, will be discussed in a separate section at the end of this report.

4.3 Evaluated endpoints.

The focus of this study was on the most biologically active (uppermost two centimetres) portion of the sediment column. Parental PAH (16 EPA priority PAHs plus benzo(e)pyrene) (Table 1) were chosen as the primary chemical indicator of effects associated with the creosote treated piling. Benthic infauna, mussels (*Mytilus edulis edulis*), and a suite of laboratory bioassays using Microtox™, echinoid fertilization and amphipod survival (*Rhepoxynius abronius* and *Eohaustorius washingtonianus*) were selected as the primary biological indicators. Mutatox™ testing of sediments was applied to assess the genotoxic potential. The Mutatox™ assays were later abandoned after determining that changes to the test media were interfering with results on marine samples. During the course of the study, a number of other sediment, water, and biological parameters were measured at selected stations and exposure periods for specific purposes. A complete list of the parameters examined in this study is provided in Table 1.

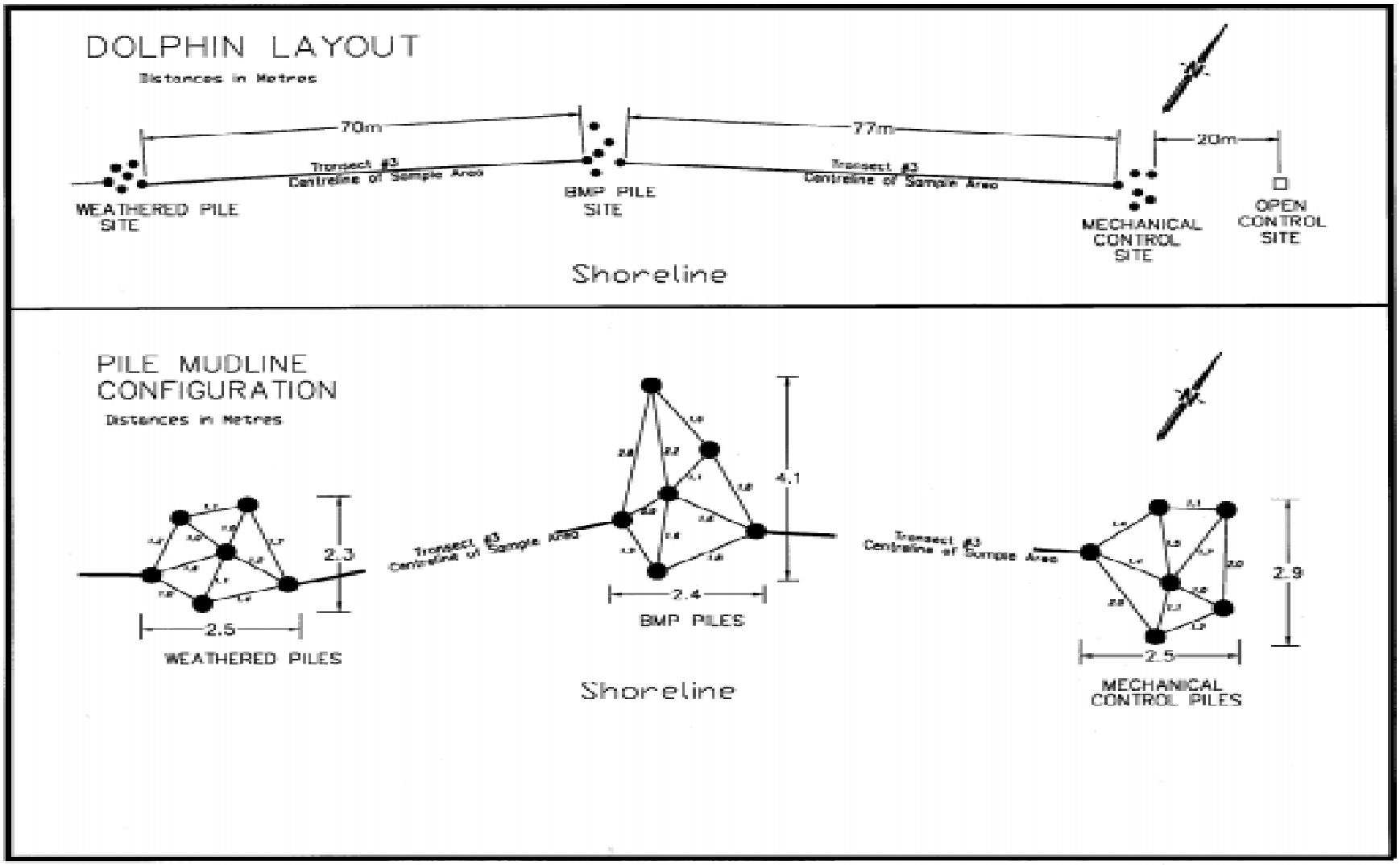


Figure 3. Sooke Basin Creosote Evaluation Study: Dolphin Layout and Pile Mudline Configuration (prepared by Foreshore Technologies Inc.)

Table 1. List of parameters measured during the first 384 days at the Sooke Basin Creosote Evaluation Study – 1995 to 1996.

Sediment PAH. PAH in surficial (0 - 2.0 cm) sediments (routine at all stations). Low molecular weight compounds are presented in italics. Perylene and benzo(e)pyrene (bolded in Table 1), while included in this analysis, are not EPA priority pollutants. Benzo(e) pyrene is summed with priority PAH in determining total PAH in this analysis. Perylene is not. Benzo(a)fluoranthene and benzo(b)fluoranthene are grouped as benzofluoranthenes

Naphthalene	Pyrene	Ideno(123-cd)pyrene
Acenaphthylene	Benz(a)anthracene	Benzo(ghi)perylene
Acenaphthene	Chrysene	Dibenz(a,h)anthracene
Fluorene	Benzo(a)fluoranthene	Benzo(a)pyrene
Phenanthrene	Fluoranthene	**Perylene**
Anthracene	Benzo(b)fluoranthene	**Benzo(e)pyrene**

Alkylated PAH in surficial (0 - 2.0 cm) sediments (routine at selected stations)

C1 naphthalenes	C4 phenanthrene or anthracene	C4 fluoranthene/pyrene
C2 naphthalenes	Retene	C5 fluoranthene/pyrene
C3 naphthalenes	C5 naphthalenes	Dibenzothiophene
C4 naphthalenes	C5 naphthalenes	C1 dibenzothiophene
C1 phenanthrene & anthracene	C1 fluoranthene & pyrene	C2 dibenzothiophene
C2 phenanthrene & anthracene	C2 fluoranthene & pyrene	
C3 phenanthrene & anthracene	C3 fluoranthene & pyrene	

Surficial sediments for dibenzofuran (routine)
Surficial sediments for total organic carbon (routine)
Surficial sediments for trace metals (baseline characterization only)
Surficial sediments for sediment grain size distribution (gravel >2.0 mm; sand >0.63 µm; silt <63µm and clay <4µ) (Baseline and Day384)
Subsurficial sediment cores for parental PAH (Day384 only)

Water column

Current profile (baseline only)
Temperature profile at the BMP site (winter and summer)
Salinity profile at the BMP site (winter and summer)
Fixed, non-filterable residue (TSS) at the BMP site (routine)
Volatile, non-filterable residue (TVS) at the BMP site (routine)
Qualitative surface sheen PAH characterization (during construction only)
Water column PAH concentration using Semi-Permeable Membrane Devices (one time only)

Table 1 (cont'd).

Biological Endpoints

Amphipod bioassays using *Rhepoxynius abronius* and *Eohaustorius washingtonianus* (routine at selected stations).
Microtox™ assays (pore water and solid phase routinely at selected stations)
Mutatox™ assays (routinely at selected stations)
Echinoid fertilization inhibition (Day535 only)
In-situ Bioassay using *Mytilus edulis edulis*
- Growth and survival (routine)
- Whole body tissue PAH determination (routine)
  - *parental* PAH
  - *alkylated* PAH

Reproductive bioassay (April 1996 and April 1997)
- Comparison of PAH concentrations in gonadal and somatic tissues
- Spawning success
- Larval development to the "D" hinge stage

Benthic Infauna
- Characterization to species of animals retained on a 1 mm sieve (routine)
- Characterization to species of animals retained on a 500 μm sieve (selected stations)

Photography of the algal and invertebrate growth on the pilings (routine)

4.4 Cleaning and preparation of sampling equipment and containers.

Four sets of 10 cm deep hand held stainless steel benthic samplers with individual spatulas having 2 cm deep sidewalls, one for each treatment (BMP, WP, MC and OC) were pre-cleaned by washing with a phosphate-free detergent solution, followed by thorough rinses with hot tap water and analyte-free water and a final rinse using high-purity acetone. Sampling equipment (samplers and spatulas) was heat treated and individually sealed in plastic bags which were not opened until ready for field use.

New glass containers (250 mL) for TOC and PAH analysis were heat treated at 330^{o}C for four hours and equipped with an aluminum foil seal under the cap. Samples for particle size analysis were collected separately in new 250 mL glass jars. Samples for Microtox™ bioassays were collected in multiples of seven new 50 mL polypropylene centrifuge tubes at each station. Samples for amphipod bioassays were stored on ice in new five litre plastic ice cream buckets. Upon return, bioassay samples were generally processed immediately by Environment Canada's toxicity laboratory at the Pacific Environmental Science Centre, North Vancouver or kept at 6°C until processed within a few days of collection.

4.5 Sample identification.

The lids and jars of all sample containers were pre-labeled using Write-in-the-Rain™ paper. Benthic invertebrate samples were similarly labeled but with the addition of a third label inserted into the jar with the sample. Each sample was assigned a code of the form ***Type of Sample-Day Post Construction-Treatment Code-Distance from Dolphin-(Replicate).*** For example, a typical code was ***Infauna 180MC0.5(2*)**. This infaunal sample was collected 185 days after construction at the Mechanical Control dolphin. The sample was obtained from a distance of 0.5 metres and was the second replicate collected at this station.

4.6 Sample storage.

All samples intended for chemical analysis were held on ice in the field. Samples were submitted to the laboratory immediately after each survey.

Laboratory storage of samples required that:

- All samples intended for bioassays were stored at 6^{o}C until analyzed (usually within one week);
- Samples for sediment grain size analysis were stored at 6^{o}C until analyzed;
- Samples intended for PAH analysis were frozen at –40^{o}C until analyzed.
- Infauna were fixed in 15% buffered formaldehyde in the field and transferred to 70% ethanol at the end of 4 days.

4.7 Sediment sampling protocols.

4.7.1 Modifications to Original Study Design.

A number of changes were made to the original sampling protocols during the course of the study. Some were deemed necessary to meet the main objective of the study. Others were to provide additional information based upon a unique field study and an already well established pre-construction baseline. The initial design focused on single discrete samples (linear regression approach) taken at predefined distances along the downstream and opposing upstream transects at each treatment site. Two additional samples, for a total of three replicates, were added to the BMP 0.5m, 2.0m, 5.0m and 10m upstream and downstream distance intervals as part of the routine sediment sampling program. This was to increase the statistical flexibility of the data and to provide a comparison between the linear regression approach and the ANOVA sampling approach. A mid-point station was also added to the up-stream transect at the Weathered piling site (WP-28/BP50) and mid-way between the BMP and MC dolphins (BP-28/MC49). This was to monitor any overlapping chemical contamination between treatment sites, if occurring. Alkylated PAH and dibenzofuran analyses were added to a selected number of samples from the BMP and Weathered Piling sites, initially a “long list” of alkylated PAH compounds, which was later shortened to reduce cost.

One of the more significant changes to the initial program occurred with the amphipod bioassay samples. Initially, the entire contents of a hand held benthic sampler, which sampled to

a depth of 10cm, was taken for amphipod sediment toxicity testing. It was apparent after Day185 that, by including the lower, less contaminated contents of the grab, the bioassay results were not giving the anticipated toxicity based on the PAH levels measured in the surface layer and toxic thresholds reported in the literature. After a brief test survey on Day270, samples for amphipod toxicity tests were changed to include only the top 2cm. This required about five separate grabs to obtain sufficient material. Both the bioassay tests and chemical analyses were conducted on a well homogenized composite. Since bioassay tests were only being conducted at selected distance intervals, homogenized (mixed) samples were added to each distance interval at the WP and BP transects for sediment PAH chemistry. This allowed a direct comparison between sediment toxicity and the PAH chemistry.

Mutatox™ assays intended to measure the genotoxic potential of the sediments were discontinued after Day185. Initially, the Microbics Corporation test system provided a salt solution separately as an osmoregulator for the marine bacteria. Therefore, when testing marine sediments, the salinity could be adjusted accordingly to maintain an appropriate salinity environment. However, it was determined that Microbics Corporation had altered their procedures, making salt an integral part of the test media and therefore, could not be adjusted or eliminated. Salinity levels in samples from Sooke Basin were increased to 60ppt when preparing the test media. This produced misleading or spurious results and hence, the tests were discontinued.

Sediment samples from inside the dolphin perimeter and at 2.0, 5.0 and 10m intervals along offshore transects at the WP and BMP treatment sites were added on Day384. This was to obtain additional information on the PAH distribution pattern around each dolphin site. Although taken in the same manner as the downstream homogenized composites, since sampled only once during the first 384 days, results from the perimeter and offshore transects have been treated separately in this report.

On one occasion, a set of four semi-permeable membrane devices, provided by the Battelle Marine Sciences Laboratory were installed at the BMP and Open Control sites to quantify dissolved PAHs in the water column.

4.7.2 Benthic sampler.

Sediment samples were collected by SCUBA divers using a 0.032 m^2 hand held sampler designed by Aquatic Environmental Sciences (Figure 4). Sediment samples for chemical and infaunal analysis were collected by inserting the right angle portion of the lid into the bottom sediment and drawing it a few centimetres towards the diver to form a vertical surface. The main body of the sampler was then pushed into the sediments until the vertical wall reached the rear portion of the sampler. At this point the lid was closed, cutting the column of sediment and sealing the sampler until it was brought to the surface. At the surface, the lid was opened revealing the entire sediment sample for easy sub-sampling. Sample acceptability criteria required that the sampler be full to within 2 cm of the top but not be over full.

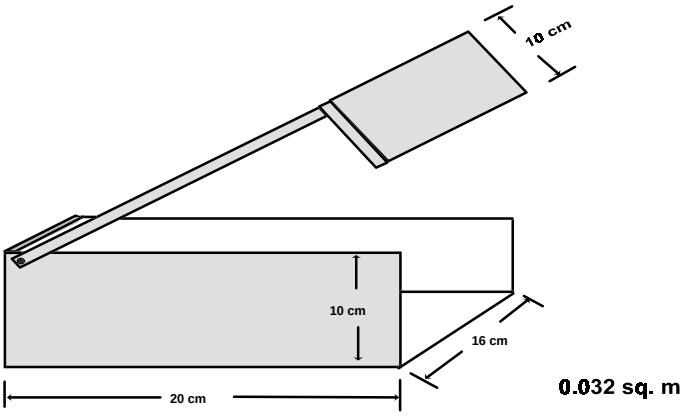


Figure 4. Stainless steel benthic sampler used by SCUBA divers during the Sooke Basin Creosote Evaluation Study.

4.7.3 Sampling Transects.

Sampling transects consisted of five parallel lines, spaced approximately 0.67 metres apart as outlined in Figure 5. Four lines were scheduled for sediment sampling, the fifth for mussel cage installation. Each transect was assigned a specific sampling date using a random number table and sampled only once during the study. Since the exact position of the pilings and transect lines would not be known until after piling installation, baseline sampling was conducted along a sixth line displaced two to three metres shoreward to avoid disturbing the post

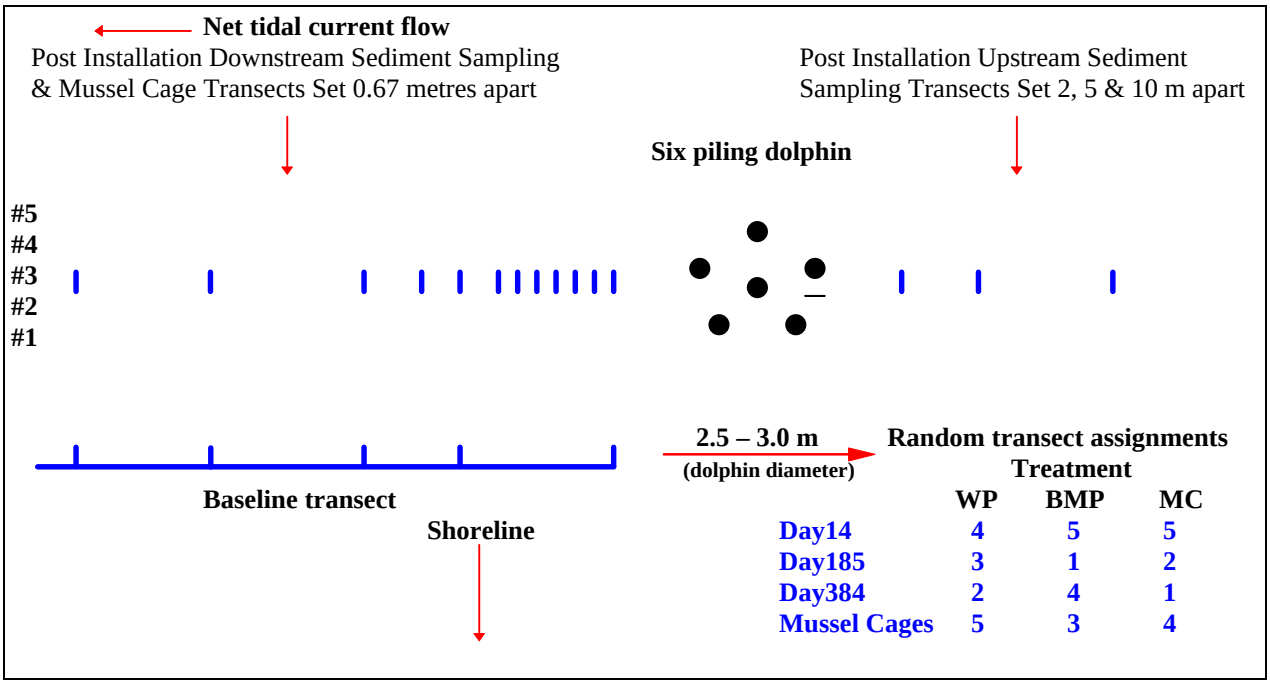


Figure 5. Location and assignment of sampling transects used in the Sooke Basin Creosote Evaluation Study during 1995 and 1996.

installation sampling transects. The center transect line (Transect #3) at each treatment site was permanently marked with a polypropylene rope stretched between the adjacent dolphin and held slightly off the bottom. A metric tape was also laid along the bottom to position the various sampling distances. This served as a reference point for establishing the sampling transects during subsequent surveys rather than attempting to permanently position each one individually. Every effort was made to avoid disturbing areas previously sampled or yet to be sampled. The transect numbers and assigned sampling periods are provided in Figure 5.

Additional sampling transects were laid out on the upstream side of each dolphin and along the centerline between treatments. Upstream samples were collected to verify that higher PAH accumulation occurred in sediments on the downstream transect. The midpoint between treatment sites was also sampled to provide chemistry data in case the influence from one treatment site overlapped the adjacent treatment.

The most intense monitoring was accomplished at the BMP treatment and at the mechanical control dolphin (MC). Sampling distances for each treatment are described in Table 2 (below).

Table 2. Routine sampling distances, by endpoint, for each treatment in the 1995-1996 Sooke Basin Creosote Evaluation Study.

Treatment	Downstream Distances (metres)	Upstream Distances
BMP	0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 5.0, 7.5, 10.0, 20.0, 30.0, 50.0	2.0, 5.0, 10.0
BMP Mussel Cages	0.5, 2.0, 10.0	
BMP Bioassays (amphipod & Microtox™)	0.5, 2.0, 5.0	
Mechanical Control	0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 5.0, 7.5, 10.0, 20.0, 30.0	2.0, 5.0, 10.0
Mechanical Control Bioassays	0.5	
Open Control	0.0	
Open Control Mussel Cages	0.0	
Open Control Bioassays	0.0	
Weathered Piling	0.5, 2.0, 5.0, 10.0	2.0, 28 (BP50)
Weathered Piling Mussel Cages	0.5, 2.0	
Weathered Piling Bioassays	0.5, 2.0	

4.7.4. Sampling quadrants.

Each sampling point along the transects was divided into four quadrants as shown in Figure 6. This was necessary because multiple samples were required at each station to fulfill the quantity requirements of bioassays and replicated sediment chemistry. This methodology was invoked to minimize disturbance of sediments during sampling.

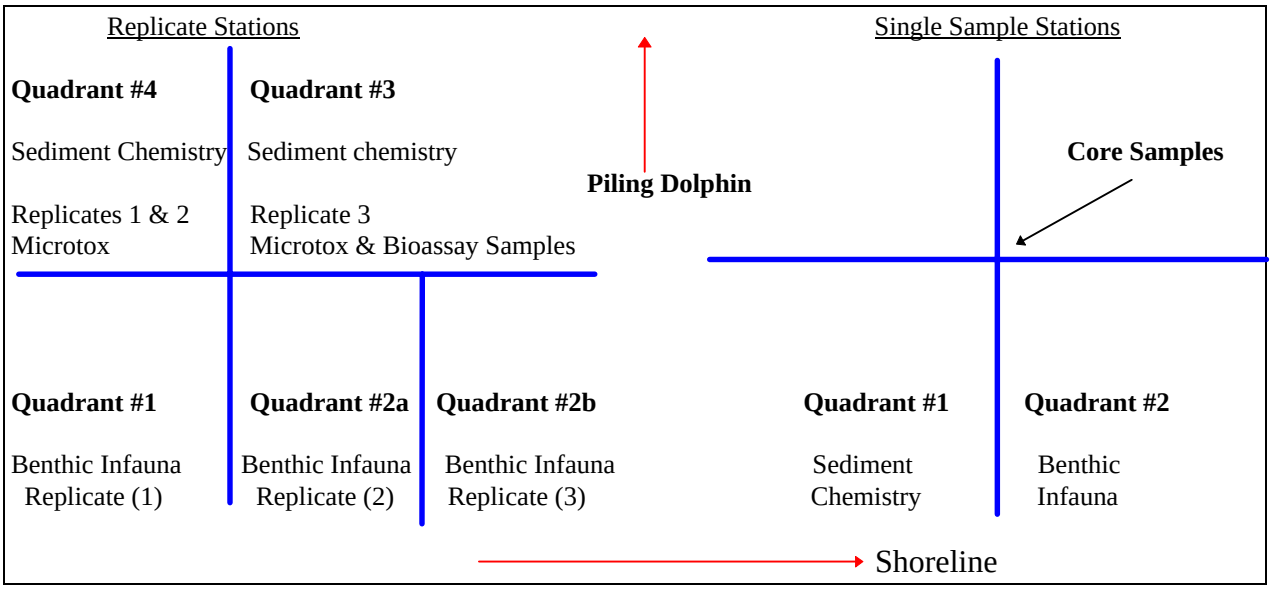


Figure 6. Sampling quadrants used to collect multiple samples from each station during the 1995-1996 Creosote Evaluation Study conducted in Sooke Basin, British Columbia.

4.7.5 Sampling Frequency.

Baseline sampling took place on September 14 and 15, 1995; 18 days preceding piling installation. This was to allow time to assess the sampling design and make any necessary changes. The pilings were installed on October 3, 1995. Post construction sampling occurred on October 17 to 19 (14 days post construction); April 1 to 3, 1996 (185 days post construction) and on October 21 to 25 (384 days post construction). Three days were generally required to complete the field program. The site was also visited in June, 1996 to clean the mussel cages and to install Semi-Permeable Membrane Devices (SPMD) used to assess dissolved PAH in the water column and to install a Kaolin tray experiment. Additional sediment samples were collected on days 270 and 535. All unscheduled sediment sampling will be discussed later in this report.

4.7.6 Sample Replication.

Several different approaches were taken for sample replication depending upon the treatment site and particular parameter. Routine sampling along the downstream transect for sediment chemistry and benthic infauna at the BMP site consisted of two basic approaches involving a combination of regression analysis and ANOVA. Single samples, spaced at close but variable intervals, were collected in support of the regression approach. Three replicate samples were collected at the 0.5, 5.0 and 10.0 metre stations in support of the ANOVA approach. In addition, during the Day384 survey, an additional sample was collected at each station. This sample was a well homogenized composite of all of the samples collected at each station. This was to provide a matching sample for sediment chemistry to compare against the bioassay samples and to determine the affect of sample mixing or compositing on PAH concentration.

Single samples were collected at each Mechanical Control (MC) treatment station for infaunal analysis. A total of three replicates were collected at stations located 0.5. 5.0 and 10.0 metres downstream from the MC site for chemistry. The emphasis at the MC site was primarily to determine biological responses to the structure (physical structure and effects of untreated wood). Sediment PAH levels at the MC site were not expected to change and only single samples were collected here. Triplicate samples were obtained at all upstream stations and at the Weathered Piling (WP) and Open Control (OC) sites.

Seven (7) subsamples were collected in the field for Microtox ™ and Mutatox™ assay. The porewater was extracted by centrifuging and composited by the laboratory into a single sample and divided into the replicate test samples. One subsample was used for solid phase testing. Initially, from Day0 to Day185, material for amphipod bioassay testing consisted of the entire contents from the benthic grab and then subdivided by the lab into five replicates per site per species. On Day384, sampling procedures were changed to include only the top 2 cm from each grab (see Section 5.7.3). Each sample was then homogenized and subsampled for chemical analysis before submitting to the lab. For bioassay tests, each sample was then split into five replicates by staff at Environment Canada's Aquatic Toxicity lab.

4.7.7 Sediment sample collection.

At each treatment (BMP, WP, MC & OC), samples were collected, in order, from the least contaminated sediments (most distant from the dolphin) to the most contaminated sediments adjacent to the dolphin using a single sampling fixture and utensils for each treatment site. At stations requiring multiple samples, the more distant quadrants described in Figure 6 were sampled first to avoid drawing sediment over un-sampled areas. This approach also kept the divers from working over areas yet to be sampled.

4.7.8 Sediment analysis.

Sediment PAH analysis was conducted by Axys Analytical Services Ltd. Sidney, B.C. TOC analysis was done by Cantest Ltd., Vancouver B.C., under contract to Axys. PAH analysis was accomplished using high resolution gas chromatography with low resolution (quadropole) mass spectrometric detection (HRGC/LRMS). Analytical methods and QA/QC procedures are described in Appendix III (taken from Axys, 1996). Total Organic Carbon was measured using a carbonate analysis and a total carbon analysis (U.S. EPA, 1986). The difference in carbon values is reported as total organic carbon. Measurement of sediment particle size distribution was done by Pacific Soil Analysis Inc., Burnaby, B.C. and involved oven-drying (105°C) of the material prior to using standard sieves for the sand and silt fractions, and the pipette method for the clay fraction (Walton, 1978). Sediment particle size distribution was also determined at Aquatic Environmental Sciences using the sieve and pipette method of Plumb (1981).

4.8 *In-situ* Mussel Bioassays.

In-situ bioassays using *Mytilus edulis edulis* were conducted at stations located 0.5, 2.0 and 10.0 metres on the downstream transect at the BMP treatment. Additional *in-situ* bioassays were conducted at the Open Control and at distances of 0.5 and 2.0 metres downstream from the Weathered Piling dolphin.

The cages described in Figure 7 were installed immediately after construction on October 3, 1996 for study of the growth, survival, PAH tissue content and reproductive success of 50 mussels (*Mytilus edulis edulis*) The top three tiers in each set of cages contained 50 randomly selected, pre-measured, mussels used in the growth and mortality study. Tier four contained approximately 120 mussels, 30 of which were measured and divided into three composites of ten each for PAH tissue analysis during each sample period. Tier five contained 100 mussels retained for reproductive studies (spawning success and larval development to the "D" hinge stage). Cages were identified with tags placed inside the bags and attached outside the bag. In addition, the PVC pipe closure had the Treatment and Tier Number inscribed with a permanent marker. Mussel cages were designed by Aquatic Environmental Sciences, Washington State and the mussels provided by Island Scallops, Qualicum Beach, B.C. Reproductive bioassays were conducted at the Aquatic Environmental Sciences Laboratory.

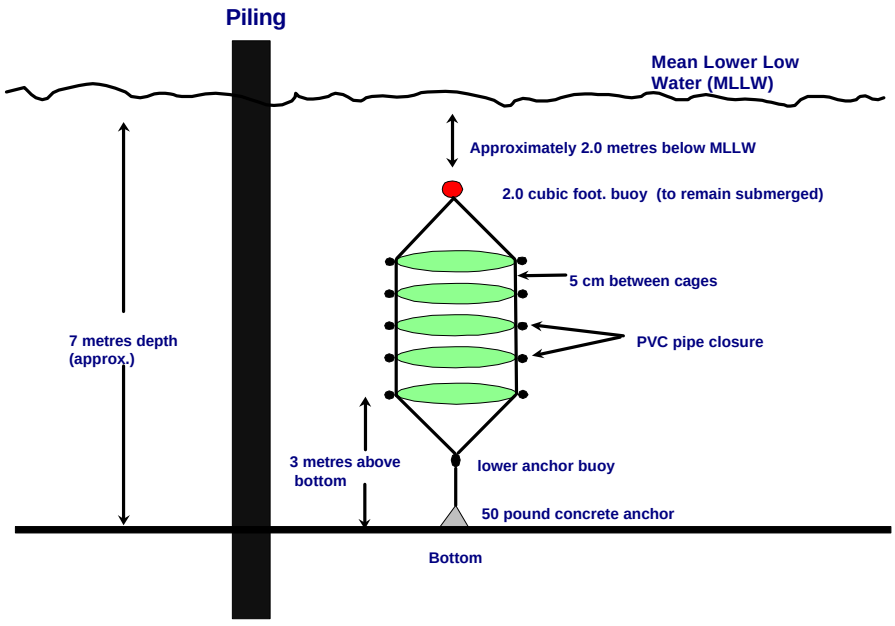


Figure 7. General layout of the cages containing mussels (*Mytilus edulis edulis*) used in the *in-situ* bioassays at the 1995 – 1996 Sooke Basin Creosote Evaluation Study.

The ¼ inch mesh cages were constructed from heavy duty ADPI™ clam bags with the opening held together by a split PVC pipe. The five cages were supported by a frame made from PVC pipe (see Figure 8). The 0.5 metre cages were attached directly to the downstream piling at each treatment, suspended between two metal brackets at a distance such that the cages did not abrade the piling. Other cages were moored as shown in Figure 7. The top of each cage was

located two metres below Mean Lower Low Water (MLLW) to prevent damage from passing boats. The cages were brushed and cleaned of fouling organisms at approximately six-week intervals between surveys.

Figure 8. Photographs of cages used to house mussels (*Mytilus edulis edulis*) for *in-situ* bioassay during the 1995-1996 Sooke Basin Creosote Evaluation Study.

4.9 Benthic Infaunal Community Analysis.

Single sediment samples were collected for infaunal analysis during each exposure period. Samples were taken at each station along the BMP and MC transects. Three replicate samples were collected at each of the 0.5, 2.0, 5.0 and 10.0 m stations on the downstream transect at the BMP and MC treatments. In addition, three replicate infaunal samples were collected at the 0.5 and 2.0 metre stations at the WP treatment and at the 0.0 metre station at the Open Control site.

The entire contents of each grab were placed in individual plastic bags, labeled inside and out, and screened in the field over 1.0 mm and 0.5 mm stainless steel sieves. All water used to wash utensils and for sieving was filtered to 100 µm. Material retained on the sieves was transferred to one litre HDPE bottles and fixed with 15% buffered formaldehyde in filtered seawater. Material from the 1.0 mm and 0.5 mm sieves was retained in separate bottles.

A single sample of material retained on the 1.0 mm sieve, from each of the BMP and MC treatment stations, plus the three Open Control replicates were sorted by Aquametrix Research, Sidney, B.C. and identified by Columbia Sciences, Royston, B.C. Taxonomy was required to species or the lowest level possible. All material was transferred to Aquatic Environmental Sciences for Quality Assurance testing upon completion of the taxonomy. The wet weight of arthropods, annelids, small molluscs, large molluscs, echinoderms and “miscellaneous” organisms was measured by removing the sorted infauna from alcohol and blotting dry for five to fifteen minutes, followed by immediate weighing to the nearest 0.0001 grams. Quality assurance testing required re-picking ten percent of the samples in their entirety. Only the anterior end of the organism was counted in determining the numbers present. A minimum of 95% sorting efficiency was required for this study. In addition, taxonomic verification was accomplished at Aquatic Environmental Sciences. Any discrepancies in the identifications were resolved before the final data package was submitted.

4.10 Kaolin Tray Experiments.

On June 18, 270 days after piling installation, stainless steel baking trays contained within large plastic tubs were mounted just below the intertidal zone and 0.6 metres from the bottom at the BMP, WP and MC sites in an attempt to elucidate the transport mechanisms responsible for movement of PAH from the piling to the benthic sediments. Sampling and visual observations suggested that creosote was present in the benthic sediment surface and subsurface layers in the form of distinctive micro-droplets. Each tray contained a 1.3 cm (½") layer of fine Kaolin clay to trap the droplets and isolate the source. This was accomplished by covering each tray with Saran wrap and filling the trays with liquefied clay through a small hole in the plastic wrap. The trays were placed at each depth interval by divers and the plastic wrap then removed. Kaolin trays were recovered in November, 1996, during the 384 day survey. Each tray was examined visually and subsamples placed in clean, heat-treated 250 mL glass jars for PAH analysis.

4.11 Semi-Permeable Membrane Device (SPMD) measurement of dissolved PAH.

Lefkovitz *et al.* (1994) have described the use of polyethylene sheets to estimate water column concentrations of hydrophobic organic compounds (HOC). These membrane devices were prepared by the Battelle Marine Sciences Laboratory (MSL) in Sequim, Washington and deployed at the Sooke Basin BMP site to see if PAHs were present in the water column. New polyethylene sheets (30 cm by 60 cm) were welded to wire hangars, sealed in polyethylene bags and then placed in heat-treated glass bottles for shipment to Sooke Basin. Once in the field, the SPMDs were removed from the glass bottles and taken to metal hangars installed on the piling by divers. At depth, each SPMD was removed from its bag and immediately stretched between the hangars. Divers wore new latex gloves for each installation. Three membrane devices were suspended 15 cm from the face of the BMP piling at a depth of 4 metres below MLLW, one upstream, one downstream and a third on the offshore side of the dolphin. A fourth SPMD was installed on the buoy at the Open Control. The fifth SPMD was used as a trip blank by swimming down to the appropriate depth, removing it from the polyethylene bag, then replacing it in the bag and returning it to the surface.

These SPMDs come to equilibrium with HOC dissolved in the water column within a few days (Lefkovitz *et al.*, 1994). Following exposure for approximately two weeks, the sheets were returned to their polyethylene bags, brought to the surface, replaced in their respective precleaned bottle and shipped to the Battelle Marine Science Laboratory in Sequim, Washington. The membranes were then rinsed in de-ionized water and extracted in hexane for 48 hours. Surrogate internal standards were added prior to the extraction. Compounds were isolated from the hexane extracts using AI/SI column chromatography followed by Gel Permeation Chromatography to remove lipid. Membranes were analyzed for 16 EPA priority PAH by gas chromatography/mass spectrometry (GC/MS) in the Selected Ion Mode (SIM).

The first set of SPMDs was installed on April 1, 1996 and retrieved on April 16, 1996. All of the membranes, including the Open Control and the Trip Blank were contaminated with naphthalene at between 404 and 573 ng/L. A second experiment was initiated in early June following the same procedures and retrieved on June 19, 1996. No contamination was evident in this second experiment which is documented in this report.

4.12 Amphipod Bioassays.

Tests were performed at Environment Canada's Pacific Environmental Science Centre, North Vancouver, B.C., using two species of amphipods, *Eohaustorius washingtonianus* and *Rhepoxynius abronius* (Appendix IV). The *E. wash.* were field collected at Esquimalt Lagoon, Victoria, B.C. by Biologica Environmental Services. The *Rhepoxynius* were field collected from Whidbey Island, Washington State by Environment Resolution Services. Both species were collected and delivered to the laboratory within five days of test initiation. Amphipods were acclimated to 15 ± 1^{o} C in control sediment (*i.e.* collection site sediment) under continuous light and aeration at a rate of $\leq 3^{o}$C/day, and held under these conditions for about two days prior to test initiation.

These amphipod species are two of the four recommended for use in amphipod sediment testing for the Pacific coast (Environment Canada, 1992a), and are both commonly used at the Environment Canada, Aquatic Toxicology Section Laboratory. The sensitivity of these species has been found to differ with respect to response in contaminated sediments, chemical-toxicant solutions, and in response to non-contaminant effects such as particle size, salinity, and photoperiod.

Static 10-day acute lethality tests were performed according to the procedures outlined in Environment Canada (1992a). The control sediment used in these tests was homogenized and wet sieved through a 0.5 mm stainless steel sieve to remove native organisms. Large rocks and other debris were removed from each test sediment and the remaining sample homogenized by hand. Three to six acid-washed, one litre jars (depending on volume of test sediment available) were prepared for each control and test sediment. Approximately 175 to 200 g of sediment (to a height of 2 cm) was added to each jar.

photo by S. Yee

Each container was then carefully filled with a fresh laboratory supply of sand-filtered seawater from Burrard Inlet, being careful not to disturb the sediment layer. The test containers were aerated and allowed to settle overnight. Twenty (ten for Day384) - *E. wash.*, randomly selected amphipods, were added to each of the replicate jars per sediment. The bioassays were conducted in an environmental chamber at 15 ± 1^{o}C under continuous light. Water quality (temperature, pH, salinity and dissolved oxygen) was measured periodically throughout the tests. At the conclusion of the bioassays, the total number of emergent (dead and alive) amphipods on the sediment surface (or swimming in the water column) of each test container was recorded. The sediments were wet-sieved through a 0.5 mm stainless steel screen, and total surviving, dead and missing amphipods were recorded.

Baseline assays for the study site took place from 19 to 29 September, 1995; Day14 (14 days following piling placement) assays were performed from 24 October to 3 November, 1995; Day185 assays were performed from 09 April to 19 April, 1996; Day270 assays took place from 25 June to 5 July, 1996; and finally, Day384 amphipod assays ran from 5 to 15 November, 1996.

In addition, 96 hour LC_{50} positive control tests were run concurrently with each set, using various concentrations of the reference toxicant cadmium chloride in seawater, to assess the acceptability of test conditions and amphipod sensitivity in reference to historical performance under the same conditions (including absence of substrate and darkness).

4.13 Acute Toxicity Test Using a Photoluminescent Bacterium (Microtox™).

A marine bioluminescent bacterium, *Vibrio fischeri*, was used to assess the toxicity of the test sediments using the Microtox™ test system (Appendix IV). Vials of freeze-dried *V. fischeri*, stored at $-20 \pm 2^{o}C$ were reconstituted in 1.0 mL of distilled water and incubated at $5.5 \pm 1^{o}C$ for no less than 20 minutes prior to use in liquid and solid phase tests. Test results were based on measured light output in the presence of various levels of test substance in aqueous solutions, which were compared with light output of a control blank (*i.e.* bacterial cell suspension in diluent only). Light output is a product of the electron transport system and relates directly to the metabolic state of the bacteria (Schiewe *et al.*, 1985). The degree of light loss (degree of metabolic inhibition in the bacteria) indicates the degree of toxicity of the sample.

Each of the full 50 mL polystyrene tubes collected per test sediment was centrifuged for 30 minutes at 4,000 rpm and 4 ^{o}C to extract the pore water from the sediment. This interstitial water of the sediments was immediately decanted and tested within 24 hours for toxicity using liquid-phase testing procedures for screening and IC_{50} determination outlined by Microbics Corporation (1992a) and Environment Canada (1992b). A 50 to 100% effect during the screening test using a 100% concentration only, indicates that a test of serial dilutions of the pore water might allow determination of an IC_{50} value. Natural seawater, adjusted with natural brine salts to match the salinity of the pore water samples, was used as a control/dilution water during liquid-phase testing. Light emission readings were recorded after 5 and 15 minutes (also after 30 minutes for baseline and Day14 samples) of incubation at $15.0 \pm 0.5^{o}C$ in controls and test solutions.

The sediment remaining in one of the tubes per test sediment following centrifugation was homogenized prior to solid phase testing, which was carried out according to methods outlined by Microbics Corporation (1992b). Bacteria were incubated for 20 minutes at ambient room temperature in a series of aqueous solutions of various concentrations made up of the sediment sample and a 3.5% solution of Reagent Grade NaCl crystals dissolved in de-ionized water. Following this incubation period of direct bacterium-particle interaction, the solutions were filtered and 500 µL of each filtrate was transferred to a corresponding glass cuvette within the incubation unit. After a further five minute incubation period at $15.0 \pm 0.5^{o}C$, light emission from each concentration was measured.

A Microtox™ model 500 Toxicity Analyzer (Microbics Corporation) controlled by the appropriate Microtox™ software (versions 7.03 and 7.81) was used for all procedures.

4.14 Mutatox™ Genotoxicity Test Using Luminescent Bacteria.

The Mutatox test system is designed to determine the presence of genotoxic agents in various sample types using a dark mutant of the photoluminescent bacterium *Vibrio fischeri* (Strain M169). Vials of freeze-dried *V. fischeri* (Strain M169), stored at $-20 \pm 2^{o}C$ were reconstituted in 1.1 mL of reconstition solution (ultra pure water) in preparation for addition to reconstituted growth media and serial dilutions of pore water samples, which were all subsequently incubated at $27 \pm 1^{o}C$. A genotoxic response was indicated when the luminescent state in bacteria was restored. After 12 to 24 hours of exposure to sublethal concentrations of genotoxic chemicals, this dark variant produces light (Microbics Corporation, 1993b) (Appendix IV).

Each of the full 50 mL polystyrene tubes collected per test sediment was centrifuged for 30 minutes at 4,000 rpm and $4^{o}C$ to extract the pore water from the sediment. This interstitial water of the sediments was immediately decanted and tested within 24 hours for genotoxicity using testing procedures outlined in Microbics Corporation (1995) and Environment Canada (1995).

Each pore water sample was run in two types of assay media; direct Mutatox medium to detect environmental substances which damage DNA in their present form, and indirect Mutatox medium which contains rat-liver microsomal preparation (S9 protein plus co-factors) for exogenous metabolic activation of progenotoxins (which must first be biotransformed to a genotoxic form). Positive controls run concurrently with the pore water samples were the direct acting compound phenol, and benzo(a)pyrene, a compound which requires metabolic activation by hepatic enzymes. Besides media controls, solvent controls for dimethyl sulfoxide (DMSO) were also included for testing, as b(a)p is not readily soluble in water and DMSO was used in b(a)p stock preparation. Also, natural and laboratory prepared solutions of 30 ppt salt water were tested as controls for these marine samples to determine any confounding effects of salinity.

Light levels were determined by a Microtox™ model 500 Luminometer (Microbics Corporation) after 16, 21 and 25 hours of incubation.

4.15 Photography.

A series of underwater still and video photographs were taken by divers from Foreshore Technologies Inc. during each survey to record piling growth and other conditions at each site using 35mm still and Sony 8mm video cameras. Diver observations were recorded on the video tapes. The inshore piling of each dolphin was routinely photographed from the surface to the mudline at the base of the piling.

4.16 Data Analysis.

The number of infauna, by species, was entered into a Quatro-PRO data base by Columbia Science. All other data was entered in Microsoft EXCEL™ spreadsheets and is available in electronic format. The following types of analyses were performed by Aquatic Environmental Sciences, either in spreadsheet format, using the SYSTAT 6.0 for Windows® or

STATISTICA® Release 7 for Windows statistical analysis programs. All statistical tests in the report are at alpha = 0.05. Some tests are one and some two tailed. All confidence limits presented are 95% for the mean. The following sections describe the analyses performed.

4.16.1 Sediment PAH Concentrations.

Data were initially graphed to explore spatial and temporal relationships. Regression analysis (linear and non-linear) was used as the primary tool to evaluate trends in PAH concentrations. Statistical significance was evaluated at $\alpha = 0.05$ in all tests. During the evaluation of the treated wood's contribution of PAH to the sediments, observed concentrations were corrected for the average background PAH (0.2 μg/g dry sediment weight). Data used in the analysis of biological effects were not corrected for average background PAH (0.2 μg/g) because it is the total sedimented PAH concentration that has biological significance.

Statistically significant changes in PAH concentration were evaluated in two ways. The primary experimental design relies on regression analysis to determine significant trends. The statistical significance of these trends was determined by the significance of appropriate regression coefficients. Replicate samples at the Open Control and at the inner stations at WP, MC and BMP treatments allows further analysis by ANOVA. The point on the downstream transect at which significant ($\alpha = 0.05$) elevations in PAH were observed, above background levels, was determined using both *t*-tests and by identification of significant regression coefficients. Error analysis was used to determine whether or not the data met underlying assumptions for parametric testing using regression techniques. Appropriate transformations were used where error terms were not normally distributed or where significant heteroscedasticity was observed.

4.16.2 Benthic Infaunal Community Analysis.

Both the abundance and diversity of infauna were plotted for each sample period and compared with the Open Control and the Mechanical Control. The database was searched for species with significant responses to the various treatments in this study. Regression analysis and ANOVA was used to evaluate differences in this index. Finally, the Day384 data were submitted to Cluster and Principal Components Analysis to search for Treatment–Community associations.

4.16.3 Amphipod Bioassay Tests.

The QA/QC and toxicity criteria listed in Table 3 (Lee *et al.,* 1995) were used to evaluate Sooke Basin sediments in amphipod bioassays using *Rhepoxynius abronius* or *Eohaustorius washingtonianus*. All data were tested for normality using the Shapiro-Wilk test and homogeneity of variance was tested using Bartlett's test in the TOXSTAT statistical program (Gulley *et al.* 1989). If any of the treatments showed zero variance (i.e. identical survival rate in all replicates), the treatment was removed from the analysis since treatments with zero variance will always result in a rejection of the test for normality and homogeneity of variance (US EPA, 1994). If the data passed the tests for normality and homogeneity of variance, a two-sample one-tailed *t*-test with equal variance ($\alpha = 0.05$) was used to determine whether survival in each test and reference sediment was significantly lower from that in the control. If data failed the test for

normality of homogeneity of variance, the data were transformed using an arcsine – square root transformation developed by Anscombe and described in Zar (1984) before being retested for both. If the transformed data passed tests for normality and homogeneity of variance, the two-sample, one-tailed *t*-test with equal variance was performed on the transformed data. If the transformed data still failed tests for homogeneity of variance, but passed the test for normality, a two-sample, one-tailed *t*-test with unequal variance was used on the transformed data to determine whether survival in each test and reference sediment was significantly lower from that in the control.

It should be noted that biological significance in laboratory tests does not necessarily reflect environmental significance, and that it is up to the researcher evaluating the study site to determine what is to be considered a relevant toxic response.

Table 3. Interim pass/fail criteria for 10-day amphipod sediment toxicity testing (Lee *et* al., 1995).

Condition	Requirement
Reference sediment Available	1. Control Sediment Survival $\geq$ 90% 2. Reference Survival $\geq$ 80% or abandon reference comparison 3. If % control survival - % reference survival $\geq$ 20% & statistically lower, abandon the reference comparison 4. Test sediment toxic if: % reference survival - % test survival $\geq$ 20% and is statistically lower
Reference Sediment Unavailable Or Abandoned.	1. Control Sediment Survival $\geq$ 90% 2. Test sediment toxic if: % control survival - % test survival $\geq$ 30% and is statistically lower.

In order for a test to be considered valid, amphipod survival in the control sediment must be 90% or greater (Environment Canada, 1992a). The LC_{50} values (and associated 95% confidence limits) for the positive reference toxicant tests were determined using the Environment Canada computer program based on Stephan (1977).

4.16.4 Acute toxicity Test Using a Photoluminescent Bacterium Microtox™.

A 50 to 100% inhibition of light production during the screening test (using a 100% concentration only) indicates that further testing using serial dilutions of the pore water may allow determination of an IC_{50} value. The degree of light loss (*i.e.* degree of metabolic inhibition in the bacteria) indicates the degree of toxicity of the sample. A dose-response curve was determined by Microbics software (Version 7.81 for liquid-phase; Version 7.03 for solid-phase), on which the IC_{50} was located. A 95% confidence range was also reported. The IC_{50} is the inhibiting concentration of a sample causing a 50% decrease in the bacterial light output under defined conditions of exposure time and test temperature. Interpretation guidelines for these tests are given in Table 4.

Table 4. Interpretation guidelines for Microtox™ Photoluminescent Bacterium toxicity tests.

	Type of Test and Condition	
	Solid-Phase 5 minutes IC_{50}	Liquid-phase 15 minute IC_{50}
Practically nontoxic:	$\geq$1.0%	>100%
Moderately toxic:	0.1 to 1.0%	50 to 100%
Toxic:	$\leq$ 0.1%	<50%

4.16.5 Mutatox™ Genotoxicity Test Using a Photoluminescent Bacterium.

Light output of the bacteria after exposure to a specified dilution series of a sample are compared to the light output of control blanks and positive controls (known mutagenic substances - phenol and benzo(a)pyrene). No statistical calculations are made on the results; the test endpoint is a positive or negative response. Positive samples containing suspected genotoxic agents are defined as those which induce increased light levels of at least two times the average control blank reading in at least two consecutive test dilutions in the series.

4.16.6 *In-situ* Mussel (*Mytilus edulis edulis*) Growth and Mortality Study.

Length data for each surviving mussel in the top three tiers of each set of cages were entered in a Microsoft EXCEL™ database. The data were graphed by treatment and sampling date. Significance of observed differences was examined using ANOVA and two sample *t*-tests with unequal variance. The number of survivors at each station, on each sample date were transformed using a Log_{10} (N +1) transformation. The transformed data were analyzed using ANOVA with two sample *t*-tests to examine observed differences between treatments and the Open Control.

4.16.7 Mussel (*Mytilus edulis edulis*) Reproductive Bioassay.

The number of dead and abnormally developed embryos in each of the replicate cultures was determined using a Sedgewich Rafter counting cell. The proportion of normal embryos was determined and entered into a STATISTICA™ database. A box and whisker plot was developed with 1.00 and 1.95 standard errors of the mean. The data was then transformed using an arcsine(square root proportion) transformation and analyzed using ANOVA

4.17 Laboratory Methods.

For that portion of the study being reported in the body of this report, laboratory analysis for organic contaminants was performed by Axys Analytical Services Ltd. located in Sidney, British Columbia. Additional sampling of offshore transects on scheduled and unscheduled days resulted in the design of a supplementary study to examine this transect. Sediment samples were collected on April 22, 1997 and analyzed for PAH by National Environmental Testing, Inc. in

Bartlett, Illinois, U.S.A. Split samples in this 1997 study were also analyzed by Axys. The results of this unscheduled sampling and the resulting offshore transect study are presented in a separate section in this report. The main body of this report pertains only to those samples collected in support of the original study design. All of the analyses were performed by Axys.

Sediment samples were kept on ice in the field and generally delivered to the lab immediately after completing each survey or frozen at –40^{o}C, sorted and then delivered to the laboratory. Samples were kept frozen in the laboratory until analyzed.

4.17.1 Sediment/Tissue PAH and Dibenzofuran Analysis.

Sediment samples received by the laboratory were homogenized by stirring with a solvent-rinsed spatula. Rock and the larger seashells were removed. Smaller shell debris was not removed. Mussel samples (three composites per station with ten animals in each composite) to be used for tissue PAH and lipid analysis were kept alive on ice and sent to the lab intact. Mussels were then shucked using solvent-rinsed tools and homogenized in a Virtis blender and frozen until analyzed. Immediately prior to analysis, homogenized samples were thawed, stirred thoroughly and subsampled. Samples were analyzed wet and separate subsamples taken for moisture determinations. Sediment data were reported on a dry sediment weight basis (12 hrs @ 105°C), tissue data on a wet weight basis. Samples were analyzed for EPA priority parental PAH (n=16 plus benzo(e)pyrene) and selected alkylated PAH. Perylene, not included in the EPA priority PAH list, was excluded from the summations for high molecular weight (HPAH) and total PAH (TPAH) determinations.

Each sediment or mussel sample was spiked with an aliquot of surrogate standard solution containing nine perdeuterated homologues (naphthalene, acenaphthene, phenanthrene, pyrene, chrysene, benzo(a)pyrene, perylene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene and one perdeuterated alkylated PAH (2-methylnaphthalene d-10). Each sample was digested in ethanolic KOH and extracted with pentane, followed by clean-up by column chromatography on silica gel. Prior to instrumental analysis, an aliquot of recovery standard containing three perdeuterated PAH was added. An additional surrogate standard containing perdeuterated dibenzofuran was added in samples requiring dibenzofuran analysis and analyzed along with the PAHs. The extract was analyzed by high resolution gas chromatography with low resolution (quadropole) mass spectrometric detection (HRGC/LRMS) using a Finnigan INCOS 50 mass spectrometer equipped with a Varian 3400 GC, a CTC autosampler and a DG10 data system. A 30 metre DB-5 (0.25 mm i.d. x 0.25 μm film thickness) chromatography column, used for GC separation, was coupled to the MS source. The mass spectrometer was operated in the EI mode (70Ev). Selected ions were acquired using a Multiple Ion Detection (MID) to enhance sensitivity, acquiring at least two characteristic ions for each target analyte and surrogate standard. A split/splitless injection sequence was used.

4.17.2 Gravimetric Lipid Determination.

Lipid content was determined on each mussel sample submitted for analysis. A subsample of tissue was ground with sodium sulfate, packed in a glass column and eluted with solvent. The extract was concentrated, transferred to a petri dish and dried to a constant weight. Lipid content was determined gravimetrically using a four place analytical balance.

4.17.3 Total Organic Carbon (TOC) Analysis.

Subsamples of sediment were taken from each sample jar intended for PAH analysis by Axys and sent to Cantest Ltd., Vancouver, B.C., for TOC analysis. The procedure consisted of first air drying a subsample of sediment at room temperature. The dried sample was digested with concentrated hydrochloric acid to remove inorganic carbon. The acid-treated sample was dried at 60^{o}C. Iron tin fines were added to the sample prior to combustion in a Leco Induction Furnace. Organic carbon was determined volumetrically as CO_2.

4.17.4 Particle Size Distribution.

Duplicate sediment samples for particle size distribution were given to Axys Analytical Services Ltd. in separate, clean, 250 mL glass jars. These were sent to Pacific Soils Analysis Inc., Burnaby, B.C. Particle size distribution was determined by the sieve and pipette method. Grain sizes were reported as gravel (>2.0 mm), sand (>0.63 μm, ≤2.0 mm), silt (≤0.63 mm, ≥ 4.0 μm) and clay (<4.0 μm). Particle size analysis was carried out at Aquatic Environmental Sciences using the sieve and pipette method of Plumb (1981). In addition to the particle sizes described by Pacific Soils Analysis, Aquatic Environmental Sciences partitions the sand fraction into compartments >1.0 mm, 250 μm to 1.0 mm and 63 μm to 250 μm.

4.17.5 Water Samples – Filterable and Non-filterable Residues.

Residue analysis on water column samples was carried out by Environment Canada's Pacific Environmental Science Centre, North Vancouver, B.C. Concentrations of Filterable Volatile Solids were determined by filtering a homogeneous sample through a Whatman GF/C glass fiber filter (1.2 μm particle retention) that had been muffled at 550 ^{o}C for 20 minutes and pre-weighed. The filter, with the residue, was then dried at 103 ^{o}C for one hour and weighed again to constant weight. The filter, with dried and weighed residue was then ignited in a muffle furnace at 550 ^{o}C. The resulting weight difference gave the fixed non-filterable residues.

A similar procedure was used at Aquatic Environmental Sciences with the exception that a 0.45 μm glass filter was used and samples were dried or ignited until less than 2% weight loss was observed between weighings.

4.17.6 Benthic Infaunal Analysis.

Samples sieved (1.0mm & 0.5mm) in the field by either Columbia Science or Aquatic Environmental Sciences were delivered to Aquametrix Research, Ltd. in Sydney, B.C. Samples were transferred to 70% isopropyl alcohol or ethanol at the end of four to seven days. Samples were sorted into four major taxonomic groups (Annelida, Crustacea, Mollusca (small and large), Echinodermata and Miscellaneous) under a 10X power dissecting scope at Aquametrix.

Invertebrates were identified to the level of species (or the lowest level possible) at Columbia Science. For incomplete specimens, only the anterior end was counted. All identifications were made using binocular and, if required, compound microscopes. If possible, at least two pieces of literature were used for each species identification.

Following taxonomic identification, biomass (wet weight) was determined for each major taxonomic category (Annelida, Crustacea, small Mollusca, large Mollusca, Echinodermata and Miscellaneous) by placing the group on filter paper and blotting until no moisture readily appeared on the paper. The group was then weighed on an A & D electronic balance accurate to 0.0001 grams.

Infauna was archived, by sample, in 70% alcohol and transferred to Aquatic Environmental Sciences along with the residue from the 1.0 mm samples and the unpicked 500 μm samples. Infauna will be archived at Aquatic Environmental Sciences for a period of three years following Quality Assurance checks.

4.17.7 Mussel (*Mytilus edulis edulis*) Growth and Mortality.

Mussel cages were retrieved at ca. six week intervals and cleaned of fouling fauna and flora that might interfere with the flow of dissolved or particulate PAH through the cages. At each sampling interval, the mussel cages were retrieved and the mussels carefully removed by cutting their byssal threads with a sharp knife or scissors. Clumps of mussels were cut apart using the same knife or scissors. Mussels were then rinsed in filtered, ambient seawater and their valve length measured to the nearest 0.1 mm. The data was entered on field data sheets and later transferred into a STATISTICA database. Only mussel valves containing live tissues were measured during each sample period. The number of measured valves was taken as the number of survivors.

4.17.8 Mussel (*Mytilus edulis edulis*) Reproductive Bioassays.

Approximately 30 mussels (*Mytilus edulis edulis*) were removed from the bottom tier of each set of five cages on April 3, 1996 and again on April 22, 1997. In each case, the mussels were slowly acclimated (2.0 ^{o}C/day) and conditioned at 12 $\pm$ 1.0 ^{o}C for four days in aerated, sand filtered to 10 μm and pasteurized seawater (28 ppt). Mussels were obtained from a commercial shellfish hatchery (Taylor United, Incorporated in Dabob Bay, Washington). Acclimated mussels were then subjected to a thermal shock at 20^{o}C with 1.0 litres of live algae, at a density of 6 x 10^{6} cells/mL added to their 10 litre, aquariums.

Spawning males and females were removed from the aquarium and placed in individual finger dishes filled with seawater (28 ppt) maintained at 18.5 $\pm$ 2.0 ^{o}C. Sperm from a minimum of six spawning males was pooled and eggs from a minimum of six spawning females were pooled in separate finger dishes. The eggs were washed through a 75 μm Nytex™ screen and suspended in one litre of water in a graduated cylinder. The suspension was homogenized by gentle agitation with a perforated plunger. The density of the suspension was determined using a Sedgewick-Rafter counting chamber. Only ova with a normal physiology were counted. The egg density was then adjusted to 20 eggs/mL. The pooled sperm were gently washed through a 37 μm Nytex™ screen and examined at 400 power under a Zeiss compound microscope for motility. Eggs were fertilized by adding enough sperm to create a suspension of ca. 10^{5} sperm/mL in the egg suspension. Fertilization was accomplished at 18.5^{o}C. The egg-sperm suspension was held for 20 minutes and then the eggs were gently poured through a 54 μm screen. The sieve was then gently agitated in 28 ppt seawater at 18.5 ^{o}C to remove excess sperm.

The eggs were then re-suspended in a graduated cylinder filled with one litre of fresh seawater and gently homogenized with the plunger. Two hundred millilitres of this suspension was then dispersed into new, sterile, Falcon 4020 (250 mL) sample containers. Four replicates from each study site treatment were incubated in a water bath for 48 hours. All temperatures were maintained at 18.5 ^{o}C. This procedure was accomplished separately for mussels collected at Stations BP 0.5, BP 2.0, BP 10.0, WP 0.5 and the Open Control site in Sooke Basin.

At the end of 48 hours, six 1.5 mL subsamples of larvae were scored from each replicate. Larvae were considered normal if they developed a typical "D" hinge. Those which did not develop to the "D" hinge stage were judged abnormal.

4.18 Analytical Chemistry Quality Assurance/Quality Control (QA/QC).

The basis for Axys' Quality Assurance plan is the batch method. All samples are worked up in small batches, each with accompanying QC samples. Each sample batch is treated as a unit from sample work-up to instrumentation and on to data interpretation and final reporting. Sample results are reviewed and evaluated in relation to the QA/QC samples worked-up at the same time. Analysis of PAH was carried out in batches consisting of a maximum of nine samples plus one known sample (a certified reference material or a spiked matrix sample), one analysis duplicate and a procedural blank. Quality Assurance results are reported with each sample batch. In addition to the QA/QC procedures carried out by Axys, blind samples made from several HS Standard Reference Materials (marine harbour sediment) by staff at Environment Canada's Pacific Environmental Science Centre were submitted along with each series of field samples.

Results obtained from the field replicates, particularly from the open and mechanical control sites also provided a measure of laboratory QA/QC and analytical precision. Laboratory QA/QC results are provided in Appendix V (A, B, C & D).

4.18.1 Procedural Blanks.

One procedural blank was analyzed with each sample batch. In general, the blanks demonstrated low or no detectable background levels of the target compounds. Field data were not blank corrected. This might bias the reported results upward. However, the amount of the bias appears very small. Procedural blank results are provided in Appendix V(A).

4.18.2 Duplicate analyses.

Acceptance criterion for duplicate samples is $\pm$ 20% of the Method Detection Limit. Analyses were repeated if they failed to meet this criterion and the nature of the creosote contamination could not account for the variation. Results for laboratory duplicates are reported with the sample results in Appendix VI, VII, & XII. The mean concentration of each duplicate was considered to be the final sample concentration.

4.18.3 Surrogate Standard Recoveries.

Surrogate standards consist of internal chemically labeled analogs of the target compounds. These were used to correct for potential losses during analysis. Quality assurance protocols require that surrogate standard recoveries must be within an acceptable range. Analysis was repeated in cases where the acceptable range was not met. Surrogates are added at the beginning of the analysis procedures. For PAH analysis, each field sample was spiked with a mixture of known amounts of perdeuterated surrogates, nine for parental PAHs and one (2-methylnaphthalene) for alkylated PAH. Dibenzofuran d-8 was used for dibenzofuran. The surrogate recoveries serve as overall quality indicators to ensure proper method development and a measure of any losses that may occur throughout the analytical process. Final concentrations were determined by comparing target peak responses to the appropriate surrogate peak response. This method of quantification is referred to as "isotope dilution." The nine surrogates used for the parental PAH analyses spanned a range of PAH target compounds. All reported concentrations are corrected for recovery of the surrogate standards since the target and surrogate compounds are chemically similar and will, therefore, be recovered at similar rates. Surrogate recovery rates are given for each set of field data. Because of the high PAH content, analysis of wood cores from the treated pilings required further dilution and addition of more surrogate standard. Surrogate recoveries were not reportable in these cases and data are provided as minimum levels.

4.18.4 Certified Reference Material.

A "known" sample was worked up with each batch of analyses and used to demonstrate the accuracy of the data and method performance. Each batch of samples analyzed for PAHs included either a certified reference sediment or a spiked matrix sample. A marine harbour certified reference sediment, HS-6 (National Research Council of Canada) was used in the sediment analysis and a spiked sample for tissue analysis. Results generally fell within $\pm$ 20% of the certified value range which met Axys' criteria for acceptability. Results for the analysis of marine reference sediments are given in Appendix V(B). In addition, a 'blind' N.R.C. Standard Reference Material prepared by Environment Canada's Pacific Environmental Science Centre by combining several Standard Reference Materials was submitted along with each survey batch of sediment samples. Results are given in Appendix V(C).

4.18.5 Raw PAH Data Correction.

Nine, perdeuterated surrogate PAH compounds were run with each sample. In addition, multiple N.R.C. Marine Sediment PAH Standards (HS6) were run with the samples from each sampling event. These standards contained known amounts of each of the 17 parental PAHs. The BMP site was most extensively sampled during this study and an analysis of the Quality Assurance data provided by Axys is given below. All data (field samples and standard reference materials) provided by Axys were corrected for surrogate recovery. The data were not blank corrected.

Perdeuterated surrogates added to the NRC Standards examined during evaluation of the 384 day samples were recovered with averages of 68% to 105%. For all twelve NRC samples

evaluated during the 384 day sampling, the average surrogate recovery was 83.5%. Not correcting these NRC Standard determinations for surrogate recovery would have resulted in under-reporting the true PAH value by (1.00 - 0.835 x 1.094) = 8.65%.

Correcting the raw PAH concentrations obtained on these NRC standard data for surrogate recovery resulted in an average total PAH value of 32,910.75 ng/g. This value exceeded the known (mean) PAH content in the NRC Standard by 9.4%. To determine the effect of correcting the raw PAH data for surrogate recovery, a one tailed *t*-test at $\alpha = 0.05$ was applied to the data with a null hypothesis that the determined PAH levels from the NRC Standards was less than or equal to the known PAH levels in those standards. The variance was assumed to be equal to that of the sum of PAH determined between the 12 NRC Standards analyses. For 11 degrees of freedom, the critical value of *t* is –1.796. The calculated value of *t* was –6.94 and the null hypothesis was rejected. This suggests that at $\alpha = 0.05$, the mean value of the surrogate corrected PAH levels significantly exceeds the known value of the NRC Standards.

To evaluate the potential effects of correcting the determined PAH levels for surrogate recovery, the data were entered into a SYSTAT™ database. A total of 1179 surrogate recovery values were determined from all BMP piling data. Surrogate recoveries ranged from 12% to 120% with a mean of 70.6% and a median of 73%. Only two of the 1179 values exceeded 100% and the distribution, while negatively skewed (Skewness = -0.591) is approximately normal (normal probability plot). A histogram describing this data set is provided in Figure 9. Using the mean of 70.6% recovery, the average correction would be approximately 41.6%. Averages were used in this analysis because information was not available describing how the corrections were applied to those compounds for which no surrogate was evaluated.

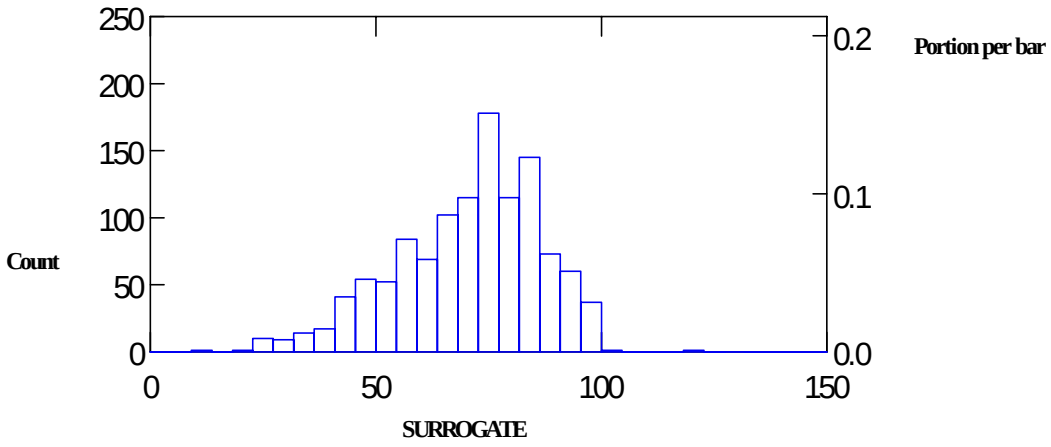


Figure 9. Histogram of percent surrogate PAH compound recovery for all samples evaluated at the BMP treatment in the Sooke Basin Creosote Evaluation Study.

This analysis suggests that not applying a correction for surrogate recovery would result in underestimating true sediment PAH concentrations by 8.7%, and that correcting the raw data for surrogate recovery would overestimate these values by 9.4%. To account for losses during the analytical process, the analytical laboratory (Axys) corrects the raw data for per-deuterated surrogate recovery, nine for the parental PAHs, one for alkylated PAHs and one dibenzofuran. All data provided in Appendix VI and VII have been corrected for surrogate recovery but not

normalized to the NRC Standards. The application factor, if applied would be 0.914. This should more closely estimate actual sediment concentrations of PAH.

4.18.6 Detection Limits.

Detection limits for PAH were calculated on a sample-specific basis and reported with each sample. Each was calculated as the concentration corresponding to the area reject. The area reject, determined from the ion chromatogram of each compound, is the area of the peak with height three times the maximum height of the noise. Only responses with peaks greater than three times the background noise level were quantified. Detection limits for each sample and exposure period are given and summarized in Appendix V(D).

4.18.7 NDR Values.

At times, peaks were detected but did not meet laboratory quantification criteria for positive identification of a particular compound. Results were reported as "NDR" with the corresponding concentration given in brackets as if it were that compound. For purposes of this study, any NDR value reported in a replicate sample set was taken as being positive if one or more of the samples showed positive results for that compound.

4.19 Benthic Infaunal Quality Assurance/Quality Control (QA/QC).

Infaunal Quality Assurance checks were conducted at Aquatic Environmental Sciences. Ten percent of the residues remaining after picking and sorting samples examined in this study were re-picked. In addition, the identification of each species determined by Columbia Science was confirmed. Discrepancies were discussed and corrected where appropriate.

4.20 Reproductive Bioassay Quality Assurance/Quality Control (QA/QC).

The purpose of this bioassay was to examine reproductive potential in mussels exposed at a control site and at varying distances from new and used creosote treated piling. Once spawned, mussel larvae are planktonic for a period of three or more weeks. They are therefore, unlikely to be subjected to environmental conditions present at the site where they were spawned. Any reproductive effects observed in this bioassay were those associated with the bioconcentration of PAH by the adults and its transfer to gametes (primarily the lipid fraction in eggs). For these reasons, a reference toxicant was not applied in this bioassay. Quality assurance was achieved through the measurement of appropriate environmental parameters (salinity, D.O., temperature) and by replication (four replicates per treatment and six measurements of each replicate).

4.21 Amphipod (*Rhepoxynius abronius* and *Eohaustorius washingtonianus*) Bioassay Quality Assurance/Quality Control (QA/QC).

Quality Assurance is addressed through incorporation of the pass/fail criteria for control and reference sediments provided by Lee *et al.,* 1995. Various concentrations of cadmium chloride in seawater were used as a reference toxicant to assess the acceptability of test conditions and amphipod sensitivity in reference to historical performance under the same conditions (including absence of substrate and darkness) (Appendix IV).

5.0 RESULTS AND DISCUSSION.

A large and detailed database has been developed during this study. Evaluating all aspects of that database will require significantly more effort than is currently available. Not included in this analysis, are evaluations of alkylated PAH and changes in the sedimented PAH community as a function of time due to variable PAH solubility and rates of microbial metabolism. Sufficient data are present in Appendix VI (A to E), for the parent or unsubstituted PAH and Appendix VII(A to C), for the alkylated or substituted PAH, to examine these parameters and this should be accomplished in the future. In addition, this report focuses on total PAH and in some cases generic low or high molecular weight PAH. The data describing individual PAH, both parent and alkylated, are in Appendix VI and VII and should be analyzed in depth as part of a continuing study. The following discussion is presented in an effort to elucidate the biological effects of the use of creosote treated wood in worst case situations and to examine our ability to manage the use of this product. Data presented in Appendix VI and Appendix VII are presented as if one was looking seaward to the test site, with the weathered pilings to the left and the open control to the far right or northernmost end of the test site.

5.1 Site Characterization.

Goyette (1995) provides a detailed description of the 13 locations and 21 sites examined during the site selection process. Data on sediment parent PAH concentrations collected during the site selection process are given in Appendix VI(A). While Sooke Basin was selected as the final site for the study, data collected from other sampling locations are provided as examples of the surficial sediment PAH levels from a variety of locations within the lower Georgia Strait, Gulf Islands and Vancouver Island area. Most of these sampling locations were chosen because of their low exposure to human activity and other anthropogenic sources of PAH.

The southern shore of Sooke Basin (Figure 1 and Figure 2) most closely met the site selection criteria established by the Creosote Evaluation Committee. Space along the shoreline was adequate to allow for the installation of an open control site and all three sets of test dolphins with sufficient inter-dolphin spacing to minimize the risk of chemical interference between sites. Adjacent uplands were low density residential, farmland or open space associated with Saint Anne's convent. The area was also accessible by boat from the northern shore of Sooke Basin. Apart from occasional boat traffic, the area appeared to have minimal human activity.

5.1.1 Background PAH and Metals Levels.

Bottom sediments at all of the treatment locations visually appeared to be clean, generally free of H_2S, except along the southwest perimeter of the study area, and ideal for both chemical and biological testing. Background PAH levels in the sediments at the study site were low during the site selection sampling, averaging 0.043 ± 0.08 µg/g total PAH on a dry sediment weight basis. Except for a creosote treated pier located approximately 500 feet north, and well inshore from the open control site, the area appeared free from anthropogenic sources of PAH. Sediment PAHs at Sooke Basin site SB 5D were higher at 1.02 µg/g. This station lies well to the west of the selected location and no cross contamination from SB 5D was anticipated. A summary of the baseline PAH data developed prior to installation of the creosote treated dolphins

is provided in Table 5. The average, across the entire site was very low at 0.133 µg/g with an average TOC content of 0.90 percent.

Table 5. Summary of baseline* survey low, high and total molecular weight PAH collected at the site of the Creosote Evaluation Study prior to installation of the treated wood. Data have been corrected for surrogate recovery and normalized to NRC standards. All values are in µg/g (dry sediment weight). Total organic carbon values for each site are also provided as a percent of dry sediment weight.

	Open Control	Mechanical Control	BMP Treatment	Weathered Piling
Low Molecular Wt. PAH	0.023 ± 0.01	0.020 ± 0.081	0.027 ± 0.070	0.036 ± 0.074
High Molecular Wt. PAH	0.095 ± 0.66	0.081 ± 0.024	0.106 ± 0.030	0.158 ± 0.046
Total PAH	0.118 ± 0.77	0.101 ± 0.033	0.133 ± 0.037	0.187 ± 0.573
Total Organic Carbon (%)	0.900 ± 0.50	0.820 ± 0.120	0.920 ± 0.080	0.920 ± 0.370

* Appendix V (B-E)

Sediment concentrations of 26 metals revealed that levels were below B.C.'s sediment quality criteria (Nagpal, 1994) and less than 25% of Washington State's Sediment Quality Criteria (WAC-173-204). All of the values were less than the Effects Range Low (ER-L) of Long and Morgan (1990). Mercury levels were not determined.

5.1.2 Sediment Grain Size Distribution and Depth of the Reduction-Oxidation Potential Discontinuity (RPD).

Sediment texture can have a direct bearing on the chemical distribution pattern. The finer the particles, generally, the greater the adsorption capability and consequently, the higher the concentration. Sediment textures at the proposed dolphin locations were composed of 16 to 40 percent gravel, 46 to 77 percent sand and nine to 37 percent fines (silt and clay). In general, the percent fines tended to increase slowly as one proceeded from northeast to southwest along the study area. The study area encompassing the open control, weathered and BMP dolphins contained 9.0 to 9.8% fines and was considered excellent from the point of view of a homogeneous substrate. Data collected at the individual sampling stations over the different exposure periods are given in Appendix VIII.

The depth of the RPD was generally greater than 3.0 centimetres in all samples. It gradually decreased as one proceeded to the south. No organoleptic evidence of either hydrogen sulfide or ammonia was present at the Open Control, Mechanical Control or BMP sites. The most distant sample stations south of the Weathered Piling dolphin indicated a slight odor of H_2S.

5.1.3 Baseline Benthic Infaunal Survey.

All reference to either abundance or diversity data refer to the sample size (0.032 m^2) used in this survey. Abundance data can be transformed to numbers per square metre by multiplying by 31.25. There is no sure way of determining the number of species obtained in quadrats of varying sizes. However, Brooks (unpublished data) has compared diversity data collected from the same location on the same day using either a Petite Ponar (0.032 m^2) or a

modified van Veen (0.10 m^2) dredge. On average, 6% more species were observed in the larger van Veen dredge than were observed in similar samples collected using the Petite Ponar dredge, which is 4.3 times smaller.

The abundance and diversity of infaunal organisms observed during the baseline survey is described in Figure 10. In general, reduced numbers of infauna were observed during the entire study at the extreme ends of the area (i.e. at the Open Control site to the North and at the Weathered Piling site to the South).

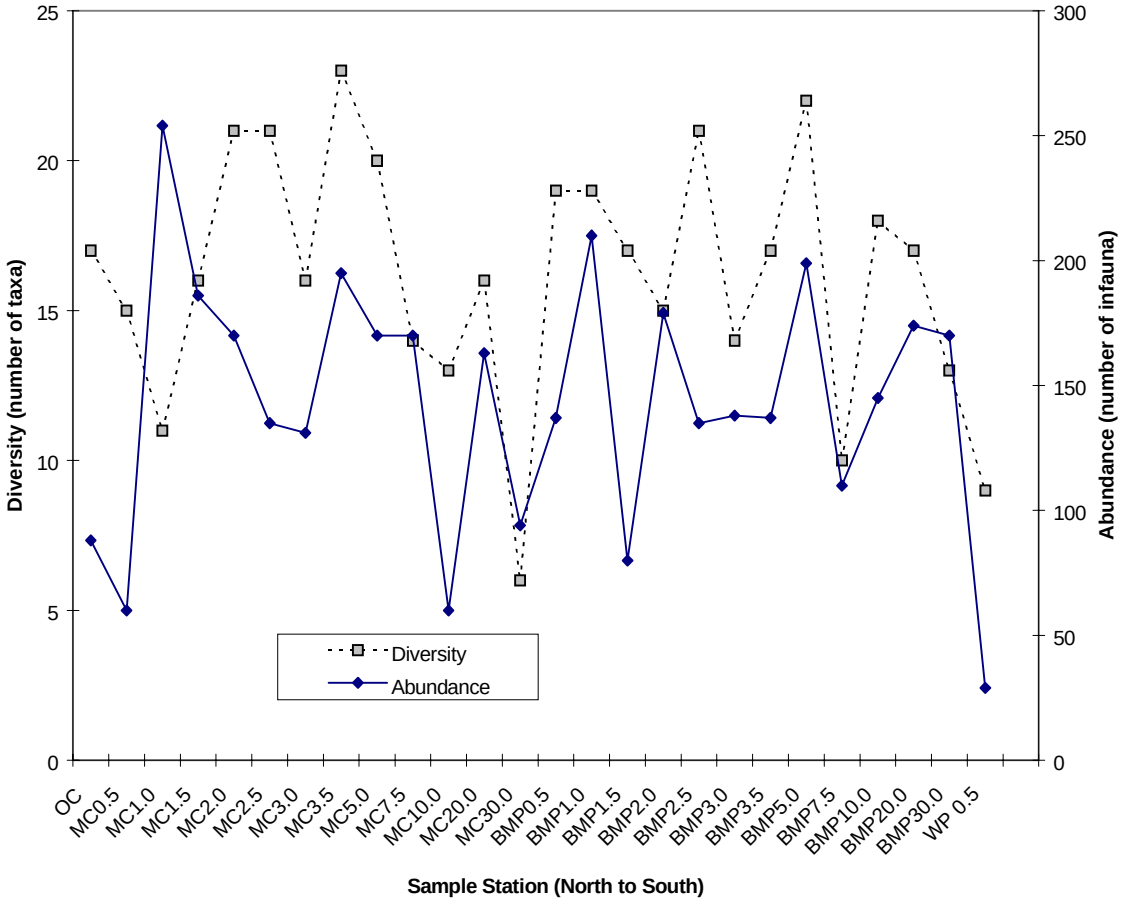


Figure 10. Abundance and diversity of infauna observed during baseline sampling at the Sooke Basin Creosote Evaluation Study site. The OC (Open Control) site is the northernmost and the WP0.5 (Weathered Piling) site is the most southerly. Other stations are presented as they occur on a line from north to south.

Three replicate samples were collected at the 0.5 m stations, at the Open Control and Mechanical Control sites. The numbers presented in Figure 10 are averages of these replicates. Means and 95% confidence intervals for these parameters are provided in Table 6.

Table 6. Baseline infaunal abundance and diversity at the Open Control and Weathered Piling sites. Each value is the mean ± 95% CI on the mean for three replicates.

	Abundance	Diversity
Open Control Site	88 ± 73	17 ± 11
Weathered Piling Site	29 ± 19	9 ± 7

Considering either the replicated Open Control or Weathered Piling sites or the entire study area as a whole, the variance of the abundance is significantly greater (S^2 = 2708) than the mean abundance (143). This suggests that total infauna are distributed in a patchy pattern across the area and that their distribution would best be described by a negative binomial distribution. The variance associated with the number of species across all sampling stations is approximately equal to the mean (S^2 = 17.6; Mean = 16.2) suggesting that the number of species is randomly distributed and could be approximated using a normal distribution. This analysis will consider changes in the abundance of all infauna and of individual species but will emphasize diversity as a more sensitive metric.

The composition of species observed in the baseline study is important in that crustaceans were nearly absent from the samples suggesting that for whatever reason, this area is unsuitable for this Class of infauna. A single crab (*Pinnixa schmitti*) was observed in all 12 samples analyzed at the BMP sites during the baseline survey. A total of four crustaceans were observed at the 12 Mechanical Control Sites (one crab, *Pinnixa schmitti*; two amphipods *Heterophoxus conionae* and *Erichthonius sp.* and a single Tanaidacean, *Leptochelia savignyi*). No crustaceans were present in the six samples collected at either the Open Control or the Weathered Piling sites. Diving observations during the study did indicate an abundance of Dungeness crab (*Cancer magister*) in the area and the basin has traditionally supported a viable commercial and recreational fishery.

Molluscs dominated the infauna in the baseline survey with the ubiquitous bivalve, *Mysella tumida* represented in greatest numbers in nearly every sample. Molluscs also dominated the community in terms of biomass. Other dominant infauna (those found with an abundance > 3 in more than 50% of the samples) observed during the Baseline Survey include:

Class Polychaeta
- *Nephtys ferruginea*
- *Paraprionospio pinnata*
- *Spiophanes berkeleyorum*

Phylum Mollusca
- *Alvania compacta*
- *Mysella tumida*
- *Parvilucina tenuisculpta*
- *Nassarius mendicus*
- *Nitidella gouldi*
- *Tellina modesta*
- *Macoma nasuta*

Phylum Echinodermata
Ophiuroidea

In the authors' experience, brittle stars of the Class Ophiuroidea are sensitive environmental indicators that are among the first invertebrates to disappear when stressed by organic or inorganic toxicants. Their ubiquitous presence in Sooke sediments (18 $\pm$ 5 per sample) during this baseline survey suggests that they may provide a key in determining the response of the benthic community to the presence of creosote treated wood.

5.1.4 Hydrographic and Conventional Water Column Parameter Characterization.

The following parameters were analyzed to confirm sample transect bearings and to obtain reasonable inputs for the risk assessment models of Brooks (1994).

5.1.4.1 Current speed and direction.

Nearshore circulation patterns at the Sooke Basin study site were determined by Aquametrix Research on 25 September, 1995. Four *Window Shade* drifters were monitored for a ten hour period. Drifter position was fixed at intervals ranging from 15 minutes to 1 hour during the sampling period. The differential shore station at Race Rocks (309.0 mhz) was used to provide GPS positioning accuracy of ±3 to 5 metres. Two drifters were used to measure surface currents at two metres depth. The other two drifters were set at four and eight metre depths. Data from this study were entered into a Microsoft EXCEL database and weighted average current speeds were calculated for each depth.

The current's direction averaged 258° True on both the flood and ebb tides. Observed currents were weak averaging 2.3 cm/sec at two metres depth and 1.9 cm/sec at four and eight metres depth. Current speeds were measured using a Price AA current meter on September 16, 1996 during a period of maximum tidal exchange. Bottom currents were measured at 1.74 to 1.94 cm/sec. Currents at depths of four to six metres (MLLW) averaged 2.6 cm/sec and surface currents at depths less than two metres averaged 3.46 cm/sec.

5.1.4.2 Salinity profile.

Salinity was measured by Aquametrix during the September 25, 1995 Drifter Study. Salinity in the study area was very constant at all depths (31.7 $\pm$ 0.08 ppt). Freshwater influence is seen in the winter and spring. In April, 1996, salinity increased with depth from 25.7 ppt at the surface to an average of 27.5 ppt at depths greater than six metres.

5.1.4.3 Temperature profile.

Water temperatures varied from 9.2^{o} C on the surface to 8.8^{o} C at 11.4 metres depth during the April 1-3 baseline survey. Temperatures on October 24, 1996 varied from 11^{o} C at the surface to 9^{o} C at a depth of 11.5 metres. Temperatures measured in Sooke Basin by Aquametrix on September 25, 1995 were highly variable. This database revealed surface temperatures

ranging from 12.2^{o} C to 17.1 ^{o}C. Temperatures at 4.0 to 17.0 metres depth varied between 10.5 and 16.4^{o} C.

Average sea-surface temperature data for the North Pacific Ocean reported by the US Department of the Interior (US FWS, 1968) suggests that surface temperatures along the south shore of Vancouver Island average nine to ten degrees from December through April. Temperatures begin climbing in May and peak in August at ca. 14.8^{o} C. These data suggest that the average annual surface temperature is 11.4 ^{o}C and the average temperature below ca. 5 metres is ca. 10^{o} C.

5.1.4.4 Dissolved oxygen

Dissolved oxygen measured at 0.5 metre intervals in the water column during the October, 1996 survey averaged 7.5 ppm from the surface to a depth of 5.5 metres. Oxygen levels decreased with further depth to 5.5 ppm at 11.5 metres. These conditions are likely characteristic of Sooke Basin throughout the year.

5.1.4.5 Total suspended solids and total volatile solids

Total suspended solids (TSS) in the water column on April, 1996 baseline survey decreased from 0.03 g/L at the surface to 0.007 g/L at 11 metres. Total volatile solids were fairly uniform at 0.006 $\pm$ 0.002 g/L. All these values are low. The low TSS values are consistent with the very slow currents at this site. The evidence suggests that there are few silt or clay particles for dissolved PAH to adsorb to in this area of Sooke Basin. This observation will be important in considering potential transport mechanisms for PAH from creosote treated piling to adjacent sediments.

5.2 Sediment PAH Modeling.

The Creosote Risk Assessment Model of Brooks (1994) was used to predict sediment concentrations of PAH on the downstream transect, as a function of distance, at the BMP creosote treated dolphin. Input parameters for this exercise are provided in Figure 11 which is a copy of the spread sheet output from Brooks (1994).

	Model Input		Intermediate Output
1. Piling Retention in pounds per cubic foot	27.00	Migration (microg/cm^2)	15.770
2. Average piling radius (centimetres)	15.00	Age Factor (years)	1.000
3. Piling Age in Years	0.00	Retention Factor	1.108
4. Average Annual Water Temp. (deg C)	10.50	Sediment Partition Coef.	0.225
5. Salinity (parts per thousand, ppt)	29.00	Deposition Coeff.	0.346
6. Settling Velocity (0.05 for silt; 0.00005 for clay)	0.050	Degradation Coeff.	651.868
7. Average Maximum Tidal Velocity	0.00	Model Velocity (cm/sec)	1.890
8. Steady State Currents (measured at slack tide)	1.89	Geometry Factor	1.000
9. Redox Potential Discontinuity (in centimetres)	3.00	Sed. Accumulation Factor	2563.108
10. Sediment Total Organic Carbon (in % TOC)	0.90	Water Partition Coef.	1.000
11. Sediment Total PAH Standard (ppm TOC)	1330.00	Water Column Conc.(ppt)	336.031
12. Maximum Allowable Sed. PAH (ppm TOC)	6080.00	Water Column Stand. (ppt)	8000.000
13. Sediment Density (grams/cubic centimetre)	2.2	Ratio (Standard/PAH Conc)	23.807
14. Background sediment PAH burden (mg/kg dry wt)	0.19		

Distance (m)	Accumulation P1
300	10.87
275	11.69
250	12.64
225	13.76
200	15.10
170	17.09
165	17.48
125	21.31
100	24.70
75	29.37
50	36.21

Figure 11. Model input and output predicting sediment accumulation of PAH downstream from the BMP treated dolphin at the 1995 – 1996 Sooke Basin Creosote Evaluation Study.

The output in Figure 11 is for individual pilings. This exercise assumes that a single piling was located in the centre of the dolphin with five additional pilings distributed at the corners of a symmetrical pentagon with major dimension of 300 cm. Predictions were made by summing the predicted contribution from each piling in the array at the distance of that individual piling from each sample point on the downstream transect. Figure 12 describes the predicted concentrations. Predictions assume that PAH accumulate in the top two centimetres of the sediment column.

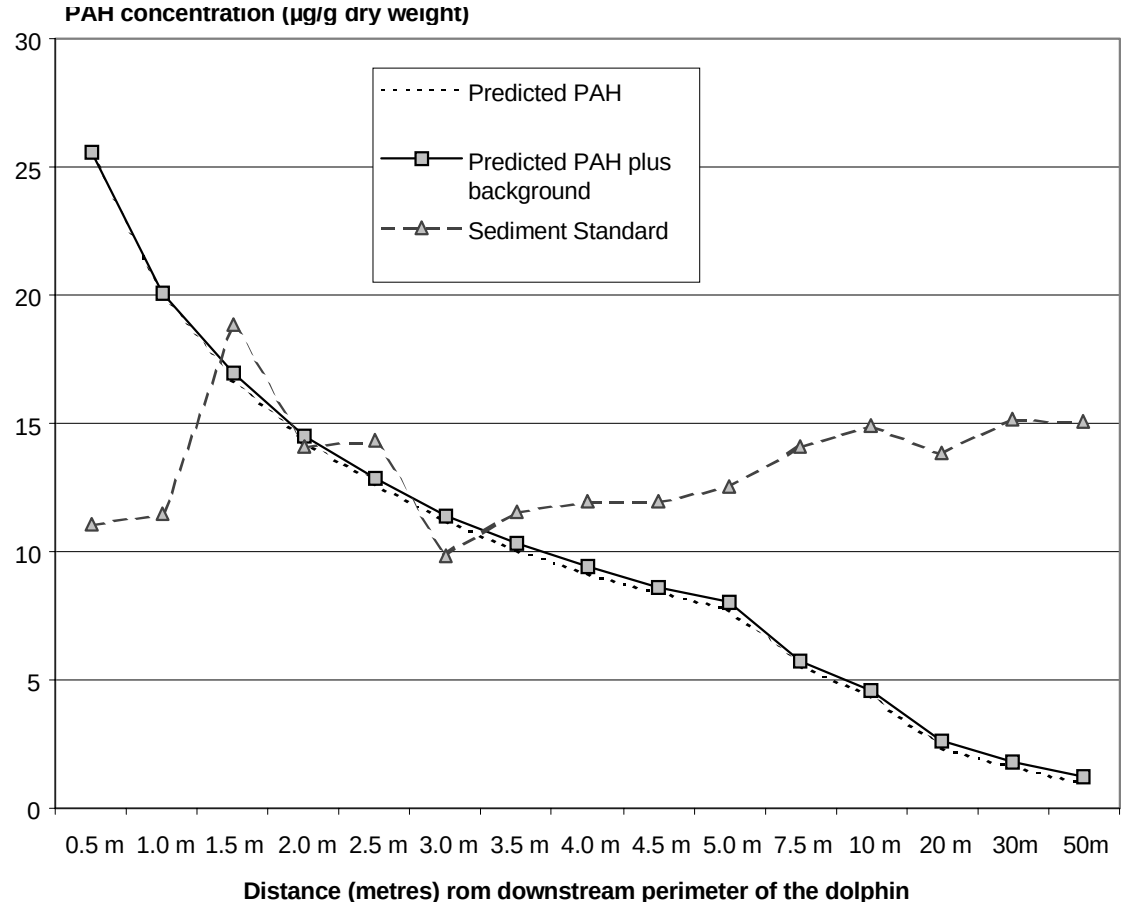


Figure 12. Predicted accumulation of PAH (µg/g) in the top two centimetres of the sediment column downstream from the perimeter of a six piling dolphin treated to 27 pcf with marine grade creosote using Best Management Practices (BMP). The Apparent Effects Threshold based total PAH Sediment Quality Standard adopted in Washington State is based on measured TOC values at the Sooke Basin Creosote Evaluation Study site.

The Washington State, Apparent Effects Threshold (AET) based Sediment Quality Standard (WAC 173-204) is provided for reference. This standard is normalized to total organic carbon. The values given in Figure 12 were computed from TOC data collected in Sooke Basin during the baseline survey. It should be noted that predicted PAH concentrations at this site are equal to or exceed the criteria at distances less than 3.5 metres from the perimeter of the dolphin. Therefore, this installation is one at which at least some adverse biological effects could be anticipated. Figure 12 suggests that the goal of creating a worst case study has likely been met.

Figure 11 includes a predicted water column PAH concentration of 336 parts per trillion (ng/L). The *Water Column Partition Coefficient* was set to 1.0 for this prediction assuming that all PAH migrating from the piling are dissolved in the water column or adsorbed to suspended particulate matter in the water column.

5.3 Sediment PAH Concentrations.

Following a brief description of PAH concentrations observed at the Open Control and Weathered Piling sites, the emphasis in this section will focus on the BMP dolphin where routine sampling was most intense.

5.3.1 Characterization of sedimented parental PAH associated with the Open Control (OC) and Mechanical Control (MC) sites.

Sediment concentrations of PAH did not significantly vary at the Open Control site where the values were consistently <0.20 µg/g total PAH (Figure 13). The same statement is true for the Mechanical Control dolphin with a single exception (Figure 14). Moderately high levels of PAH were observed at the 5.0 metre downstream station on Day14. Three replicate samples at this station had a mean TPAH concentration of 5.57 µg/g (dry sediment weight). Analyses were re-run on replicate one, whose initial value was 7.63 µg/g TPAH. Concentrations in the re-run samples were 0.51 and 0.25 µg/g. However, two separate analyses on the second replicate yielded values of 19.92 and 1.16 µg/g. The third replicate was slightly elevated above background at 0.31 µg/g. High PAH concentrations observed in several samples from this station on this day suggest that the contamination is real. It is possible that oil or debris from the pile driver was lost overboard during construction on Day0. Re-analysis of the Day14 MC5.0 samples, however, included extracting and analyzing suspicious dark particles (Axys, pers. com.), which yielded no apparent reason for the differences between replicates. These high values were not repeated at any of the Mechanical Control Piling stations on subsequent sampling days and there is no reasonable evidence of other sources of PAH contamination to this portion of Sooke Basin. These data do indicate that it is possible to observe some elevation in PAH concentrations in the absence of treated wood and that care must be taken in interpreting the meaning of apparent outliers.

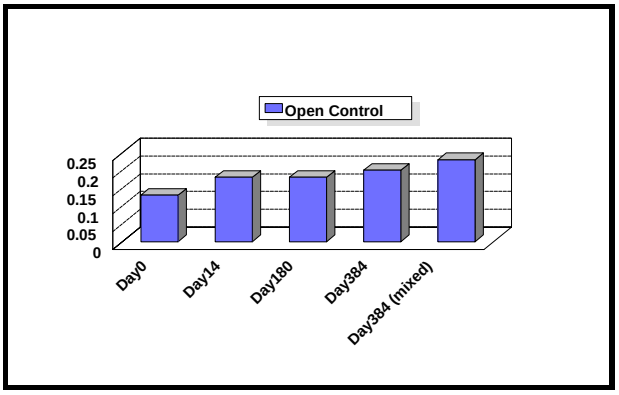


Figure 13. Surface (0-2 cm) sediment total PAH concentration (µg/g, dry weight) - Open Control (Day0 to Day384).

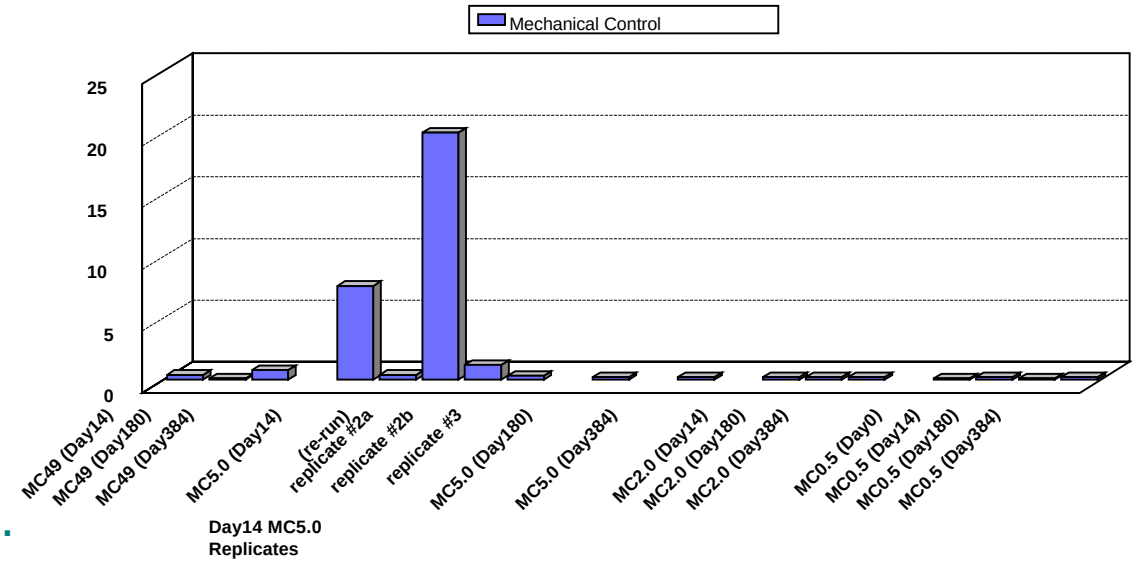


Figure 14. Surface (0-2cm) sediment total PAH concentrations (µg/g, dry weight) - Mechanical Control Piling (untreated) - (Day0 to Day384). Note: Data have not been normalized to the CRM standard and may overestimate actual sediment concentration by about 10 percent.

5.3.2 Characterization of PAH in creosote oil, Weathered and BMP treated piling.

Prior to installation, core samples were extracted from the pilings and analyzed (Appendix IX). In addition, absorbent tissue and a clean, heat treated glass jar were used to collect samples of the surface sheen which formed between the rafted pilings (Appendix X). These samples were analyzed for parental and alkylated PAH. The proportion of each parental PAH compound in the BMP and WP core samples was determined and compared with the proportion of each PAH compound in new creosote oil and in the sheen. The results are provided in Figure 15, which suggests that following treatment, piling contains a lower proportion of the lower molecular weight compounds than did the whole creosote treated oil. This is particularly true of naphthalene which represents 23.8% of the PAH in new creosote oil, 15% of the PAH in Weathered Piling and only 0.3 percent of the PAH observed in surface sheen. Naphthalene content was reduced to 10.6% in BMP piling. This is likely due to steaming of the piles during BMP treatment and to the longer post treatment vacuum times. The subsequent loss of naphthalene from the surface sheen is likely due to its solubility in water and high volatility. The same trends are noted for acenaphthylene, acenaphthene and fluorene. Excepting fluoranthene, the intermediate weight compounds, represented by phenanthrene, anthracene and pyrene are enhanced in the surface sheen. This is likely associated with their relatively low water solubility (1.00 to 0.04 µg/mL). The high molecular weight PAH are slightly enhanced in the surface sheen but remain a very small proportion of the PAH observed in that compartment.

Low molecular weight compounds comprised 73% of the new creosote oil and 79% of the PAH in BMP produced piling, but only 38% of the PAH in the sheen. It appears that the low molecular weight fraction was lost (solubilized or volatalized) from the surface sheen and that this sheen contained a significantly higher proportion of high, rather than low molecular weight PAH. These data should be useful for future research describing the environmental effects associated with PAH sheens and for predicting the toxicity of PAH in the various compartments into which it is lost from creosote treated piling.

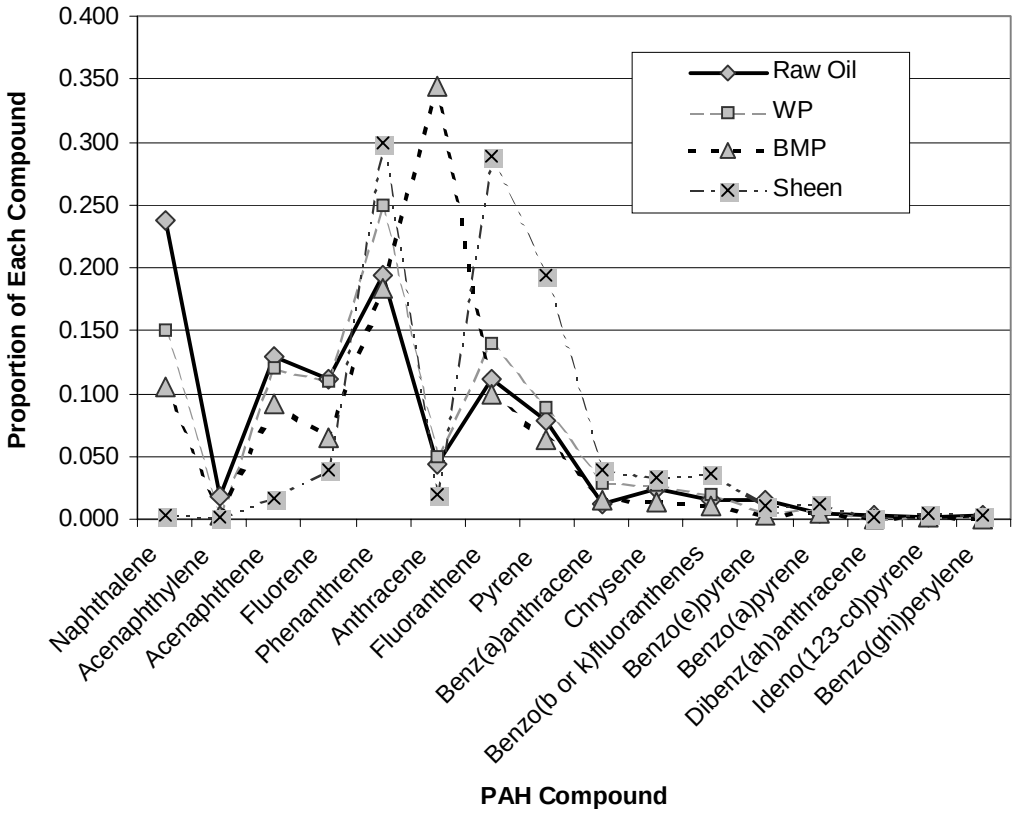


Figure 15. Proportion of individual PAH compounds in new creosote oil, in weathered pilings, in pilings produced using Best Management Practices (BMPs) and in surface sheens observed during dolphin construction.

5.3.3 Temporal changes in the proportion of various sedimented PAH compounds.

Similar changes in PAH composition occurred in the sediments over time. These effects are documented in Figure 16 which tracks the proportion of individual sedimented PAH

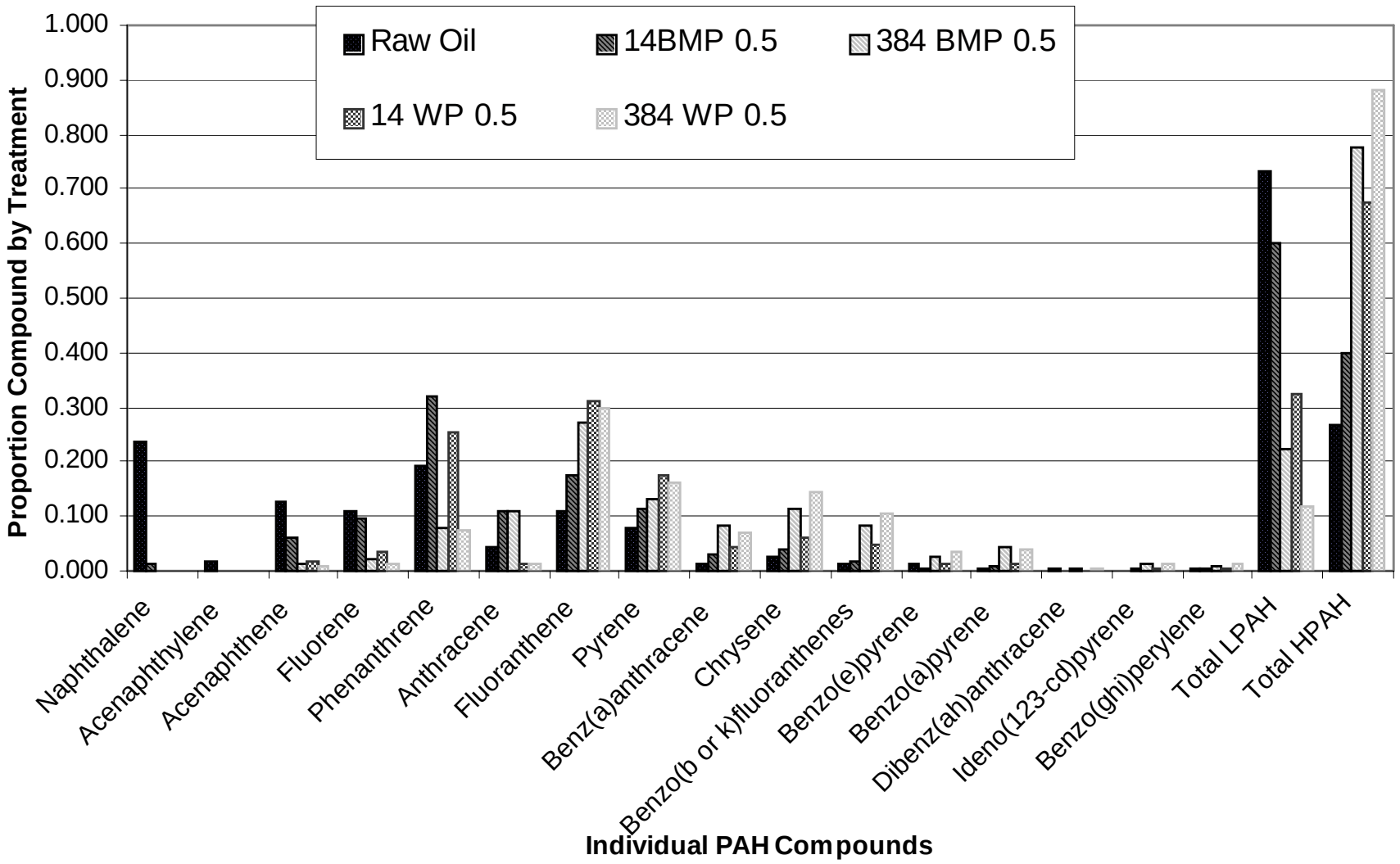


Figure 16. Proportion of high and low molecular weight individual (and summed) PAH compounds sedimented around BMP and Weathered Piling as a function of time at the Sooke Basin Creosote Evaluation Study site

compounds over time associated with dolphins constructed of BMP Treated or Weathered pilings. There is a general trend toward decreasing levels of low molecular weight compounds (naphthalene, acenaphthylene, acenaphthene and fluorene) over time. The proportion of phenanthrene and anthracene is initially greater in sediments than in raw oil, but declined rapidly between 14 and 384 days post construction. A likely hypothesis for the decrease is that these intermediate weight compounds are rapidly being catabolized by microbes. Other mechanisms also likely to occur are: physical/chemical degradation, weathering, and photodegradation.

The proportion of fluoranthene and those compounds heavier than fluoranthene increase with time in the sediments. This is likely associated with the resistance to microbial degradation of these heavier compounds and their longer half-lives in sediments (Brooks, 1994). The proportion of low and high molecular weight compounds are summed on the right side of Figure 16. Significant differences in the proportions of low and high molecular weight compounds are observed between BMP and Weathered piling. Sediments adjacent to the BMP piling contain a higher proportion of the more easily degraded low molecular weight compounds and sediments associated with the Weathered Piling dolphin contain a higher proportion of the high molecular weight compounds. However, Figure 16 also suggests that the low molecular weight compounds are being degraded (or solubilized) more quickly than the heavier compounds. This is indicated by the larger decrease in the proportion of low molecular weight compounds associated with sediments around the BMP piling than with sediments around the Weathered Piling. Also note that at 384 days, the proportion of high molecular weight compounds associated with the BMP piling is rapidly approaching that of the Weathered Piling.

Taken all together, these data suggest that during the BMP treatment process, losses of low molecular weight compounds, particularly naphthalene, acenaphthylene and acenaphthene, do occur. The intermediate weight compounds, phenanthrene and anthracene are enhanced, and those compounds heavier than anthracene remain in a relatively constant proportion. This suggests that the BMP process, by driving off the low molecular weight compounds, mimics the aging process associated with weathered piling. In the BMP process, the low molecular weight compounds are driven off by high temperatures and long vacuum times whereas in the aging process the higher volatility and solubility of these compounds may result in their preferential loss from conventionally treated wood. Much of this discussion is speculative in that these issues were not specifically examined in this study. However, the results of this analysis are consistent with the physical/chemical properties of creosote oil and from that point of view, they appear to be reasonable.

5.3.3.1 PCA Modeling.

Principal components analysis (PCA) of the parental PAH data collected at each treatment site (BMP and Weathered) between Day0 and Day384 was conducted to provide a summary of the shifts in PAH composition over time at various distance intervals. Sample plots for the Weathered Piling site are shown in Figure 17 and Figure 18, for the BMP site. Where possible, replicate samples have been circled or linked together. **Note:** Near-piling stations (i.e. 0.5m) have been circled in bold for ease in tracking shifts in position over time. For comparison, empty circles in Figure 18 indicate the position of the Weathered Piling stations. The PCA projections classified the stations roughly into three groups. The first three principal components (Factors 1, 2 and 3) account for 50%, 18.8% and 11.0% of the variance, respectively, for a

cumulative total of 79.8%. Each projection shows a predictable pattern which can be explained largely by PAH degradation rates and distance from the dolphin as the area of PAH contamination increases over time.

All baseline samples, including each of the treatment sites (BWP0.5 and BBP0.5) and the open control site at 0, 14, 180 and 384 day intervals, project together in the upper right hand corners of Figure 17 and Figure 18, indicating a similarity in PAH compound structure. The Open Control stations projected in the same position on the graph throughout the 384 days. Fourteen days after installation of the Weathered Piling dolphin (Figure 17), samples adjacent to the pilings (i.e. 14WP0.5) show a marked shift in PAH composition, projecting to the upper left hand corner. As shown by Figure 19, the PAH compounds responsible for this shift are phenanthrene, fluorene, and acenaphthene. After Day14, samples are drawn down towards the lower middle portion and by 384 days most project fully into the lower middle portion. This includes samples taken from inside the dolphin perimeter and the 5.0m interval which were not previously sampled. The two main PAH compounds largely responsible for this shift are the higher molecular weight and less degradable PAH compounds, chrysene and benz(a)anthracene.

A similar pattern occurred at the BMP site where the near-piling stations showed a strong shift in position, projecting to the upper left side (Figure 18). Stations further from the pilings took longer to shift position, and some replicate samples tended to remain clustered with the baseline samples (e.g. 14BP5.0, 14BP10, and 180BP5.0). At 384 days, sediment samples from the 0.5m distance interval and inside the piling dolphin (i.e. BP0.5 and BP0.0) showed a similar projection to the Weathered Piling sites. Again, this was primarily driven by chrysene and benz(a)anthracene (Figure 19)

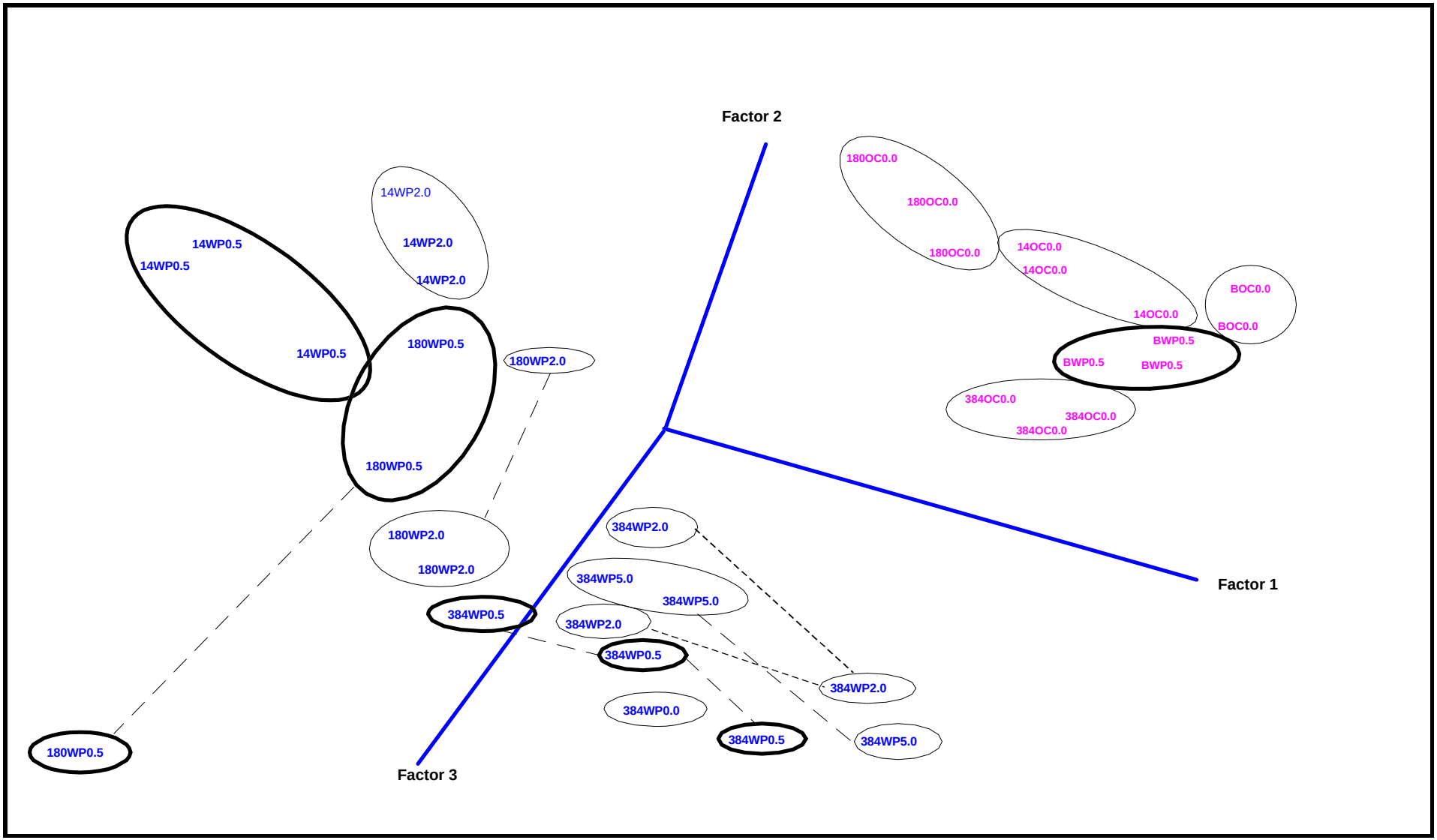


Figure 17. Sample plot derived from PCA analysis showing the shift in sediment *parental* PAH composition at the Sooke Basin Creosote Evaluation Study Weathered Piling Site - Day0 to Day384. **<u>Note</u>:** near-piling replicates at 0.5m have been bolded to aid in tracking shifts in position over time.

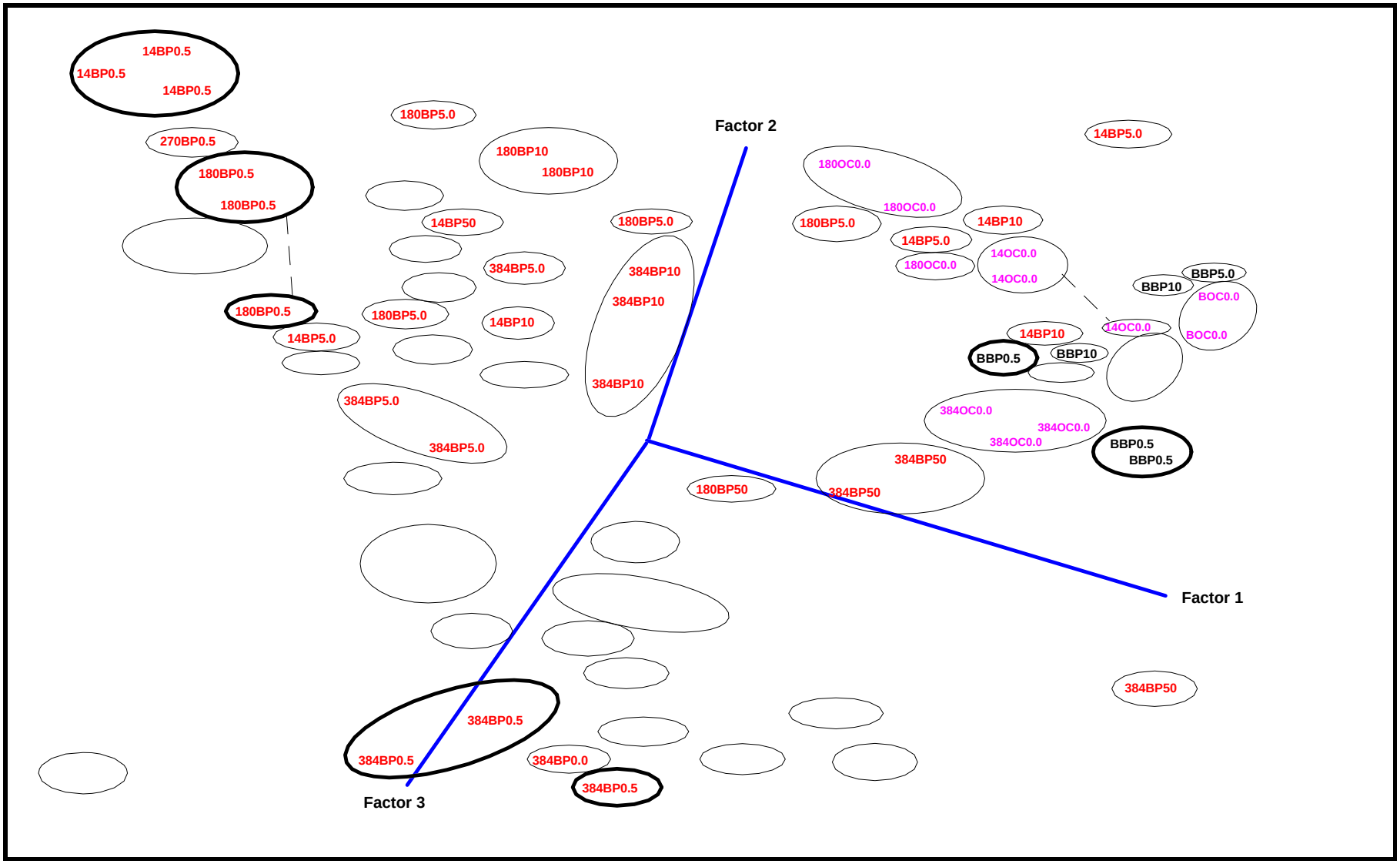


Figure 18. Sample plot derived from PCA analysis showing the shift in sediment *parental* PAH composition at the Sooke Basin Creosote Evaluation Study BMP Site - Day0 to Day384. <u>Note</u>: Empty circles show the position of the Weathered Piling stations in Figure 17. Near-piling replicates at 0.5m have been bolded to aid in tracking shifts in position over time.

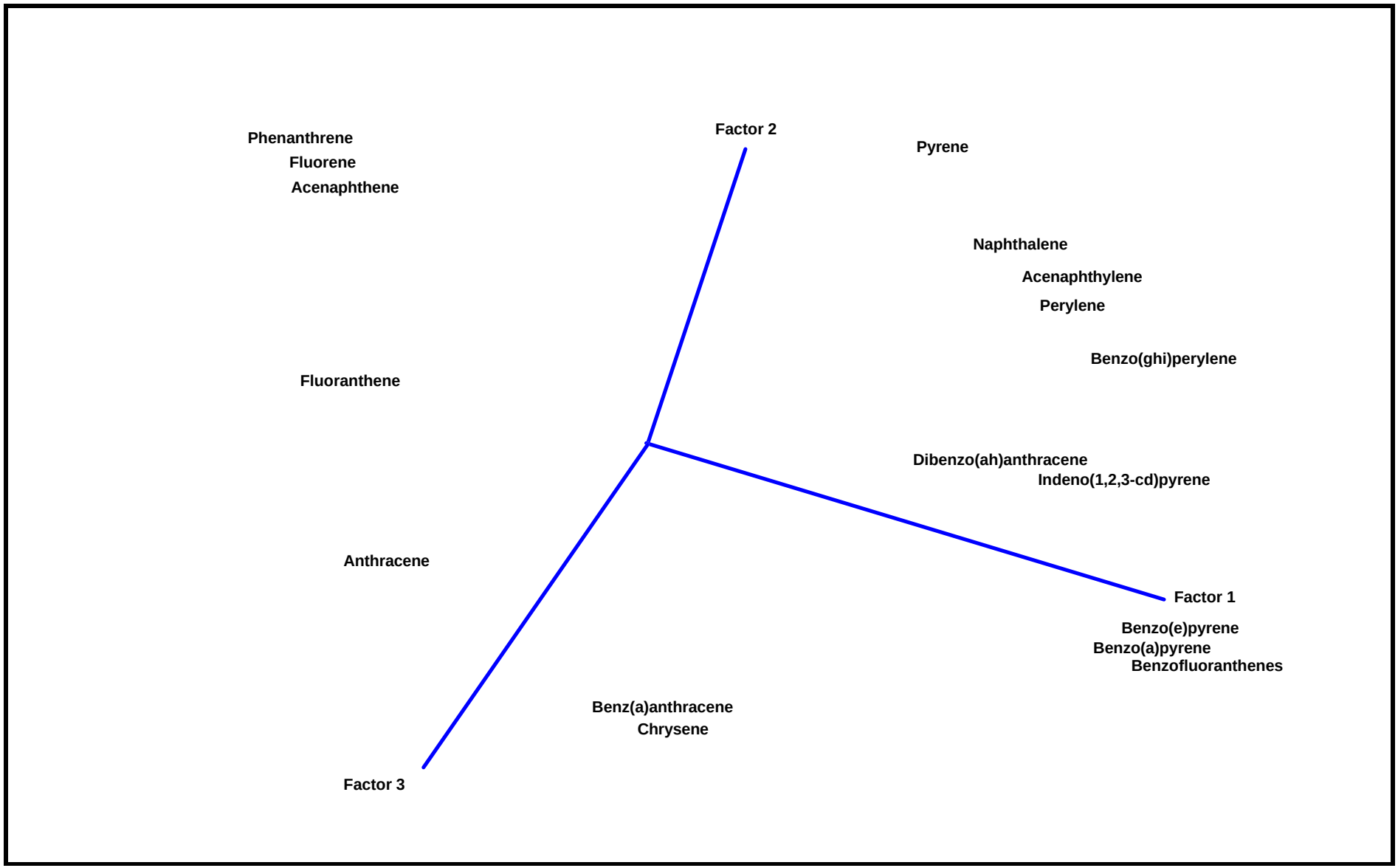


Figure 19. PCA scores plot showing the PAH compounds responsible for the shift in sample position.

5.3.4 Total sediment PAH concentrations as a function of time and distance from the Weathered Piling dolphin.

Detailed data for each of the 17 PAH compounds are provided in Appendix VI(B) and Appendix VII(A). Raw data corrected for surrogate recovery are shown in Figure 20 and Table 7. Figure 20 is based on data collected under the initial study design (see Section 5.8).

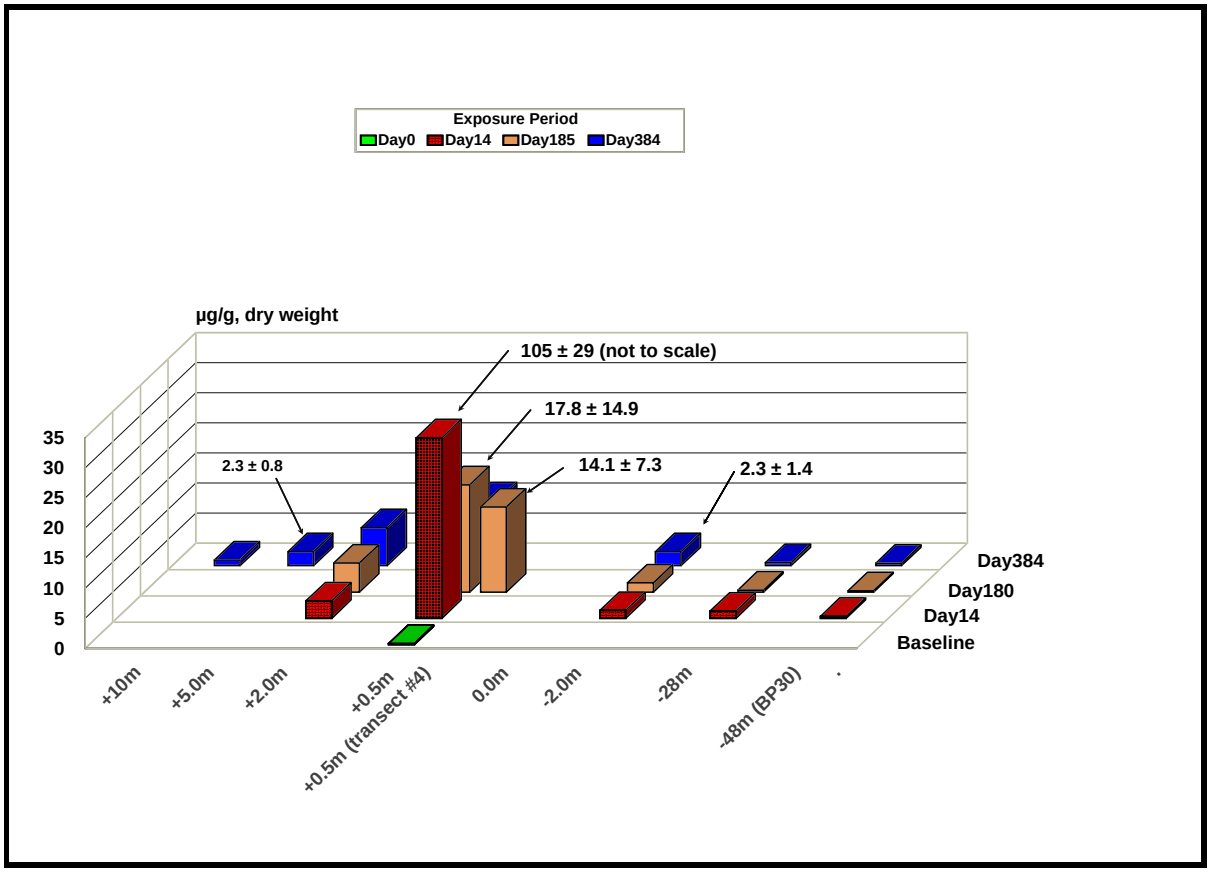


Figure 20. Sooke Basin Creosote Evaluation Study: Total PAH concentrations (µg/g, dry weight) in surface sediments at the Weathered Piling downstream and upstream distance intervals during Day0 to Day384. Note: Data have been corrected for surrogate recovery only and may overestimate actual sediment concentrations by 10 percent.

Sampling jars were pre-labeled before each survey and sample descriptions maintained throughout for purposes of consistency in laboratory reporting. Consequently, the exposure periods shown in the raw data spreadsheets and appendices may vary slightly from the report text (e.g. Day180 vs. Day185). Days shown in the main body of the report represent the actual exposure period.

Analytical results between sample replicates, distance intervals and patterns over time show a high degree of consistency. This suggests that even the more subtle differences in the PAH concentrations are real and significant.

The raw data corrected for surrogate recovery and **normalized to Certified Reference Material** value, as described previously in this report, are summarized in Figure 21. Downstream levels of PAH observed two metres downstream at the weathered piling site on Day384 (mean = 5.71 µg/g) were significantly higher (*t*-test; $\alpha = 0.05$, $t = -2.72$; $t_{crit} = 2.132$) than those observed upstream (mean = 2.04 µg/g). This helps confirm the current study and supports selection of the 245 ^{o}M bearing transect for worst case evaluation of sediments.

Table 7. Summary table showing the breakdown of sediment LPAH, HPAH, and TPAH concentrations (µg/g, dry weight) and percent LPAH to HPAH composition at the Weathered Piling Site (Day0 to Day384).

STATION	n	TOC	LPAH		% TPAH	HPAH		% TPAH	TPAH		TPAH (µg/g)
		%	µg/g			µg/g			µg/g		organic carbon
			Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.	
BASELINE (0 Days)											
BWP0.5	3	0.97	0.035	0.005	18	0.16	0.02	82	0.19	0.02	19
BOC0.0	3	0.90	0.026	0.004	20	0.10	0.03	80	0.13	0.03	14
WEATHERED PILINGS											
384WP10	1	1.20	0.13		14	0.80		86	0.94		78
384WP5.0	3	0.60	0.26	0.08	12	2.0	0.75	88	2.3	0.8	383
14WP2.0	3	1.30	0.83	0.16	28	2.1	0.57	72	2.9	0.7	225
180WP2.0	3	1.34	0.90	0.42	19	3.9	0.73	81	4.8	0.9	358
384WP2.0	3	0.60	0.75	0.38	12	5.6	1.8	88	6.3	2.2	1050
mixed	1	0.70	0.80		20	31.3		80	39.4		5629
14WP0.5 (Transect #4)	3	1.32	34.0	11.9	32	71.3	18.3	68	105	29	7965
180WP0.5 (Transect #4)	3	0.92	2.9	1.64	20	11.2	5.7	80	14.1	7.3	1533
180WP0.5 (Transect #3)	3	1.25	6.2	7.2	35	11.6	7.6	65	17.8	15	1424
384WP0.5	3	0.71	1.3	0.68	12	9.5	4.4	88	10.8	5.1	1521
mixed	1	0.53	0.38		19	1.6		81	2.0		377
384WP0.0	1	0.71	5.0		11	42.3		89	47.4		6676

Table 7 (cont'd)

STATION	n	TOC	LPAH		% TPAH	HPAH		% TPAH	TPAH		TPAH (230g/g)
		%	µg/g			µg/g			µg/g		organic carbon
			Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.	
Offshore Transect											
384WP0.5	1	0.58	4.6		14	29.2		86	33.8		5828
384WP2.0	1	0.92	3.0		20	12.2		80	15.3		1663
384WP5.0	1	1.52	0.2		16	11.0		84	1.3		86
384WP10	1	2.79	0.1		16	0.53		84	0.63		23
Upstream											
14WP2.0	3	1.22	0.59	0.47	44	0.74	0.48	56	1.3	0.9	107
180WP2.0	3	1.10	0.39	0.02	25	1.14	0.40	75	1.5	0.4	136
384WP2.0	3	0.7	0.48	0.15	11	3.8	2.0	89	2.3	1.4	329
14WP28	1		0.41	0.02	36	0.75	0.03	64	1.2	0.1	
180WP28	1		0.07		21	0.26		79	0.32		
384WP28	3	0.49	0.07	0.005	15	0.41	0.07	85	0.49	0.07	100
mixed	1	0.82	0.10		12	0.68		88	0.78		95

On Day384, TPAH concentrations 5 metres downstream from the dolphin were significantly elevated (*t*-test; $\alpha = 0.05$; $t = -4.31$; $t_{crit} = 2.132$) above PAH concentrations observed at the Open Control site. However, they were well below the Apparent Effects Thresholds of either Washington State (WAC 173-204) or Long and Morgan (1990 and 1996) at a mean value of 2.06 µg/g. The peak TPAH concentration (normalized) of 94.5 µg/g observed 0.5 metres downstream on Day14 is likely the result of either contamination associated with the pile driver or wood debris from the pile driving operation. Additional samples taken from the same transect (Transect #4) on Day185 had decreased to 14.0 µg/g compared to the 105 µg/g on Day14 and 17.8 µg/g on the regular 185 day sample from transect #3. Similarly high values were not observed at other stations or times in this study. With the exception of this sample, PAH levels, while significantly elevated above background levels, did not exceed the Apparent Effects Threshold for Total PAH.

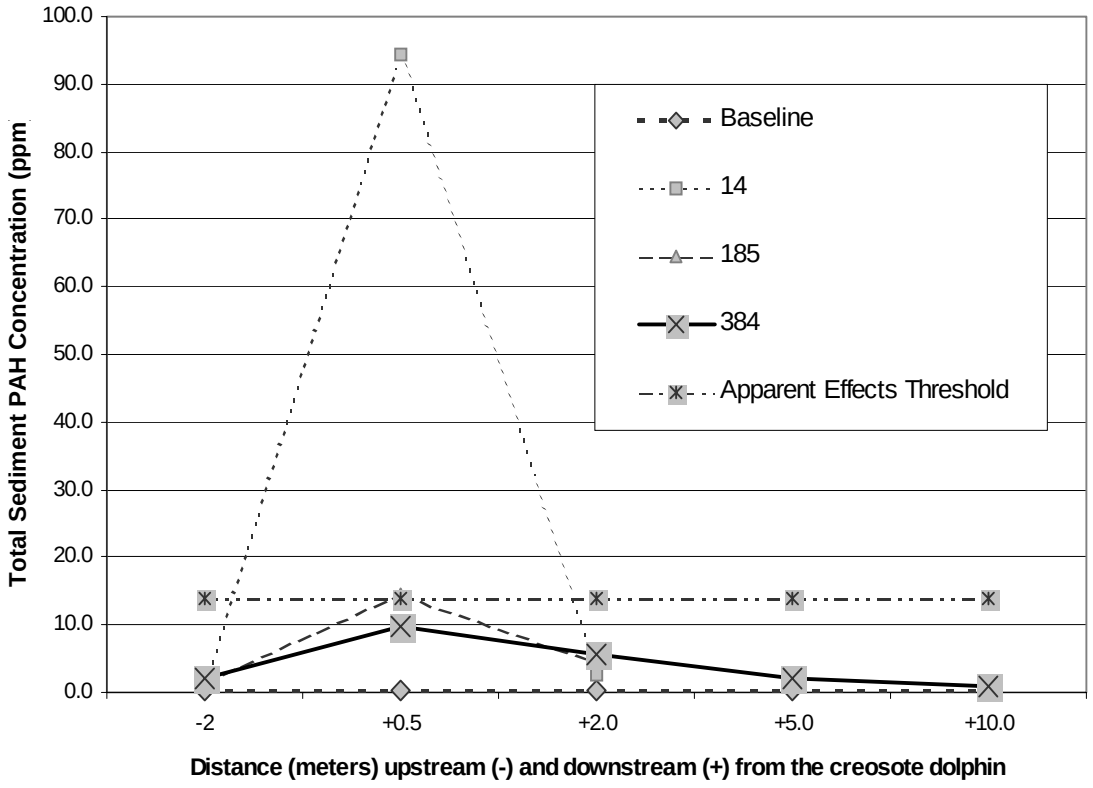


Figure 21. Normalized total PAH concentrations observed in sediments adjacent to a six piling dolphin constructed of aged creosote treated Douglas fir (Weathered Pilings).

Distances are provided in metres. Upstream stations are designated by negative numbers and downstream stations are positive. Concentrations are provided in µg Total PAH/g dry sediment for the Baseline and 14, 185 and 384 days post construction samples. The average Total Organic Carbon observed in sediments at this site was 1.04 $\pm$ 0.13 percent. The Washington State Apparent Effects Threshold Sediment Quality Standard for this level of sedimented carbon is provided as a standard against which to measure possible biological effects.

Environment Canada (1995) has developed 'Interim Sediment Quality Guidelines' for marine and freshwater, which include PAHs. These are intended as a screening tool for further investigation at a given site. They do not take into account such factors as, the pH of the medium, total organic carbon content, sediment grain size, or other environmental factors that might determine the fate and effects of PAHs at a particular site. These are intended as scientific benchmarks for evaluating sediment quality in Canada and are not meant to be standards. The U.S. Environmental Protection Agency (EPA, 1993a,b,&c) has developed numerical Sediment Quality Criteria for freshwater and marine environments. These are reviewed in Table 8 along with Apparent Effects Threshold based numerical sediment quality standards for Washington State (WAC 173-204-320). The Washington State Standards are those described as necessary to, " provide chemical concentration criteria, biological effects criteria, human health criteria, and other toxic, radioactive, biological, or deleterious substances criteria which identify surface sediments that have no adverse effects, including no acute or chronic adverse effects on biological resources and no significant health risk to humans, as defined in this regulation. The sediment quality standards provide a regulatory and management goal for the quality of sediments throughout the state." Relationships to various sediment quality criteria and standards and toxicity tests on field samples from Sooke Basin are discussed more fully in Section 5.9.

Table 8. Environment Canada's Interim Sediment Quality Guidelines, the U.S. Environmental Protection Agency and Washington State (WAC 173-204-320) numerical sediment quality standards for individual PAH and the sum of low and high molecular weight PAH. Maximum concentrations of individual PAH observed at the 0.5 metre BMP downstream sample station on Day384 are provided for comparison. All US values are in µg/g organic carbon at the observed mean Total Organic Carbon content of 1.04%.

PAH Compound	Environment Canada's Interim Sediment Quality Guidelines (ISQG) in µg/g		Proposed EPA Standard	Washington Standard	Mean TPAH Observed
	ISQG* (TEL)	PEL*			
Naphthalene	0.03	0.39		1.03	0.15
Acenaphthylene	0.01	0.13		0.67	0.06
Acenaphthene	0.01	0.089	2.39	0.17	0.90
Fluorene	0.02	0.144		0.24	0.85
Phenanthrene	0.09	0.54	2.50	1.04	2.9
Anthracene	0.05	0.24		2.29	3.1
Total LPAH	0.20	1.55		3.85	7.4
Fluoranthene	0.11	1.49	3.12	1.66	7.0
Pyrene	0.15	1.40		10.40	3.3
Benz(a)anthracene	0.08	0.69		1.14	2.4
Chrysene	0.11	0.846		1.14	4.6
Benzofluoranthenes	---	---		2.39	2.8
Benzo(a)pyrene	0.09	0.76		1.03	1.4
Dibenz(ah)anthracene	0.01	0.14		0.12	0.01
Ideno(1,2,3-cd)pyrene	---	---		0.35	0.49
Benzo(ghi)perylene	---	---		0.32	0.35
Total HPAH	0.55	5.33		9.98	19.6
Total TPAH	0.75	6.88		13.83[1]	27.0

* ISQG = provisional interim sediment quality guideline; TEL= Threshold Effects Level; PEL = Probable Effects Level. Note: A standard for Total PAH has not been developed. This value is simply the sum of the standards for the low and high molecular weight PAH. This value must be used with caution.

The 384 day sediment concentrations of fluoranthene and chrysene, at the Weathered Piling 0.5 metre downstream station, are compared with their respective Sediment Quality Standards in Figure 22. The observed levels of fluoranthene are just lower than the proposed EPA SQC but higher than the Washington State standard at distances less than two metres from the dolphins. There is no federally proposed sediment standard for chrysene. However, chrysene levels exceed the Washington State SQC at distances less than ca.1.0 metres from the piling. This analysis suggests that toxicity will be observed in at least one of the biological endpoints (Microtox™, amphipod or infaunal community analysis) in sediments located at the 0.5 metre sample station and perhaps at the 2.0 metre station where fluoranthene concentrations equal the Washington State Standard.

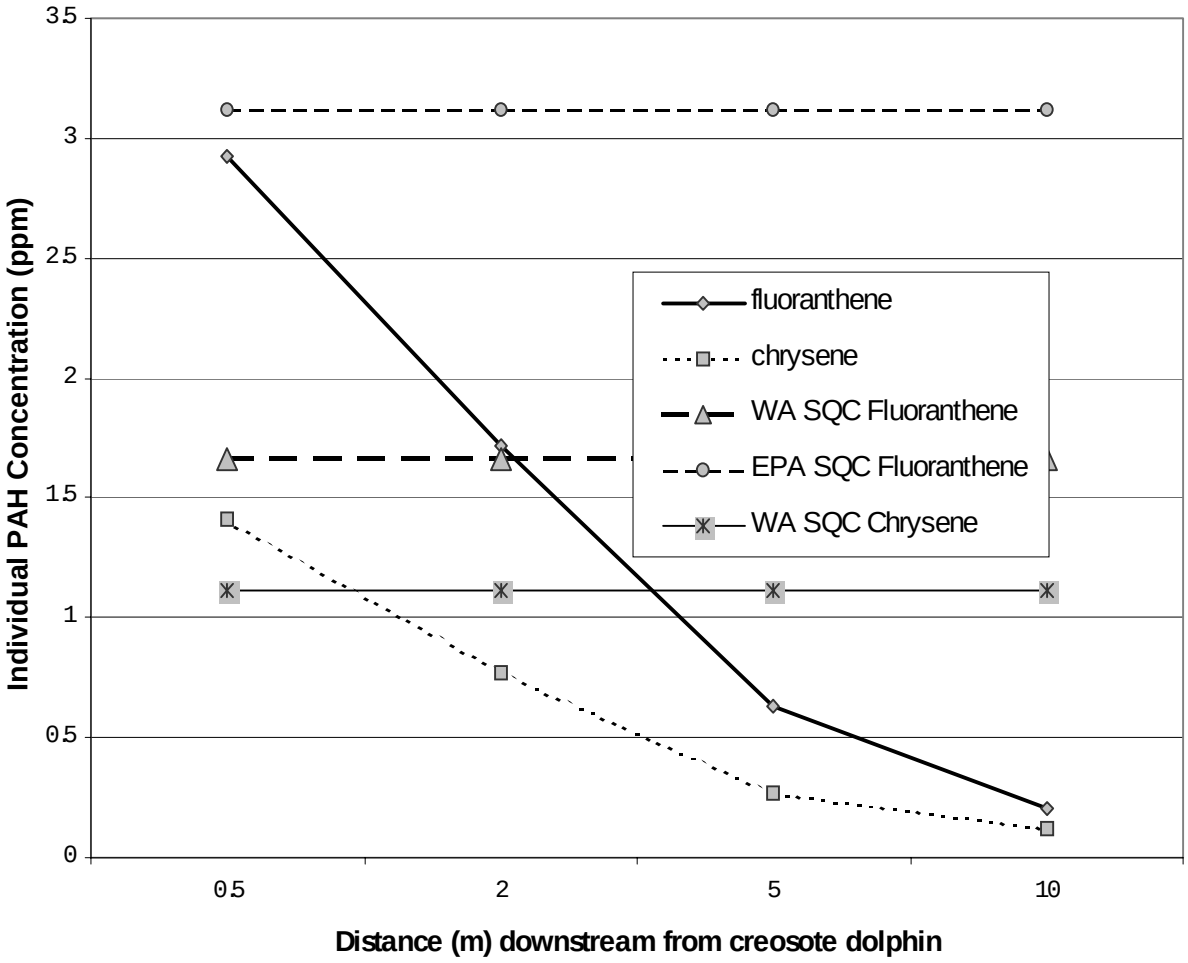


Figure 22 Comparison of observed concentrations of acenaphthene, phenanthrene and fluoranthene at stations downstream from the Weathered Piling Site in the Sooke Basin Creosote Evaluation Study with proposed EPA (1993) numerical sediment quality criteria.

5.3.5 Total sediment PAH concentrations as a function of time and distance from the BMP treated dolphin.

One hundred forty two parental PAH analyses were completed on sediment samples collected at the dolphin constructed of piling produced using *Best Management Practices* developed by the Canadian Institute of Treated Wood and the Western Wood Preservers Institute (Appendix I - creosote only). This dolphin is referred to as the BMP Dolphin. In addition to routine collection of the top two centimetres of the sediment column for chemical analysis and bioassay tests, core samples were collected on Day384 to examine the vertical PAH profile.

5.3.5.1 Total sediment PAH concentrations from Day0 to Day384.

Figure 23 shows the total PAH concentrations (sum of 16 priority PAH plus benzo(e)pyrene) found at the various downstream and upstream distance intervals at the BMP dolphin site between Day0 (baseline) and Day384. It should be noted that the data in Figure 23 are raw data adjusted for surrogate recoveries but not corrected for the CRM standard and therefore may exceed the actual sediment concentrations by about 10 percent. Table 9 summarizes the breakdown between the low molecular weight PAH (LPAH), high molecular weight PAH (HPAH) and the total PAH (TPAH) concentrations (µg/g, dry weight) and the percentage of the LPAH and HPAH compounds to the total concentration from Day0 to Day384.

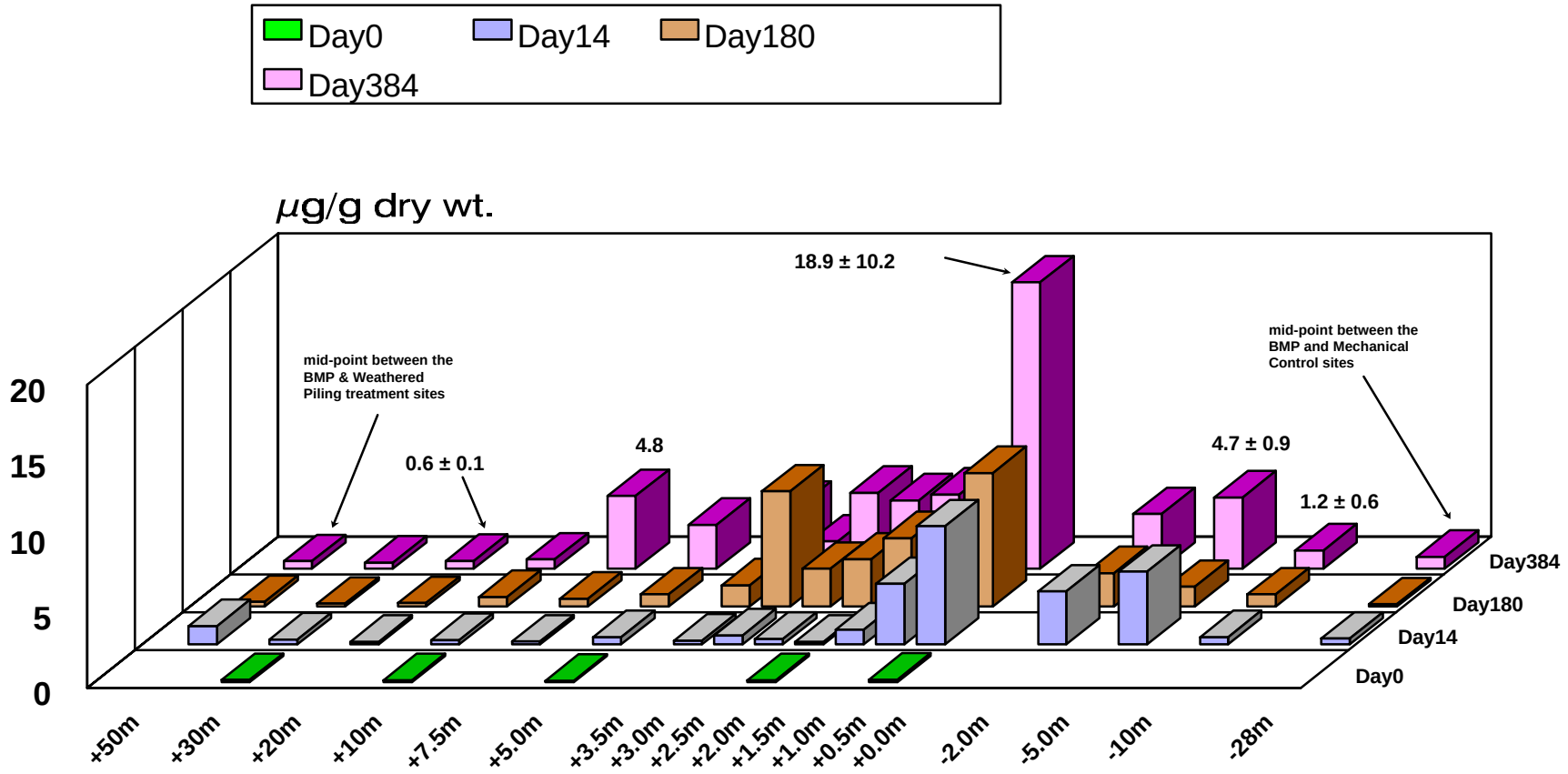


Figure 23. Sooke Basin Creosote Evaluation Study: Total PAH concentrations (µg/g, dry weight) in surface sediments at the BMP Piling downstream and upstream distance intervals during Day0 to Day384. Data are corrected for surrogate recovery only**.**

Table 9. Summary table showing the breakdown of sediment LPAH, HPAH and TPAH concentrations (µg/g, dry weight) and percent LPAH and HPAH composition at the BMP Piling Site (Day0 to Day384).

STATION	n	TOC %	LPAH µg/g		% TPAH	HPAH µg/g		% TPAH	TPAH µg/g		TPAH (µg/g) organic carbon
			Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.	
BASELINE (0 Days)											
BBP30	1	1.06	0.03		22	115		78	0.15		14
BBP10	1	0.88	0.03		22	99		78	0.13		14
BBP5.0	1	0.81	0.02		21	90		79	0.11		14
BBP2.0	1	0.99	0.03		20	109		80	0.14		14
BBP0.5	3	0.88	0.03	0.013	19	136	53	81	0.17	0.07	19
BMC0.5	3	0.82	0.02	0.003	20	90	11	80	0.11	0.01	14
BOC0.0	3	0.90	0.03	0.004	20	105	30	80	0.13	0.03	14
Mean			0.03	0.007	21	105	28	79	0.13	0.03	14
BMP TREATED PILINGS											
14BP50 (WP28)	1		0.41	0.02	36	0.75	0.03	64	1.2	0.1	
180BP50 (WP28)	1		0.07		21	0.26		79	0.32		
384BP50 (WP28)	3	0.49	0.07	0.01	15	0.41	0.07	85	0.49	0.07	100
mixed	1	0.82	0.10		12	0.68		88	0.78		95
14BP30	1	1.37	0.12		35	0.22		65	0.33		24
180BP30	1	1.35	0.04		20	0.15		80	0.19		14
384BP30	1	0.69	0.06		17	0.31		83	0.40		58
mixed	1	0.61	0.06		21	0.25		79	0.31		51
14BP20	1	1.29	0.05		27	0.13		73	0.18		14
180BP20	1	0.93	0.05		24	0.16		76	0.22		24
384BP20	1	0.90	0.12		24	0.40		76	0.52		58
mixed		0.95	0.12		24	0.40		76	0.52		55
14BP10	3	1.19	0.11	0.11	36	0.19	0.10	64	0.29	0.21	24
180BP10	3	1.46	0.20	0.12	33	0.41	0.18	67	0.62	0.3	42
384BP10	3	0.71	0.14	0.02	24	0.43	0.09	76	0.60	0.1	85
mixed	1	0.83	0.51		23	1.75		77	2.3		277
14BP7.5	1	1.15	0.05		26	0.14		74	0.19		16
180BP7.5	1	1.17	0.17		32	0.35		68	0.52		44
384BP7.5	1	0.85	1.94		40	2.85		60	4.8		565
mixed	1	0.59	0.57		20	2.29		80	2.9		492

Table 9 (cont'd)

STATION	n	TOC %	LPAH µg/g		% TPAH	HPAH µg/g		% TPAH	TPAH µg/g		TPAH (µg/g) organic carbon
			Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.	
14BP5.0	3	1.30	0.22	0.28	45	0.27	0.25	55	0.49	0.54	38
180BP5.0	3	0.93	0.27	0.13	33	0.54	0.22	67	0.81	0.36	87
384BP5.0	3	0.60	0.85	0.31	30	2.03	0.49	70	2.9	0.8	483
mixed	1	0.67	0.75		23	2.58		77	3.3		493
14BP3.5	1	1.12	0.06		26	0.19		74	0.25		23
180BP3.5	1	0.79	0.36		25	1.08		75	1.4		177
384BP3.5	1	0.70	1.25		31	2.76		69	4.0		571
mixed	1	0.85	0.51		23	1.70		77	2.2		260
14BP3.0	1	0.96	0.30		52	0.28		48	0.58		60
180BP3.0	1	0.67	3.29		43	4.29		57	7.6		1131
384BP3.0	1	0.59	0.37		20	1.46		80	1.8		305
mixed	1	0.75	0.60		22	2.06		77	2.7		355
14BP2.5	1	1.06	0.16		46	0.19		54	0.36		34
180BP2.5	1	1.58	0.84		34	1.62		66	2.5		158
384BP2.5	1	0.60	1.05		21	3.98		79	5.0		840
mixed	1	0.49	0.79		21	3.08		79	3.9		796
14BP2.0	1	0.93	0.06		33	0.12		67	0.18		19
180BP2.0	1	1.53	0.82		26	2.30		74	3.1		203
384BP2.0	1	0.72	1.08		24	3.41		76	4.5		625
mixed	1	0.66	1.29		16	6.94		84	8.2		1242
14BP1.5	1	0.86	0.49		51	0.47		49	0.97		112
180BP1.5	1	2.8	1.71		36	3.10		64	4.8		171
384BP1.5	1	0.6	0.93		19	4.00		81	4.9		817
mixed	1	0.53	0.36		19	1.54		81	1.9		358
14BP1.0	1	0.92	2.53		64	1.45		36	4.0		432
180BP1.0	1	1.07	0.88		33	1.75		67	2.6		243
384BP1.0	1	0.58	0.99		17	4.73		83	5.7		983
mixed	1	0.53	1.59		18	7.05		82	8.6		1623

Table 9 (cont'd)

STATION	n	TOC %	LPAH µg/g		% TPAH	HPAH µg/g		% TPAH	TPAH µg/g		TPAH (µg/g) organic carbon
			Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.	
14BP0.5	3	0.83	4.24	2.33	54	3.62	2.2	46	7.8	4.4	940
180BP0.5	3	0.91	3.19	0.60	36	5.59	0.97	64	8.8	1.6	967
270BP0.5	1	0.9	21.83		40	32.64		60	54.5		6056
384BP0.5	3	0.68	4.65	3.17	25	14.21	7.01	75	18.9	10.2	2779
mixed	1	0.47	2.44		17	12.33		83	14.8		3149
384BP0.0	1	0.59	6.58		21	24.22		79	30.8		5220
384BP0.5 (offshore)	1	1.15	19.26		28	49.07		72	68.3		5939
384BP2.0 (offshore)	1	0.93	0.65		23	2.20		77	2.9		312
384BP5.0 (offshore)	1	0.93	0.15		22	0.530		78	0.7		75
384BP10 (offshore)	1	1.76	0.17		25	0.49		75	0.7		40
Upstream											
14BP2.0	3		1.89	1.70	54	1.62	1.81	46	3.5	3.5	
180BP2.0	3	1.1	0.75	0.43	35	1.42	0.53	65	2.2	1.0	200
384BP2.0	3	0.46	0.97	0.24	27	2.66	0.61	73	3.6	0.8	783
14BP5.0	3		2.56	1.77	54	2.21	1.40	46	4.8	3.2	
180BP5.0	3	1.0	0.51	0.16	39	0.79	0.34	61	1.3	0.5	130
384BP5.0	3	0.79	1.06	0.23	23	3.62	0.73	77	4.7	0.9	595
14BP10	3	0.6	0.21	0.13	44	0.26	0.09	56	0.5	0.2	78
180BP10	3	1.0	0.25	0.10	32	0.52	0.22	68	0.8	0.3	80
384BP10	3	0.61	0.41	0.32	34	0.79	0.32	66	1.2	0.6	197
14BP28	1	0.80	0.16		40	0.23		60	0.4		49
180BP28	1	0.80	0.05		32	0.10		68	0.2		19
384BP28	1	0.78	0.25		32	0.54		68	0.8		100

5.3.5.2 Comparison of observed BMP sediment PAH concentrations with predicted concentrations.

Figure 12 provided a prediction, using the models of Brooks (1994), of the maximum sediment PAH concentrations anticipated at the BMP dolphin. Sediment PAH concentrations, observed on Day384, are compared with the predicted values in Figure 24.

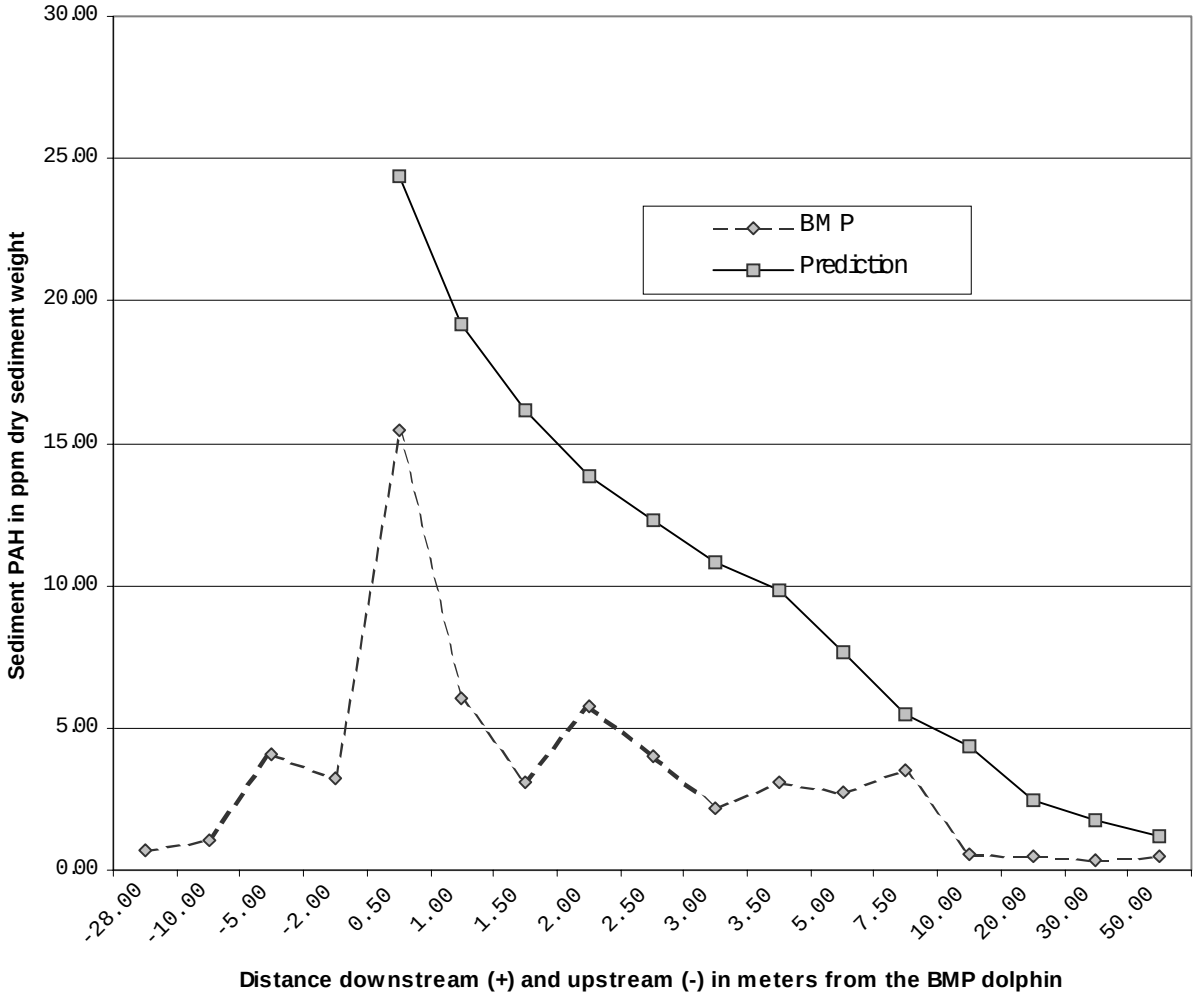


Figure 24. Predicted sediment concentrations of Total PAH from Brooks (1994) with concentrations of TPAH observed adjacent to the BMP treated dolphin at the Sooke Basin Creosote Evaluation Study on Day384.

Predicted concentrations of PAH are higher, at all points on the graph than are the observed concentrations. Two reasons for this apparent discrepancy are provided. First, the assumptions used in creating the models of Brooks (1994) are very conservative from the environment's point of view. Secondly, the model predictions provided in Figure 24 are for the maximum predicted PAH concentrations. Brooks (1997) contains a numerical solution to the series expansion describing PAH deposition and microbial degradation as a function of time, temperature, salinity and average PAH half-life for the mixture of PAH in creosote. This exercise suggested that maximum accumulation occurs

between two and three years after immersion when the mixture's half-life is 214.8 days. Brooks (1994) suggests that this is a reasonable half-life for creosote derived PAH in Pacific Northwest waters. Observed PAH concentrations will initially be lower as PAH accumulate. Creosote loss from piling appears to decline with immersion time. When microbial degradation rates exceed the loss of new PAH from the piling, sediment concentrations will decrease and within ten years, sediment PAH concentrations are predicted to be approximately half (54%) of the maximum values predicted by Brooks (1994). This exercise was completed with a half-life of 214.8 days. That implies well oxygenated sediments (RPD >2) and an average annual sediment temperature of 20 ^{o}C. Other values of sediment temperature and oxygen tension would require use of a different PAH half-life producing a somewhat different curve. However, Figure 25 can be considered typical.

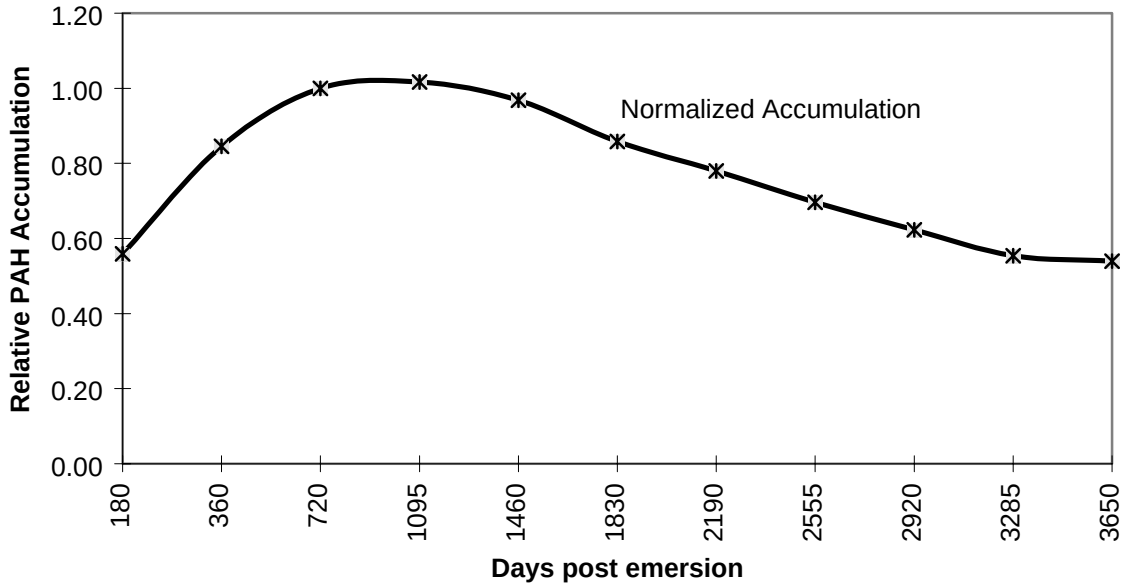


Figure 25. Predicted long term concentrations of sedimented PAH associated with creosote lost from treated pilings. Values have been normalized to the maximum values predicted by the models of Brooks (1994).

This analysis suggests that sedimented PAH concentrations have reached about 85% of the maximum predictions at the end of 384 days. Therefore, the observed values in this study are predicted to increase by 18% before reaching the maximum predicted in Figure 24 at about three years post construction. This suggests that the observed values should be increased by a factor of 1.176 to compare them with predicted values. The results are described in Figure 26. The model's predictions are still higher than the corrected observed values suggesting that the model is perhaps too conservative and should be modified. As will be seen in a later section of this report, this study suggests a PAH transport hypothesis that provides an analytical basis for correcting the model. In the interim, this analysis suggests that the model provides a significant environmental safety margin in that predictions are ca. 30% too high in the near-field where maximum PAH concentrations are predicted and observed.

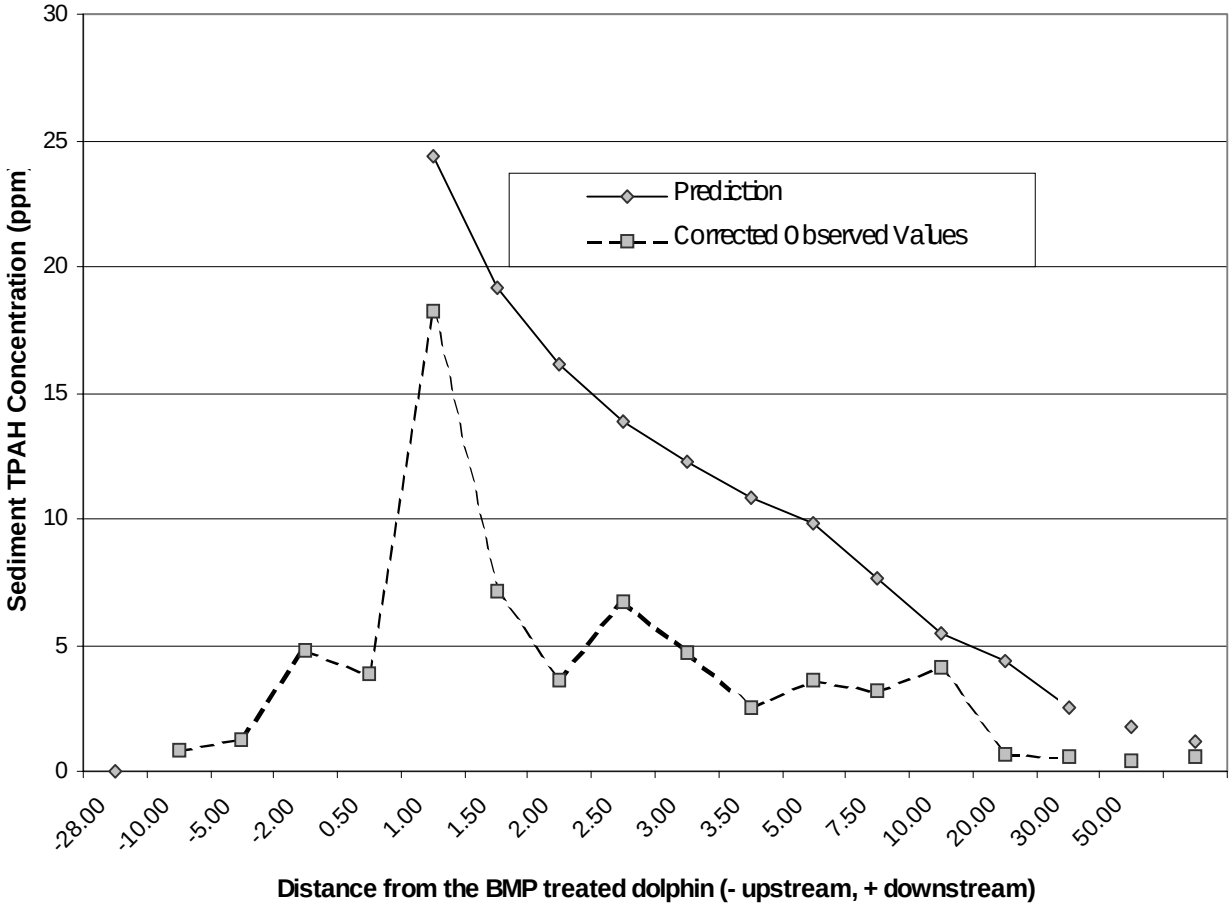


Figure 26. Predicted maximum PAH concentrations associated with the BMP Dolphin in the Sooke Basin Creosote Evaluation Study and observed sediment PAH concentrations corrected for anticipated additional accumulation before a peak is reached at about three years post construction.

The temporal aspects of PAH accumulation in sediments downstream from the BMP treated dolphin at Sooke Basin are described in Figure 27. Fourteen day PAH concentrations are significantly increased to a distance of approximately 2.0 metres from the dolphin perimeter. At 185 days, the area with significant accumulation of PAH has increased to 5.0 metres and at 384 days, significant PAH elevations are observed to a distance of 7.5 metres from the dolphin.

The accumulation of PAH in sediments is a function of the deposition of new PAH and the catabolism of sedimented PAH. No discontinuities in sediment characteristics (grain size, total organic carbon or depth of the redox potential discontinuity) were observed along the downstream transect. This suggests that microbial metabolism of the PAH is fairly uniform within the zone of accumulation. It seems reasonable that the steep decline in PAH accumulation at distances greater than 7.5 metres is associated with reduced PAH transport beyond that point.

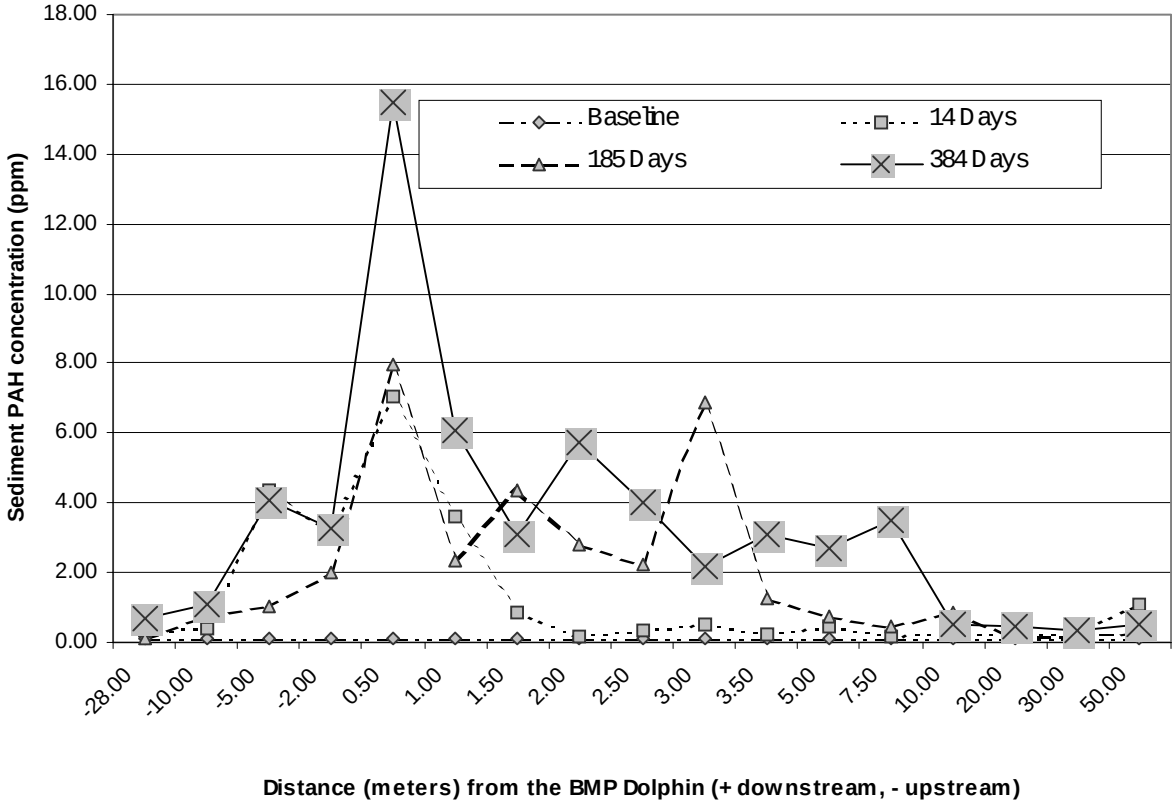


Figure 27. Accumulation of PAH in sediments upstream (-) and downstream (+) from the BMP treated dolphin during the Sooke Basin Creosote Evaluation Study.

5.3.5.2 Comparison of Total PAH between dolphins treated using Weathered Piling (WP) and new Best Management Practices Piling (BMP).

Sediment concentrations of PAH associated with BMP and WP on Day384 of the Sooke Basin study are provided in Figure 28. Sediment concentrations of PAH are similar at all stations. The range in replicate values at the 0.5 metre station was 9.9 to 29.9 µg/g at the BMP dolphin and 5.9 to 16.1 µg/g at the WP dolphin. The observed difference is not statistically significant (two tailed *t*-test, $\alpha = 0.05$, $t_{crit} = 2.776$, $t = 1.227$). Similar tests on the low and high molecular weight PAH fractions of these samples and for fluoranthene and chrysene revealed no significant differences between the BMP and WP sites at the 0.5 downstream station on Day384. These results suggest that there is no significant difference in the concentrations of PAH associated with new pilings produced by Best Management Practices and weathered pilings that are five to eight years old. This is also supported by the results of PCA analysis on the BMP and weathered piling data sets, both showing a similar PAH composition in the sediments at 0.5m after 384 days exposure.

By contrast, surface sediment TPAH concentrations at the existing creosote treated structure in Belcarra Bay during the Phase I studies (EVS, 1994b) ranged between <0.02 µg/g 40 metres from the structure and 19.7±12.9 µg/g, 3 metres from the nearest piling. Pilings at this site were between 4 and

20 years old. During site selection surveys in 1995 the sediment PAH concentration 3 metres from a creosote treated pier (unknown age) in Port Graves, Howe Sound, was 7.4 µg/g (Goyette, 1995).

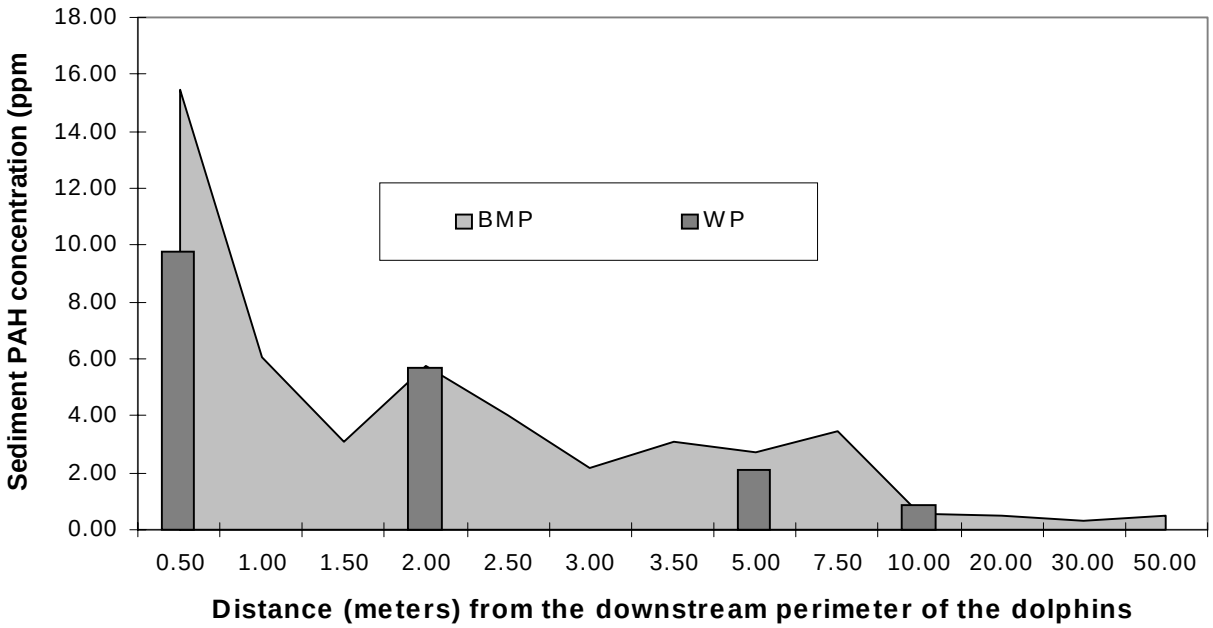


Figure 28. Comparison of sedimented total PAH concentrations at the Weathered Piling and BMP Piling dolphins on Day384 of the Sooke Basin Creosote Evaluation Study.

Goyette and Boyd (1989) and Boyd and Goyette (1993) examined the sediment PAH distribution patterns in Vancouver Harbour, an area affected by a variety of urban/industrial sources of PAHs, including refinery discharges (Port Moody Arm), historical gasification facilities (False Creek), municipal combined sewer overflows or CSO's (inner harbour), abandoned shipyards and marinas (Coal Harbour) and background conditions throughout the harbour. In comparison to the Sooke Basin study, sediment PAH concentrations in the central areas of the harbour generally ranged between 1 and 2 µg/g. Concentrations near several municipal CSO discharges (Clark Drive, Victoria Drive, and Denman Street) were between 7.6 and 37.3 µg/g, total PAH. In Port Moody Arm, site of several refineries, one extending back to 1917, PAH concentrations ranged from 4.0 µg/g in the outer reaches of the arm to a maximum of 22 µg/g and 37 µg/g near the refinery discharges (treated process effluent and stormwater). PAH levels in False Creek were between 3.1 µg/g at the mouth and 80.2 µg/g near the site of an historical coal gasification plant. PAH concentrations in Coal Harbour, site of abandoned shipyards and several existing marinas, were up to 117 µg/g (Boyd and Goyette, 1993). The dominant PAHs in the Vancouver Harbour samples were fluoranthene, pyrene, benzo(k,b)fluoranthene, chrysene and phenanthrene.

5.3.5.3 Distribution of PAH as a function of substrate depth.

Core samples were collected at the 0.5 metre downstream sample station from both the WP and BMP dolphins on Day384. Cores were also taken at the BMP 1.0, 2.0 and 5.0 metre sampling stations (Appendix VI). These cores were sectioned and PAH analyzed in the 0-2, 2-4, 4-6, and 8 to 10 cm

depths. Results are summarized in Figure 29. Sediment concentrations decline exponentially with depth. The distribution of PAH with depth is successfully modeled by the following equations. Both expressions are highly significant explaining 99.8 and 98.3% of the variation in each database. All coefficients were significant at $\alpha = 0.05$ and residuals appear normal. Results from the surface grabs were used for the 0 - 2 cm core depth. These data indicated that PAH are distributed at least to a depth of 4 - 6 cm in the sediment column. However, the concentration of PAH at the Weathered Piling site in the

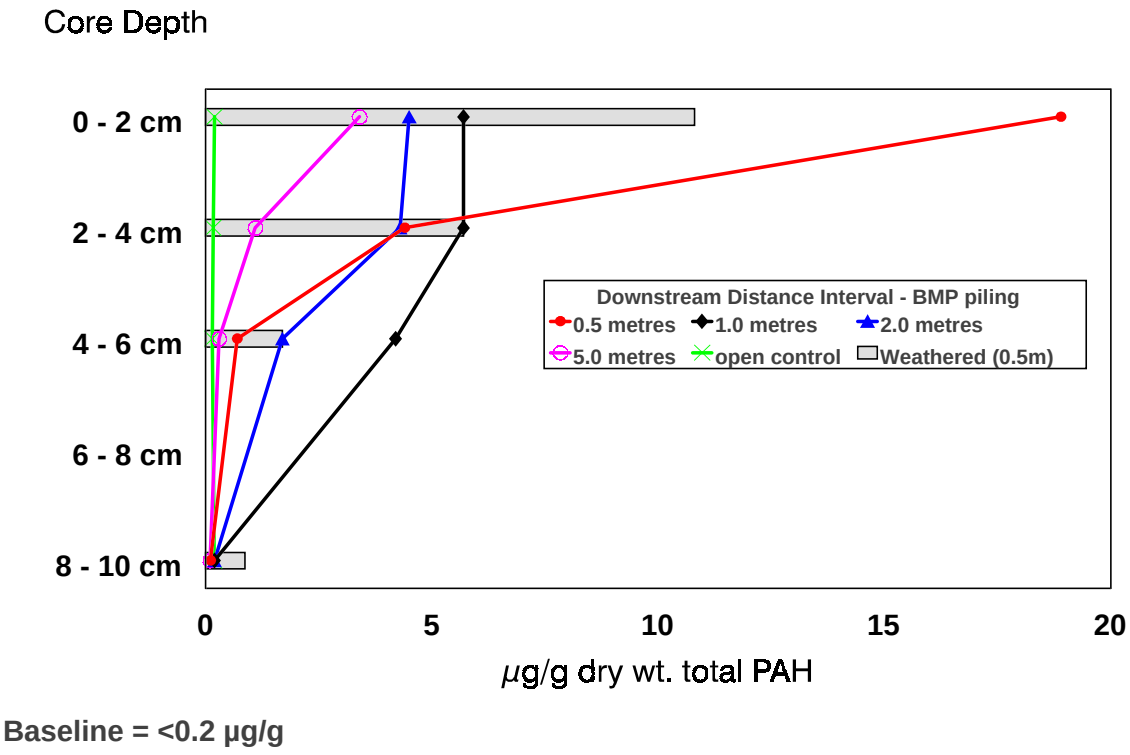


Figure 29. TPAH concentrations as a function of core depth in Sooke Basin sediments downstream from the BMP and Weathered (WP) piling dolphins.

2-4 cm core was only half (46%) of the concentration in the top two centimetres. Likewise, the concentration of PAH in the 2-4 cm core was only 25% of the value observed in the top two centimetres at the BMP site. Its worth noting that the characteristics of the sediment column changed from a fine, loosely packed surface layer to a coarser, more compact subsurface layer at about 2 - 4 cm.

Treatment	Exponential Relationship	Coefficient of Determination
BMP Piling:	$\mathbf{PAH_{BMP}\ at\ Depth = 30.24*exp^{(-0.691*Depth\ (cm))}}$	**0.998**
Weathered Piling	$\mathbf{PAH_{WP}\ \ at\ Depth = 14.43*exp^{(-0.378*Depth\ (cm))}}$	**0.983**

This analysis emphasizes the importance of the depth at which sediment PAH samples are taken and the need to standardize and harmonize protocols for collecting bioassay sediments with protocols used in developing numerical sediment quality criteria. Many regulatory programs, and protocols for the evaluation of PAH in sediments (i.e. PSEP, 1986) require collection of the top two centimetres of the sediment column because this is considered the most bioactive zone. However, these procedures are not standardized and the top ten centimetres (or more) of the sediment column are frequently collected for sediment bioassays. In this instance, homogenizing the top ten centimetres for bioassays would significantly decrease the concentration of contaminants to which test animals are exposed. This was demonstrated during amphipod bioassay tests performed in the early stages of the study (Section 5.7.3).

5.3.5.4 Modeling of observed PAH concentrations at the BMP piling site.

Section 5.3.1 discussed the presence of high PAH concentrations observed at the Mechanical Control site. That discussion concluded that the high PAH concentrations, while apparently real, were not representative of overall conditions at the Mechanical Control site and were not indicative of the presence of a source of PAH at that site. High variability among replicate samples at both the BMP and Weathered piling sites was also observed, indicating that the distribution of PAH is patchy on some undetermined scale. The experimental design used in this study relies on both replicate samples supporting the use of analysis of variance or covariance and on the use of closely spaced samples along a transect permitting an evaluation of PAH concentration as a function of distance from the dolphins using regression analysis. The following analysis will focus on those samples collected on Day384 because, as seen in Figure 25, sediment PAH concentrations are approaching an equilibrium condition wherein new deposition is predicted to be just greater than microbial catabolism of existing PAH in the sediments. An evaluation of Day384 is also appropriate because PAH levels are greatest on that day and therefore environmental risk is the greatest. A scatterplot of values of parental PAH observed on the downstream transect at the BMP dolphin is provided in Figure 30.

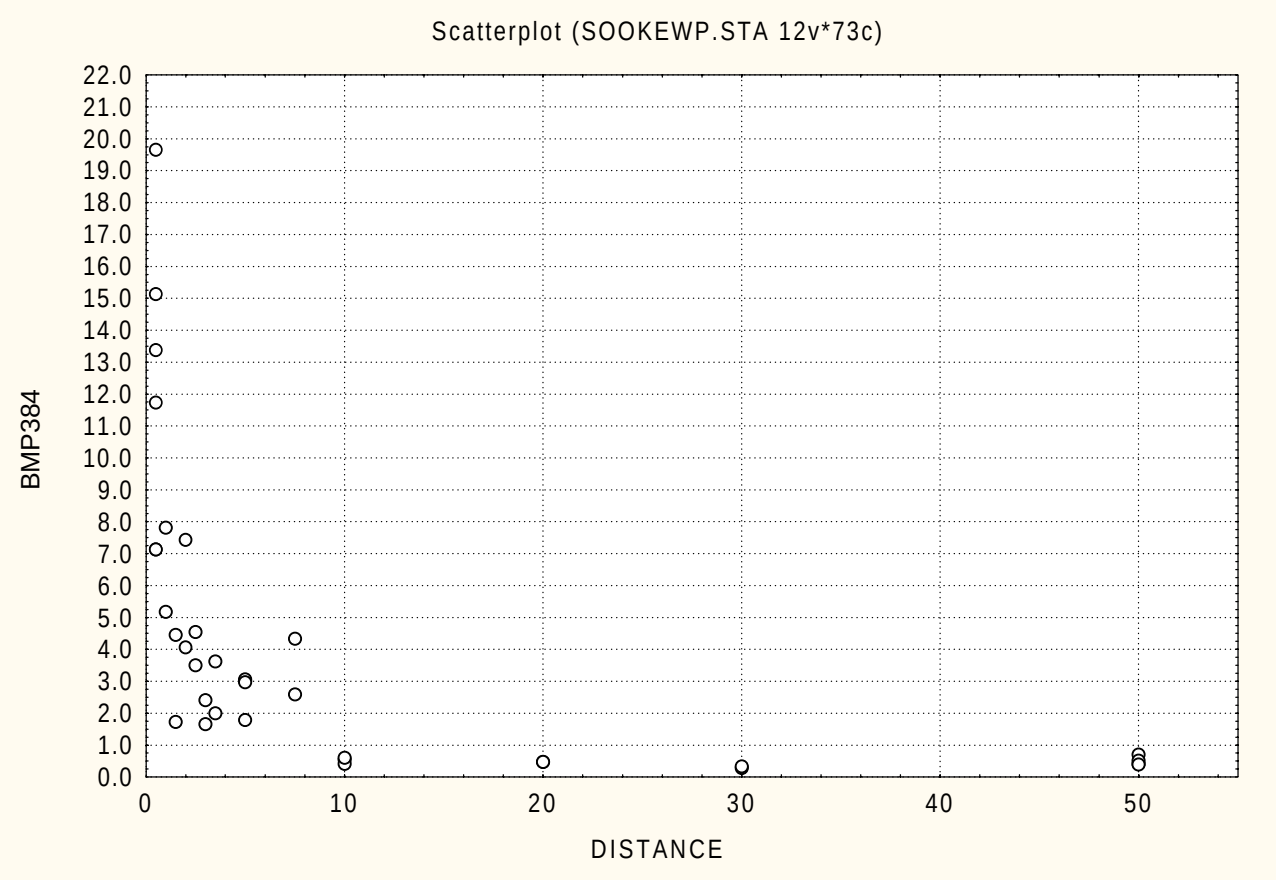


Figure 30. Scatterplot describing levels of total *parental* PAH observed in the top two centimetres of the sediment column on the downstream transect from the BMP dolphin in the Sooke Basin Creosote Evaluation Study on Day384. *Parental* PAH values are in µg/g dry sediment weight and distance is measured in metres.

Accumulation of PAH is generally restricted to distances $\leq$ 7.5 metres from the six piling dolphin. Levels of PAH outside 7.5 metres were generally low. Four of the five analyses done on samples collected at the 10 metre station on Day384 averaged 0.523 $\pm$ 0.144 µg/g TPAH. A fifth analysis revealed a TPAH value of 2.590 µg/g giving a mean of 0.598 µg/g TPAH. This value was not significantly greater than the mean value reported for the Open Control Site of 0.188 µg/g TPAH (one tailed *t*-test @ $\alpha = 0.05$; $t = -1.467$; $p = 0.166$). If the single high value is excluded from the database, then the variance associated with the BMP sites is significantly reduced and TPAH concentrations observed from 10 to 50 metres are significantly elevated above the Open Control values ($t = -3.83$, $p = 0.002$). In either case the elevation in PAH downstream is minor (ca. 0.3 µg/g) suggesting that there is no general contamination. It should be noted that the 50 metre downstream station for the BMP piling is located 28 metres upstream from the Weathered Piling site and it is likely that both structures are contributing a small amount of PAH to this station. The models of Brooks (1994) predict an increase of 1.02 µg/g TPAH at a distance of 50 metres downstream from either dolphin. This is about three times the value actually observed. Sediment concentrations of TPAH observed outside 7.5 metres from the piling are well below regulatory sediment quality criteria or levels at which biological responses are measured (Johnson, *et al.* 1994). Therefore the remainder of this analysis will focus on TPAH levels at stations located within 7.5 metres of the downstream perimeter of the BMP treated dolphin.

Nonlinear regression analysis (STATISTICA™ 7.0 for Windows) was used to model PAH accumulations along the downstream transect at the BMP piling on Day384. Figure 31 provides a scatterplot of the observed TPAH values with the fitted curve.

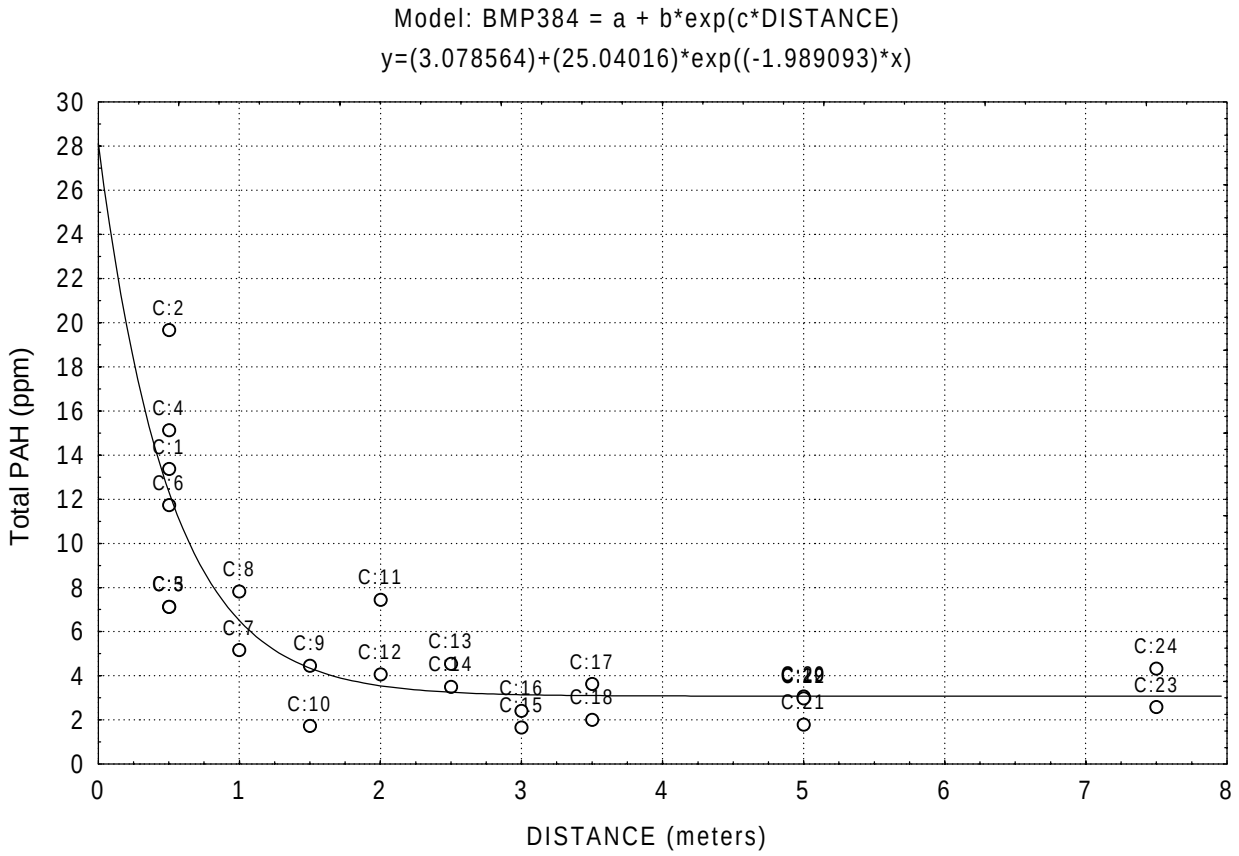


Figure 31. Scatterplot describing sediment accumulations (µg/g, dry sediment weight) of total parental PAH observed 384 days following construction as a function of distance downstream from a six piling dolphin treated using Best Management Practices for the Sooke Basin Creosote Evaluation Study. The accumulations are modeled between 0.5 metres and 7.5 metres downstream using non-linear regression techniques.

The fitted curve explains 70.1 percent of the observed variation, the regression coefficients are all significant and residual analysis indicates that the distribution meets the requirements for normality and homoscedasticity. These results suggest three areas of distinctly different levels of PAH accumulation. There is an apparent exponential decline in sedimented parental PAH from the perimeter of the BMP piling dolphin to a distance of 2.5 metres. PAH concentrations are relatively stable at 3.08 µg total PAH/g (dry sediment) from 2.5 to 7.5 metres from the perimeter of the dolphin. This increase is statistically significant but below Washington State's and U.S. Environmental Protection Agency sediment quality standards. This average level (based on regression analysis) is also less than the Effects Range Low for either total PAH or for individual PAH described by Long and Morgan (1990). PAH levels declined sharply beyond 7.5 metres from the BMP dolphin and resulted in only small increases of ca. 0.3 µg/g total PAH in the top two centimetres on the sediment column. The reason for the apparent discontinuity at 7.5 metres is undetermined at this point but may be revealed in future investigations of PAH transport mechanisms from pilings to sediment and the effects of time. The identification of

sample stations exhibiting potential toxicity is pursued in Table 10. The mean value of individual PAH for all replicates at each sample station located downstream from the BMP treated piling on Day384 is provided. The Washington State, apparent effects threshold based Sediment Quality Standard (WAC 173-204) is calculated at the mean TOC (0.68 ± 0.05 percent) observed. Additional evaluation is provided by comparing the observed PAH values against the Overall Apparent Effects Threshold of Long and Morgan (1991). Sediment PAH concentrations exceeding the AET of Long and Morgan (1990) are illustrated in italics with an underline. Benzo(e)pyrene is not included in these Sediment Quality Standards and the value used in the table is that given for benzo(a)pyrene. Based on this evaluation, adverse responses are predicted at the 0.5 metre station associated with total high and low molecular weight PAH and a number of individual compounds.

Table 10. Observed sediment concentrations of individual PAH along the downstream transect from the BMP dolphin in the Sooke Basin Creosote Evaluation Study. The Washington State Sediment Quality Standard was computed for an average sediment total organic carbon content of 0.68%. All PAH values and the Canadian Interim Sediment Quality Guidelines (ISQG) or TEL values are in µg/g (dry sediment weight). Observed values that exceed the Washington State SQS are bolded. Values exceeding the Apparent Effects Threshold of Long and Morgan (1990) are underlined and italicized.

Compound/Distance	0.5	1.0	1.5	2.0	2.5	3.5	3.5	5.0	7.5	10.0	ISQG (TEL)	WA SQS
Naphthalene	0.052	0.017	0.017	0.018	0.016	0.015	0.015	0.017	0.024	0.013	0.035	0.672
Acenaphthylene	0.033	0.016	0.008	0.013	0.009	0.004	0.003	0.005	0.006	0.002	0.006	0.448
Acenaphthene	***0.372***	**0.117**	0.057	0.099	0.136	0.069	0.146	0.112	0.231	0.036	0.007	0.109
Fluorene	***0.425***	0.156	0.070	0.140	0.127	0.066	0.126	0.107	0.191	0.035	0.021	0.156
Phenanthrene	***1.564***	*0.603*	*0.294*	*0.547*	*0.389*	0.219	*0.416*	*0.405*	*0.520*	0.094	0.087	0.678
Anthracene	1.260	0.258	0.140	0.253	0.158	0.066	0.088	0.101	0.163	0.030	0.047	1.492
Fluoranthene	***3.480***	***1.514***	0.746	1.311	0.963	0.520	0.680	0.689	0.805	0.212	0.11	1.085
Pyrene	*1.670*	0.685	0.366	0.597	0.493	0.273	0.420	0.418	0.506	0.111	0.15	6.784
Benz(a)anthracene	***1.480***	*0.655*	0.330	*0.592*	0.393	0.170	0.215	0.208	0.258	0.074	0.075	0.746
Chrysene	***2.407***	*1.022*	0.484	0.895	0.524	0.237	0.287	0.249	0.316	0.102	0.11	0.746
Benzofluoranthenes	**1.583**	0.687	0.194	0.606	0.384	0.183	0.194	0.187	0.208	0.088	---	1.560
Benzo(e)pyrene	0.471	0.212	0.108	0.185	0.118	0.059	0.060	0.058	0.061	0.029	---	0.672
Benzo(a)pyrene	***0.809***	0.337	0.177	0.298	0.194	0.091	0.096	0.088	0.104	0.041	0.089	0.672
Dibenz(ah)anthracene	0.056	0.015	0.000	0.017	0.013	0.006	0.007	0.007	0.007	0.002	0.006	0.081
Ideno(1,2,3-cd)pyrene	**0.273**	0.117	0.057	0.104	0.061	0.032	0.033	0.033	0.035	0.016	---	0.231
Benzo(ghi)perylene	0.189	0.083	0.042	0.074	0.046	0.023	0.024	0.025	0.025	0.013	---	0.210
Total HPAH	**12.420**	5.327	2.504	4.181	3.189	1.595	2.017	1.962	2.326	0.294	0.655	6.513
Total LPAH	**3.705**	1.166	0.585	1.070	0.834	0.439	0.794	0.747	1.135	0.210	0.312	2.510
Total PAH	16.125	6.493	3.089	5.252	4.023	2.033	2.811	2.709	3.460	0.504	1.684 n=12	9.023

Adverse effects are predicted at the 1.0 metre station associated with acenaphthene, phenanthrene, fluoranthene, benz(a)anthracene and chrysene. Outside 1.0 metre, the only exceedance is for phenanthrene, which is higher than Long and Morgan's (1991) AET of 0.260 at distances to 7.5 metres. Long and Morgan (1990) give an Effects Range Low of 0.225 µg/g phenanthrene (dry sediment weight) and an Effects Range Moderate of 1.380 µg/g (dry sediment weight) for phenanthrene. Excepting the 0.5 metre station, none of the observed phenanthrene concentrations exceed the Effects Range Moderate. Long and Morgan's (1990) data are not normalized to Total Organic Carbon and therefore provide a different basis for evaluation than the total organic carbon based Washington State or proposed EPA sediment quality standards. These predictions include additive, synergistic and antagonistic effects through inclusion of the Washington State Apparent Effects Threshold values for LPAH and HPAH and Long and Morgan's (1990) AET for Total PAH.

5.3.5.5 Visual observation of PAH and the *Particulate PAH Transport Hypothesis.*

During the processing of sediment samples, small microsheens (0.5 to 3.0 cm in diameter) were observed in the sediment matrix as it was exposed to the air. These microsheens were observed to depths of ca. 4 cm. In addition, in samples in which the entire top two centimetres of the sediment column were homogenized, multiple microsheens were observed at the air-sediment interface. These microsheens were observed to retain their integrity, even after vigorous stirring, suggesting that PAH were distributed in the sediment matrix as small point sources, likely contained within microspheres of PAH. A photograph of these microsheens is provided in Figure 32.

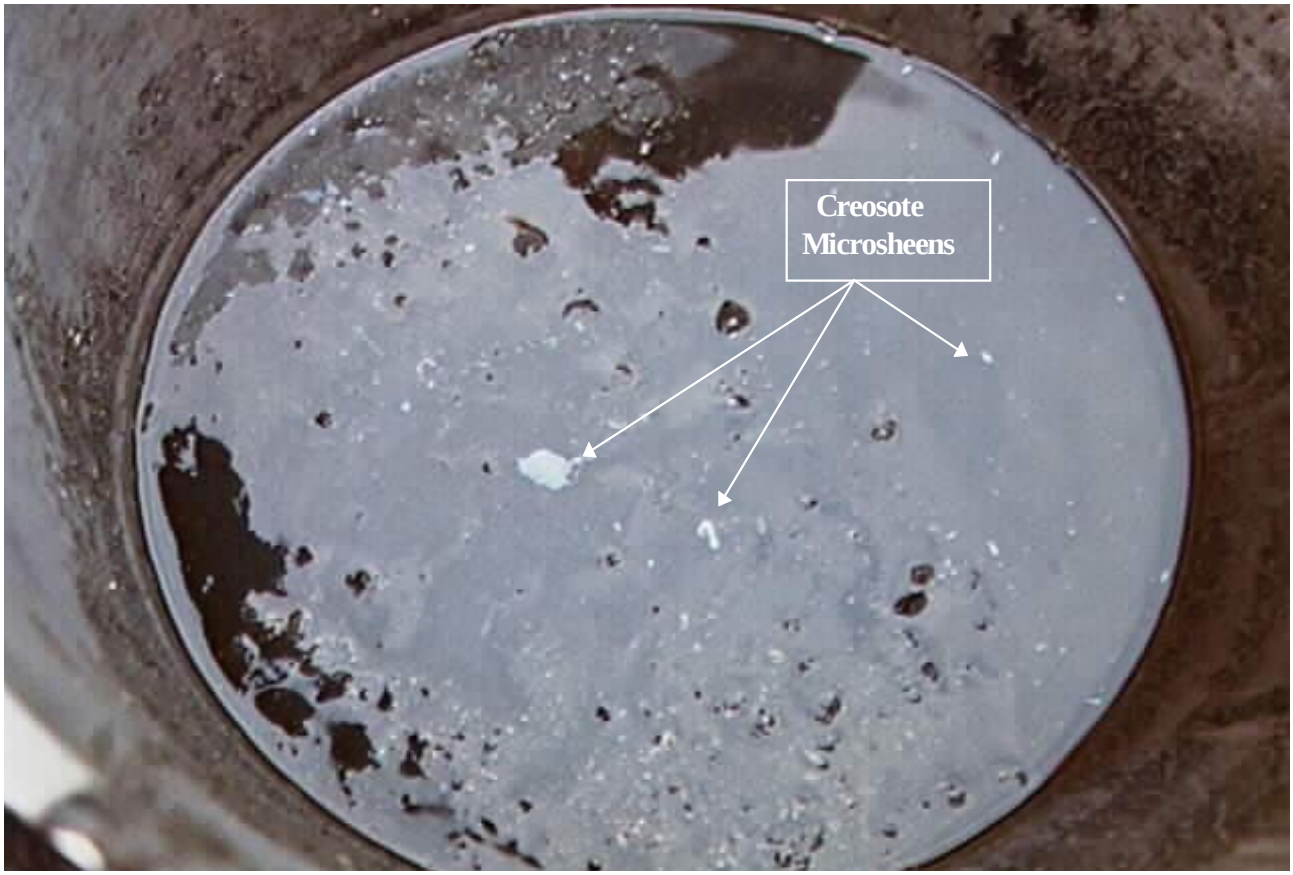


Figure 32. Photograph showing creosote microsheens in a benthic sediment sample.

5.4. Water Column Concentrations of PAH.

Semipermeable Membrane Devices (SPMD) deployed on April 3, 1996 and recovered on April 17, 1996, including trip blanks and the membrane at the open control site, were all contaminated with naphthalene to levels of ca. 500 parts per trillion (ng/L). New SPMDs were deployed on June 4, 1996 and recovered on June 18, 1996. The results of Battelle's Marine Science Laboratory analysis are provided in Table 11. All values are in parts per trillion (ng/L)

Table 11. Dissolved PAH in the water at a distance of 0.25 metres from perimeter piling at the Best Management practices creosote treated dolphin at the Sooke Basin Creosote Evaluation Study site. All values are in ng/L (parts per trillion).

Compound/Device	BMP Downstream	BMP Upstream	BMP Offshore	Open Control
Naphthalene	6.471	7.160	5.442	5.045
Acenaphthalene	0.545	0.643	0.600	0.442
Acenaphthene	4.624	7.166	3.110	2.135
Fluorene	3.695	4.572	2.779	1.999
Phenanthrene	4.066	5.677	2.848	2.030
Anthracene	0.466	0.708	0.442	0.090
Fluoranthene	2.401	3.698	2.076	1.391
Pyrene	0.571	0.947	0.464	0.213
benz(a)anthracene	0.042	0.078	0.037	0.002
Chrysene	0.035	0.061	0.030	0.001
Benzofluoranthenes	0.013	0.029	0.021	0.016
benzo(a)pyrene	0.003	0.006	0.003	0.002
dibenz(ah)anthracene	0.003	0.002	0.002	0.001
ideno(1,2,3-cd)pyrene	0.002	0.006	0.006	0.001
benzo(ghi)perylene	0.006	0.010	0.007	0.003
Total PAH	22.943	30.763	17.867	13.371

The compounds found in highest concentration in the water (acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene and pyrene) are also those PAH compounds found in highest concentration in the BMP produced piling. The potential toxicity of these compounds to organisms living on, and in, the vicinity of the piling is important to understanding the risks associated with the use of creosote treated wood. To evaluate those risks, the data for the BMP Upstream station, which revealed the highest concentrations of dissolved PAH were analyzed in the manner suggested by Swartz *et al.* (1995). The results are presented in Table 12.

The sum of toxic units, within 15 cm of the piling, for the sample with the highest concentration of PAH, is 0.0000745 or 0.4% of the value considered necessary for the protection of aquatic organisms ($\sum TU < 0.186$) by Swartz *et al.* (1995). This study supports the earlier conclusion of Brooks (1994) that water column concentrations of PAH associated with creosote treated piling pose no significant risk to aquatic organisms living in the immediate vicinity of the pilings.

The models of Brooks (1994) assume that PAH are dissolved in the water column following migration from the piling until they adsorb to silt particles. For the conditions documented in the Sooke

Basin study, these models predict a water column concentration of 0.336 µg/L or about 11 times more than was actually observed. Assuming that the creosote migration rates used in Brooks (1994) are valid, this study suggests that up to 90% of the creosote migrating from the piling is not in a dissolved state, supporting a particulate PAH transport hypothesis described in a following section of this report.

Table 12. Development of the sum of toxic units for PAH dissolved in the water column within 15 cm of the creosote treated pilings installed at the BMP dolphin in the Sooke Basin Creosote Evaluation Study. Values of dissolved PAH have been converted to parts per billion (µg/L) for ease in comparison with published LC_{50} data.

Compound	Compound Concentration	LC50	Conc/LC50
	µg/L (ppb)	µg/kg (ppb)	
Naphthalene	0.007160	3852	0.0000019
Acenaphthylene	0.000643	474	0.0000014
Acenaphthene	0.007166	480	0.0000149
Fluorene	0.004572	337	0.0000136
Phenanthrene	0.005677	140	0.0000406
Anthracene	0.000708	140	0.0000051
Fluoranthene	0.003698	18	0.0002054
Pyrene	0.000947	30	0.0000316
Benzo[a]anthracene	0.000078	2.7	0.0000289
Chrysene	0.000061	4.02	0.0000152
Benzo[b]fluoranthene	0.000023	0.45	0.0000511
Benzo[k]fluoranthene	0.000006	0.23	0.0000261
Benzo[a]pyrene	0.000006	1.09	0.0000055
Benzo[ghi]pereylene	0.000010	0.1	0.0001000
Ideno[1,2,2-cd]pyrene	0.000006	0.03	0.0002000
Dibenzo[a,h]anthracene	0.000002	0.57	0.0000035
Totals (PAH or ∑Toxic Units)	0.030763		0.000745

5.5 Results of *Mytilus edulis edulis* in-situ bioassays.

Approximately 700 mussels (*Mytilus edulis edulis*) were caged at the Open Control site, at the 0.5, 2.0 and 10.0 metre stations downstream from the BMP dolphin and at the 0.5 metre station downstream from the Weathered Piling dolphin. Three replicate samples of 100 mussels (*Mytilus edulis edulis*) were grown in the top three tiers in separate Norplex™ clam cages. The remaining mussels were grown in the bottom two tiers of the five tier racks for evaluation of reproduction and for tissue PAH evaluation. Cages at the 0.5 metre station were suspended between metal brackets, as close to the piling as possible, without a significant potential for cages to abrade the creosote treated wood. This distance was approximately 30 cm. Field measurements are provided in Appendix IX.

5.5.1 Mussel survival and growth as a function of time and distance from treated wood and control structures.

The number of survivors and valve lengths of mussels grown in the three replicates at each station were measured during installation (immediately following construction) and on days 14, 185 and 384. The results are presented in Table 13 (a and b) and described in Figure 33 and Figure 34.

Table 13. Summary of valve length measurements of three replicates of 100 mussels grown at five stations in the Sooke Basin Creosote Evaluation Study. All growth values are in millimeters valve length (longest axis) with 95% confidence intervals on the mean. Survival is in numbers of living mussels remaining on the day of examination.

a) Survival

Station	Days post construction 0.0	14	185	384
Best Management Practices treated dolphin (0.5 m)	100	100	97.3 ± 2.6	79 ± 0.7
Best Management Practices treated dolphin (2.0 m)	100	100	100	88 ± 6
Best Management Practices treated dolphin (10.0 m)	100	99.3 ± 1.3	98 ± 2.3	81 ± 7.9
Weathered Piling (0.5 m)	100	100	99.3 ± 1.3	88.7 ± 5.6
Open Control	100	100	99.3 ± 1.3	80 ± 4.5

b) Growth

Station	Days post construction 0.0	14	185	384
Best Management Practices treated dolphin (0.5 m)	29.0 ± 1.3	32.5 ± 0.6	46.7 ± 3.8	59.3 ± 2.4
Best Management Practices treated dolphin (2.0 m)	29.5 ± 2.0	32.7 ± 2.3	51.6 ± 3.8	67.2 ± 0.7
Best Management Practices treated dolphin (10.0 m)	31.2 ± 1.1	33.3 ± 0.3	56.6 ± 0.1	68.7 ± 2.1
Weathered Piling (0.5 m)	29.1 ± 1.2	31.4 ± 0.2	49.1 ± 1.0	64.2 ± 0.9
Open Control	30.2 ± 1.1	32.4 ± 0.03	55.6 ± 0.2	69.5 ± 0.8

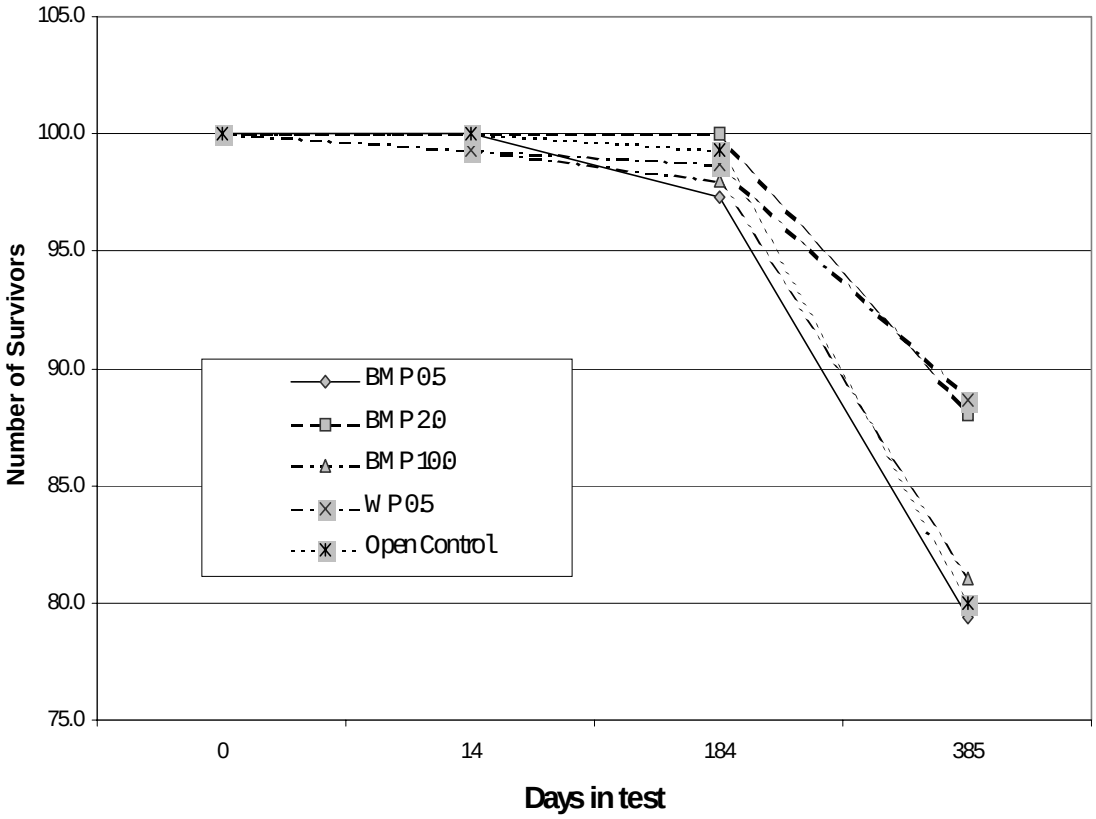


Figure 33. Mean survival of three replicates of 100 each caged mussel (*Mytilus edulis edulis*) grown at varying distances from treated and untreated six-piling dolphins during the Sooke Basin Creosote Evaluation Study. Codes are: BMP XX = Creosote treated piling produced using Best Management Practices at the indicated distance in metres; WP = eight year old weathered creosote treated piling; and Open Control is the control site located well upstream from all structures.

The number of survivors was transformed (LOG_{10}(number + 1)) and subjected to analysis of variance. Differences at the end of the study (Day384) were not significantly different (F = 1.163; p = 0.368). However, there were more survivors at the 2.0 metre station at the Best Management Practices Treated Dolphin and at the 0.5 metre downstream station at the Weathered Piling. Duncan's Test with critical ranges was used for Post Hoc assessment of these differences even though they were not significant. This test revealed that the increased survival at these two stations was marginally higher than at the control. The probability of rejecting the null hypothesis that survival was the same at these stations and the control was 0.082 and 0.069 respectively. This study indicated that there was no negative survival effect on mussels grown for over a year in close proximity to creosote treated wood.

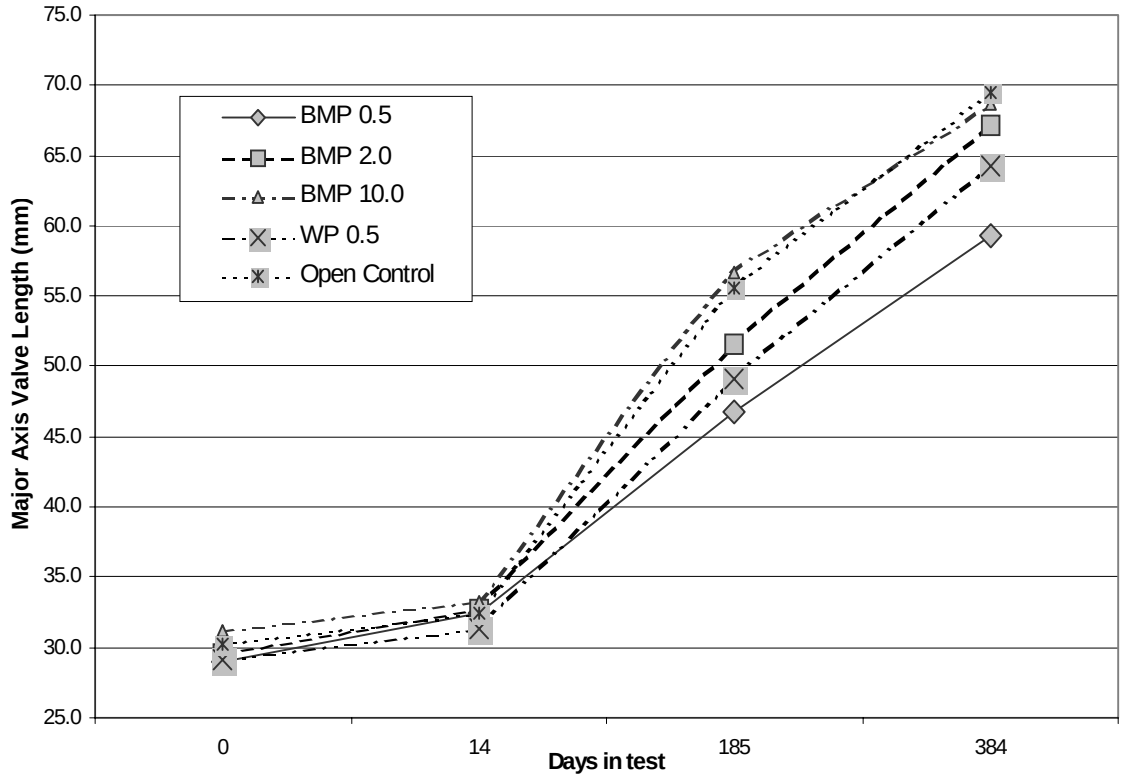


Figure 34. Mean length of three replicates of 100 each caged mussel (*Mytilus edulis edulis*) grown at varying distances from treated and untreated six piling dolphins during the Sooke Basin Creosote Evaluation Study. Codes are: BMP XX = Creosote treated piling produced using Best Management Practices at the indicated distance in metres; WP = eight year old weathered creosote treated piling; and Open Control is the control site located well upstream from all structures.

The average lengths of each replicated mussel population are provided in Figure 34. It is apparent that mussels located at the 0.5 metre stations adjacent to either the BMP or the Weathered Piling dolphins grew more slowly than did cohorts located even two metres away. High sensitivity between growth and the proximity of creosote treated wood is seen in Figure 34. Mussels at 0.5 metres grew most slowly and reached a length of 57.4 mm at the end of 384 days. Final average lengths of the mussels are provided in Table 14. The table is arranged in the anticipated reverse order of increasing PAH exposure starting with the Open Control and then working through the more distant locations to the 0.5 metre stations of the Weathered and BMP treated dolphins where the mussels were approx. 30 cm from the pilings. Growth appears negatively correlated with the potential for PAH exposure. As will be seen in a subsequent section of this report, growth is negatively correlated with mussel tissue PAH concentrations determined on Day185 of this study (Pearson correlation coefficient = -0.48, which is significant at $\alpha = 0.05$).

Table 14. Final average lengths of an initial count of 300 mussels (contained in three replicates of 100 each) at five stations in the Sooke Basin Creosote Evaluation Study. Stations are listed in the reverse order of anticipated exposure to PAH migrating from the piling.

Treatment	Final Length
Open Control	69.5 ± 0.8 mm
10 metres downstream from the BMP dolphin	68.7 ± 2.1 mm
2 metres downstream from the BMP dolphin	67.2 ± 0.7 mm
0.5 metres downstream from the Weathered dolphin	64.2 ± 0.9 mm
0.5 metres downstream from the BMP dolphin	59.3 ± 2.7 mm

Minor differences in the mean mussel length were recorded on Day0. However, these differences were not significant ($F_{(2,10)} = 0.67$, $p < 0.5333$). To assess growth, the average length of each cohort on Day0 was subtracted from the average length on subsequent sampling days for each replicate at each station. This provides an average incremental growth record for the mussels beginning on Day14. Analysis of variance was used to examine these growth increments on each day of the survey, beginning with Day14. Statistically significant differences in growth increment were not observed on Day14. However, observed differences were highly significant on Day185 ($F = 15.72$; $p = 0.000272$) and 384 ($F = 12.04$; $p = 0.000773$). Duncan's Test with Critical Ranges was used for Post Hoc comparisons. These comparisons indicated that mussels located 0.5 metres downstream from the BMP piling grew more slowly than all other cohorts, including those grown downstream from the Weathered Piling and mussels grown at 0.5 metres downstream from the Weathered Piling grew more slowly than those at the Open Control station. Incremental growth of mussels grown 2.0 and 10.0 metres downstream from the BMP dolphin was not significantly different from the rates at the Open Control ($p = 0.27$ and 0.23 respectively).

5.5.2 Mussel tissue levels of PAH as a function of time and distance from treated wood and control structures and estimation of bioconcentration factors based on SPMD analysis of water column PAH levels.

Mussels were removed from the fourth tier of the rack system on each sampling day and randomly divided into three replicate groups. These mussels were frozen until analyzed for parental and alkylated PAH and dibenzofuran. The results of the parental PAH analyses are provided in Table 15. Raw data for whole body tissue are provided in Appendix XII (A) and (B). Shell lengths for analytical samples are given in Appendix XII (C). All values are presented in ng/g wet tissue weight. The PAH data are corrected for surrogate recovery but normalized to CRM values. These data are graphed in Figure 35.

Table 15. Concentrations of *parental* PAH observed in mussel (*Mytilus edulis edulis*) tissue growing at a remote Open Control Site (OC) and at varying distances from creosote piling treated using Best Management Practices (BMP) and Weathered (WP) creosote treated piling in the Sooke Basin Creosote Evaluation Study. Distances, provided in brackets following the treatment code, are in metres. Concentrations of PAH are in ng/g, wet tissue weight (mean ± 95% confidence interval on the mean).

	Days in Test			
Treatment	0.0	14	185	384
BMP (0.5)	16.15 ± 2.19	68.07 ± 9.14	19.73 ± 0.32	8.29 ± 0.85
BMP (2.0)		47.10 ± 3.80	32.39 ± 21.43	8.73 ± 1.13
BMP (10.0)		47.04 ± 7.26	15.39 ± 0.48	15.53 ± 0.78
WP (0.5)		58.40 ± 14.71	21.15 ± 2.46	15.16 ± 1.23
OC		44.12 ± 8.09	19.61 ± 2.20	11.12 ± 1.16

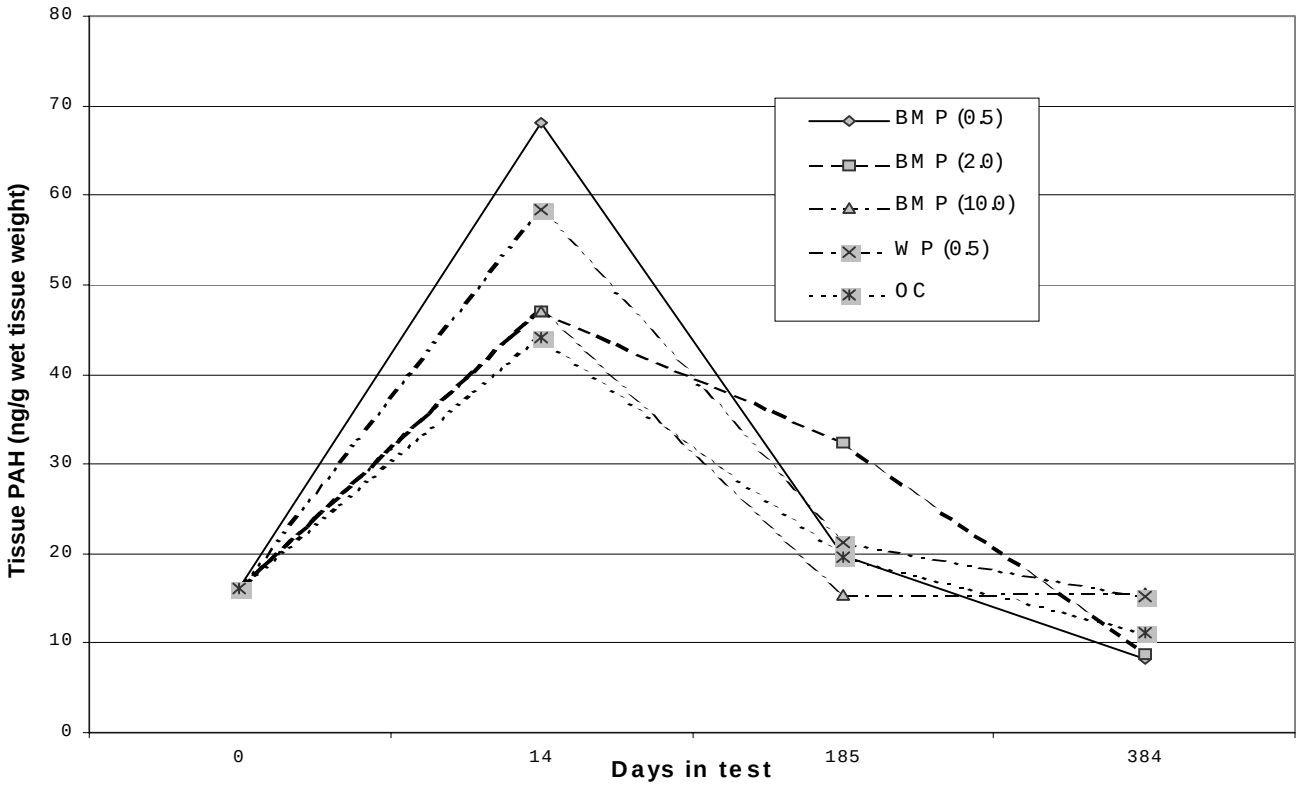


Figure 35. Wet tissue concentrations of parental PAH (ng/g) observed at a remote Open Control Site (OC) and at varying distances from creosote piling treated using Best Management Practices (BMP) and Weathered (WP) creosote treated piling in the Sooke Basin Creosote Evaluation Study. Distances, provided in brackets following the treatment code, are in metres.

Prior to being placed in the water at Sooke Basin, tissue concentrations of PAH were relatively low at 16.15 $\pm$ 2.19 ng/g. These levels increased an average of 328 percent on Day14 of the study. The most significant increases were observed in close proximity (within 0.5 metres) of either the BMP or Weathered Piling dolphins. Following that initial increase, levels returned to normal by Day185 and were slightly lower than the baseline levels by the end of the study (Day384). Analysis of variance was used to determine the significance of these increases. Differences associated with the three replicates analyzed on Day0 were not significant ($F = 0.607$, $p = 0.666$). Large increases in tissue PAH were observed on Day14 at all sites and the differences between sites were significant ($F = 4.53$, $p = 0.024$). These differences were examined using Duncan's test with Critical Ranges. Concentrations of PAH in the mussel tissue taken from BMP (0.5) were significantly higher than all but the Weathered (0.5) site. No other significant differences were observed. Differences observed on Day185 were not significant ($F = 1.66$, $p = 0.234$). Interestingly, the levels of PAH observed in mussel tissue were again significantly different on Day384. Mussels at the two stations closest to the BMP dolphin contained significantly less PAH ($p < 0.003$) than all other stations and mussels from the Weathered Piling site held significantly higher concentrations of PAH than was observed at the Open Control.

There are several factors that may influence the concentration of PAH in mussel tissue in this study. The piling were well fouled with barnacles and mussels on Day384. It is possible that this layer of organic material was intercepting a significant portion of the PAH migrating from the piling. However, this hypothesis is not supported by the increases in sediment PAH seen between Day185 and Day384. It is also possible that PAH metabolizing enzymes (MFO, AHH, Cytochrome P450, etc.) are induced in mussels inhabiting the area close to the source of PAH leading to increased catabolism. These hypotheses were not investigated in this study.

As previously stated, there is a significant negative correlation between total body burden of PAH and growth increments. Reduced mollusc feeding rates have been reported by Widdows, *et al.* (1982, 1985) at water column concentrations of PAH as low as 30 to 40 ppb in seawater. The feeding inhibition probably results from the narcotic effect of hydrocarbons, particularly aromatic hydrocarbons. These compounds have a direct effect on cilia, muscles and/or the nervous system, which controls their activity. It is interesting to note in Figure 34 that the greatest difference in the slope of the lines describing growth rates, occurred between Day14 and Day185. Water column concentrations of PAH were measured using SPMD's between Day222 and Day236. It is possible that water column concentrations of PAH were higher than the 30.7 parts per trillion (ng/L) measured at that later date (see Section 5.4). Based on the previous analysis using the methodology of Swartz *et al.* (1995), it seems unlikely that the observed concentration of 30.7 ng/L, and sum of toxic units equal to 0.000745, would account for the reduced growth observed between Days 14 and 185. The consistency of the mussel growth data suggests that mussel valve length may be a very sensitive indicator of PAH effects on this species.

5.5.3 Mussel condition factors.

Condition factor has been widely used to evaluate the overall health of fish and shellfish (Galtsoff, 1964; Quale and Newkirk, 1989). It is generally described as the ratio of dry soft tissue weight to shell volume in bivalves. There are a number of ways in which shell volume can be determined. In this instance, shell volume is estimated as the volume of an ellipsoid ($4{,}000\pi$ x Dry Tissue Weight/Valve Length x Valve Width x Valve Depth x 3). Three replicates of 10 to 15 mussels were retrieved from each *in-situ* bioassay station. These were sacrificed on Day185 in conjunction with

the first reproductive bioassays. The lengths, widths and depths of their valves were measured and the soft tissues removed. Tissues were dried at 92^{o} C until no further weight loss occurred and weighed to the nearest 0.0001 grams. The results are summarized in Table 16 with 95% confidence intervals on the mean.

Bivalve Condition Factors are influenced by a number of factors, including spawning. This is particularly true of mussels, which can convert as much as 50% of their wet tissue weight into gametes (Bayne, 1976; Brooks, 1991). In this case, the mussels were observed to be in spawning condition, but did not appear to have spawned.

Table 16. Summary of the mean (± 95% confidence intervals) condition factor for three replicates of ten mussels each collected at each *in-situ* bioassay station on Day195 of the Sooke Basin Creosote Evaluation Study. Units are grams per cubic centimetre. Condition factor is defined as 4,000 π x Dry Tissue Weight/(Valve Length x Valve Width x Valve Depth x 3).

Bioassay Station	WP0.5	BMP0.5	BMP2.0	BMP10.0	Open Control
Average Condition	0.218 ± 0.015	0.200 ± 0.009	0.244 ± 0.036	0.218 ± 0.034	0.177 ± 0.035

The database was analyzed using the Anova/Manova module of Statistica™. Significant differences were observed between treatments ($F = 7.65$, $p = 0.0007$). Post hoc tests using Duncan's Test with Critical Ranges reveals that the observed Condition Factors are not significantly ($\alpha = 0.05$) different between the WP and BMP sites. However, mussels grown adjacent to either creosote treated dolphin were in significantly better condition than those grown at the Open Control site. No cause and effect relationship was examined to explain this result. However, it is unlikely that the presence of creosote enhanced mussel condition, especially in light of the fact that mussel valve lengths increased more rapidly in mussels held at the Open Control site than at either creosote treated dolphin site. On one occasion during a cage maintenance survey, it was noted that the weight of juvenile Dungeness crab feeding on the outside of the Open Control cages had overcome the buoyancy of the subsurface float and the cages were lying near the bottom. This may have affected mussel growth if this condition persisted for some time. However, these results suggest, that at least in this worst case study, mussel condition was not negatively effected by proximity to the creosote treated structures. This is consistent with the low levels of PAH observed in mussel tissue in this study.

As shown in Figure 7, mussel replicates were held in individual clam cages with approximately 2.5 cm between the bottom of each cage and the top of the underlying cage. This may have resulted in reduced water circulation to the middle three cages, including Tiers 2 and 3 in the growth and mortality study. Significant differences were observed between Tiers in the Anova ($F = 3.81$, $p = 0.024$). Average condition, as a function of the variable Tier is provided in Table 17.

Table 17. Average Condition Factor as a function of Tier in the Sooke Basin Creosote Evaluation *in-situ* mussel (*Mytilus edulis edulis*) bioassay. Tier (1) is the top Tier in the rack with lower Tiers labeled 2,3, etc. Condition factor is given as 4,000 π x Dry Soft Tissue Weight/Valve Length x Valve Width x Valve Depth. Units are grams/mm^3.

Tier	Average Condition Factor
1	0.234
2	0.208
3	0.204

Post hoc assessment of these differences revealed that mussel condition in Tier (1), the top tier, was significantly greater than condition in Tiers 2 ($p = 0.018$) or 3 ($p = 0.009$). Condition observed in Tiers 2 and 3 was not significantly different ($p = 0.73$). The significant differences in condition between tiers suggests that more spacing should be provided between cages in future experiments of this kind.

The effect of distance from the creosote treated dolphins was addressed by pooling the data for WP0.5 and BMP0.5 and assigning a distance of 500 to the Open Control. Significant differences in mussel Condition Factor, as a function of distance from the creosote treated dolphins, was observed in the Manova ($F = 9.77$, $p = 0.000006$). Post hoc testing, using Duncan's Test, reveals that mussels were in poorer condition at the Open Control site when compared with any of the creosote dolphin sites. In addition, mussels located 2.0 metres downstream from the BMP treated dolphin were in significantly better condition that those located 0.5 metres downstream ($p = 0.0006$) or those located at 10 metres downstream ($p = 0.004$). Significant differences were not observed between mussels grown at the BMP 0.5 and BMP 10.0 metre stations. Mean Condition Factors for each cohort are provided in Table 18.

Table 18. Average Condition Factor as a function of distance from the creosote treated dolphins in the Sooke Basin Creosote Evaluation *in-situ* mussel (*Mytilus edulis edulis*) bioassay. Distances are in metres. Condition factor is given as 4,000π x Dry Soft Tissue Weight/Valve Length x Valve Width x Valve Depth. Units are grams/cm^3.

Distance (metres)	Condition Factor (1000 x grams/mm^3)
0.5	0.209
2.0	0.257
10.0	0.218
500 (Open Control)	0.177

Survival and growth of all 15 cohorts of these mussels was much higher than expected and therefore, while these differences are real, the presence of creosote appeared to have little effect on the growth or survival of these populations of mussels. Reproduction will be discussed in a following section of this report.

5.5.4 Bioconcentration Factors.

Table 19 summarizes the observed Bioconcentration Factors (BCF) obtained by dividing whole mussel tissue concentrations of PAH, observed on Day185, by the water column concentrations determined for the period between Days 247 and 261. In general, these values follow the octanol water partition coefficients provided in Meador *et al.* (1995). These values are included in Table 19 for comparison.

Table 19. Bioconcentration Factors for individual polycyclic aromatic hydrocarbons and their sum observed in mussels during the Sooke Basin Creosote Evaluation Study. The BCF is presented as the observed mussel soft tissue PAH concentration divided by the water column concentration determined using semi-permeable membrane devices. Concentrations of PAH were determined in mussels (*Mytilus edulis edulis*) and in water using semi-permeable membrane devices located 15 centimetres downstream from one of six creosote treated piling at the BMP site. This evaluation was conducted between 185 and 261 days following completion of construction and installation of the *in-situ* bioassay. Octanol-Water partition coefficients presented in Meador (1995) are provided for comparison.

Compound	BCF BMP Downstream (Tissue PAH/H_2O PAH)	BCF Open Control (Tissue PAH/H_2O PAH)	Octanol – Water Partition Coefficient	Ratio K_{oc}/BMP BCF
Naphthalene	139	226	2,188	16
Acenaphthalene	550	498	12,023	22
Acenaphthene	130	239	12,023	93
Fluorene	217	405	16,596	77
Phenanthrene	836	177	33,884	41
Anthracene	1,073	4,778	33,884	32
Fluoranthene	3,207	5,464	173,780	54
Pyrene	5,954	16,432	117,490	20
benz(a)anthracene	19,048	320,000	794,328	42
Chrysene	51,429	1,700,000	588,844	11
Benzofluoranthenes	69,231	55,000	4,216,965	61
benzo(a)pyrene	66,667	60,000	1,698,244	25
dibenz(ah)anthracene	20,000	nd (tissue)	2,951,209	148
ideno(1,2,3-cd)pyrene	90,000	170,000	26,915,348	299
benzo(ghi)perylene	41,667	80,000	10,715,193	257
Total PAH	950	1,370		

These results deserve an in-depth analysis which will follow at a later time. The observed ratios of Bioconcentration Factors to Octanol-Water coefficient may be explained, in part by PAH metabolism in *Mytilus edulis edulis* (see Moore *et al.* (1989) and Meador *et al.*(1995) for a discussion). The increased ratios for the very high molecular weight PAH supports previous observation that these compounds are metabolically more refractory to invertebrate metabolism than are the LPAH. However, the observed ratios are fairly consistent for all compounds up to and including benzo(a)pyrene. This is somewhat unexpected, because those compounds heavier than perhaps fluoranthene should also be somewhat refractory to invertebrate metabolism. These differences aside, the observed BCF's do increase with increasing molecular weight, confirming trends reported in Eisler (1987).

5.5.5 Tissue levels of carcinogens observed in mussels growing adjacent to creosote treated piling in the Sooke Basin Creosote Evaluation Study.

Neff (1979) and Stegeman (1981) indicated that consumption of PAH-contaminated molluscs probably constitutes a minor source of human dietary PAH in comparison to PAH in smoked foods, charcoal-broiled meats, and even many vegetables. Moore *et al.*, (1989) agrees with the caveat that "except possibly where animals have been exposed to very high concentrations of PAH such as those occurring following an oil spill."

Dunn and Stich (1975, cited in Dunn and Fee, 1979) recorded tissue levels of benzo(a)pyrene (B(a)P) averaging 59 ng/g wet tissue weight in areas associated with marinas and higher levels, averaging 402 ng/g in mussels taken from creosote treated pilings. Numerous other authors have associated high B(a)P levels in molluscs with proximity to creosote treated piling in marinas and industrial areas. This is the first study which looks at uptake of PAH from creosote treated piling located in an area that does not contain other significant sources of PAH.

Eisler (1987) lists the carcinogenic compounds found in creosote as benz(b or k) fluoranthene, benzo(a)pyrene, benzo(ghi)perylene and ideno(1,2,3-cd)pyrene. Benzo(a)anthracene has been added in the following analysis because it is now recognized as a carcinogen. The concentration of these PAH in mussel tissue as a function of time is described in Table 20. The highest concentration of the sum of these carcinogens (3.921 ng/g (ppb) wet tissue weight) were observed on Day14 at the BMP 0.5 station. The U.S. EPA has set a goal of <1600 ng of B(a)P per person, per day. Benzo(a)pyrene was generally about 20 to 25 percent of the sum of these carcinogens. However, if we conservatively assume that the sum of the identified carcinogens be less than the EPA standard of 1600 ng/d, then it is possible to determine the amount of wet mussel tissue a person would have to consume to reach this standard. In this case, a person would have to consume 1600 ng/d/3.921ng/g = 408 grams of mussel tissue per day.

Table 20. Sum of the carcinogenic PAH (benzo(a)anthracne, benzo(b or k)fluoranthene, benzo(a)pyrene, ideno(1,2,3-cd)pyrene and benzo(ghi)perylene) observed in mussel (*Mytilus edulis edulis*) tissue growing at a remote Open Control Site (OC) and at varying distances from creosote piling treated using Best Management Practices (BMP) and Weathered (WP) creosote treated piling in the Sooke Basin Creosote Evaluation Study. Distances, provided in brackets following the treatment code, are in metres. Carcinogenic PAH concentrations are in ng/g wet tissue weight.

	Treatment				
Day	**OC**	**BMP (0.5)**	**BMP (2.0)**	**BMP (10.0)**	**WP (0.5)**
0		**1.037**			
14	**1.361**	**3.921**	**0.624**	**0.786**	**1.764**
185	**2.248**	**2.048**	**2.565**	**1.654**	**2.580**
384	**0.380**	**0.391**	**0.443**	**0.513**	**0.560**

Mussel tissue from all locations yielded higher levels of these PAH on Day185 when the first in a series of two reproductive studies was undertaken except at BP0.5. The results of those studies will be

reported in a later section of this report. The temporal trend to lower levels of carcinogens on Day384 follows the general tissue PAH trend discussed earlier.

5.5.6 PAH in whole soft tissue and gonadal tissue.

Nearly all PAHs are hydrophobic and lipophilic. Thus, there is a potential for these compounds to become associated with stable lipid pools in aquatic organisms. Energy is generally stored as glycogen in bivalves until gametogenesis when the glycogen and lipid stores are converted into eggs and sperm. The eggs contain significant lipid reserves and may become a repository for lipophilic PAH, with unknown reproductive effects (Bayne, 1976). Moore *et al.* (1989) cited Lowe and Pipe's (1985) observation that long-term exposure to diesel oil at 30 to 130 µg/g caused a decrease in the mass of gametes produced by *Mytilus edulis edulis.*

Mussels were removed from the bottom two tiers of each of the treatment racks on Day185 and analyzed for parental PAH. The results are summarized in Table 21. Raw data are given in Appendix XIII. Replicate measurements of gonadal PAH at each station were not made and no statistical analyses were attempted. However, increases are observed, particularly in the gonadal compartment, of PAH at the BP 0.5, BP 2.0 and WP 0.5 sites. These increases appear to be greater for the high molecular weight than for the low molecular weight compounds.

Table 21. Low and high molecular weight PAH observed in the gonad and whole body tissue of mussels (*Mytilus edulis edulis*) grown at varying distances from creosote treated dolphins and at upstream control site. Tissues were analyzed 185 days into the test when the mussels were ripe and ready to spawn. All values are in ng/g wet tissue weight. Codes are: BMP XX = Creosote treated piling produced using Best Management Practices at the indicated distance in metres; WP = eight year old weathered creosote treated piling; and Open Control is the control site located well upstream from all structures.

	OC	BP0.5	BP2.0	BP10	WP0.5	Averages
LPAH in Gonad	14.8	15.1	18.2	10.0	16.4	15.0
LPAH in Whole Tissue	6.7	6.4	9.8	5.6	6.1	6.9
HPAH in Gonad	22.0	29.2	32.4	15.6	32.4	26.3
HPAH in Whole Tissue	15.0	15.4	26.0	11.5	16.7	16.9
Total in Gonad	36.7	44.3	50.6	25.5	48.8	41.2
Total in Whole tissue	21.7	21.9	35.8	17.0	25.5	24.4

5.5.7 Reproductive Bioassays.

Two reproductive bioassays were conducted, the first on April 5, 1996 (Day185) and the second on April 24, 1997 (Day569). Procedures generally followed protocols defined in ASTM E724-80. All groups of mussels successfully spawned in each bioassay. Salinity was maintained at 27 to 28 ppt during all parts of the bioassay. Separate aquaria were provided for mussels from each treatment site.

Spawning was accomplished by raising the conditioning temperature of 12 ^{o}C to 20 ^{o}C and adding sufficient live algae to create a density of 300,000 cells/mL in the holding aquaria. In the first bioassay, heat killed sperm were added to the aquarium at the end of 20 minutes. This was not necessary in the second bioassay. Spawning mussels were removed from the aquaria and placed in individual finger-bowls, one for females and one for males. Sperm were pooled and passed through a 37 µm Nytex™ screen, counted using a hemacytometer, and a sufficient amount of the mixed sperm suspension added to the eggs to bring the sperm count to approximately 10^{6}/mL. Twenty minutes were allowed for fertilization. The fertilized eggs were washed on a 22 µm screen to remove excess sperm and debris. The fertilized eggs were then backwashed into clean, sterilized sea water and diluted to provide a final density of ca. 40/mL in each of 4 replicate glass beakers. Temperature was maintained in a water bath at 18.5 ^{o}C in the first bioassay and 16.0 ^{o}C in the second bioassay. Dissolved oxygen and pH were measured at the beginning and end of the experiment in a fifth replicate, identical in all respects to the other four, except that embryos were not evaluated. Temperature was measured hourly (during normal working hours) in the fifth replicate.

At 48 hours, the embryos were fixed in 5% formalin. Six 1.5 mL subsamples of larvae were scored from each replicate. Larvae were considered normal if they developed a typical "D" pair of valves. Those that did not develop to the "D" hinge stage in 48 hours were judged abnormal. The results from each of the reproductive bioassays are provided in Table 22.

Table 22. Mean (N = 4) percent of mussel (*Mytilus edulis edulis*) larvae developing normal "D" hinge valves within 48 hours of fertilization. Gametes were obtained from the stocks held at the "Open Control" site and downstream from the BMP dolphin at distances of 0.5, 2.0 and 10.0 metres. A fifth cohort of mussel spawn was evaluated from stocks held 0.5 metres downstream from the Weathered Piling dolphin.

Treatment (distance)	Percent Normal Larvae	
	Day185	Day569
BMP Treated Piling (0.5 m)	83.13%	65.25%
BMP Treated Piling (2.0 m)	83.12%	84.12%
BMP Treated Piling (10.0 m)	79.84%	70.95%
Weathered Piling (0.5 m)	83.28%	89.89%
Open Control (500 m)	83.15%	80.76%

The results of the first bioassay were remarkably consistent and larval development from the BMP (0.5) and the WP (0.5) were not significantly different from the Open Control or the 10 metre BMP site. The second bioassay (D569) was analyzed by transforming the percent normal larvae using an ARCSIN(SQRT(Percent Normal Larvae)) transformation followed by analysis of variance. The null hypothesis was that the percent normal larvae did not differ between cohorts. The ANOVA indicates that the probability that one or more of the cohorts was different was 0.08 and the null hypothesis was not rejected at $\alpha = 0.05$. However, the null hypothesis would be rejected if the probability of a Type I error was increased to 0.10. Therefore, analysis of variance was followed by post hoc testing using Duncan's Test. This procedure indicates that the percent normal larval development at the BMP (0.5) station was significantly less than observed at the WP (0.5) site but not significantly different from the

Open Control, or the other treatments. Mussels at the WP (0.5) and BMP (0.5) sites were located within approximately 0.33 metres of the creosote treated dolphins. Neither of these closest treatments were significantly different from the Control or the stations located further from the creosote treated wood. Therefore, it must be concluded that in this study, mussels growing in the immediate vicinity of creosote treated wood (but not attached directly to the wood), produce larvae which develop as normally as those from adults grown at locations remote from creosote treated wood.

The transport of creosote from treated wood to the environment will be discussed in a later section. It should be noted that hydrophobic PAH will likely adsorb to the organic matrix formed by fouling organisms on creosote treated wood. This would greatly reduce the concentration of creosote in the water column around the piling, but could significantly increase the exposure of fouling organisms attached directly to the piling. Therefore, the observation that the reproductive success of mussels growing in close proximity to creosote treated piling (0.33 metres) was not impaired in this study should not be extended to imply successful spawning of mussels growing directly on the piling.

5.6 Infaunal Community Response to Creosote Treated Wood.

A total of 35 infaunal samples were collected on each sample day (-2, 14, 185 and 384) at the following locations:

Treatment	Downstream distance (metres)	Replicates
Open Control	**0.0**	**3**
Mechanical Control	**0.5**	**3**
	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 5.0	
	7.5, 10.0, 20.0, 30.0	**1**
BMP treated dolphin	**0.5**	**3**
	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 5.0	
	7.5, 10.0, 20.0, 30.0	**1**
Weathered piling	**0.5**	**3**
	2.0	**1**
	Number per sample period	**35**
	Total samples collected	**140**

Samples were collected by scuba using the full contents of the benthic sampler. The area sampled was 0.0320 m^2. These samples were sieved in the field on stacked 500 μm and 1.0 mm sieves. All samples were fixed in 10% formaldehyde in the field and preserved in 70% isopropyl alcohol after four days.

One hundred thirty-six (136) of the 1.0 mm samples were picked, identified to species and then archived. Four of the 1.0 mm samples and all of the 500 μm samples were archived without picking. Quality assurance involved repicking ten percent of the samples (16 samples). Fewer than 5% additional

infauna (0.0% to 3.9%) were observed in any sample suggesting that an appropriate quality assurance standard had been met (PSEP, 1986). Quality assurance on the identification has not been completed.

Data compilation was completed using Microsoft EXCEL™ for Windows 95. Statistical analyses were accomplished using STATISTICA™ software. The resulting database contains 136 cases (samples) and 120 variables. As a general note, residuals were examined in each of the regression analyses presented in the following discussion. In each case they were normally distributed and no evidence of heteroscedasticity was observed. Taxa coding and summary of the infauna data are given in Appendix XIV(a). Raw data are given in Appendix XIV(b).

5.6.1. Infaunal community characterization.

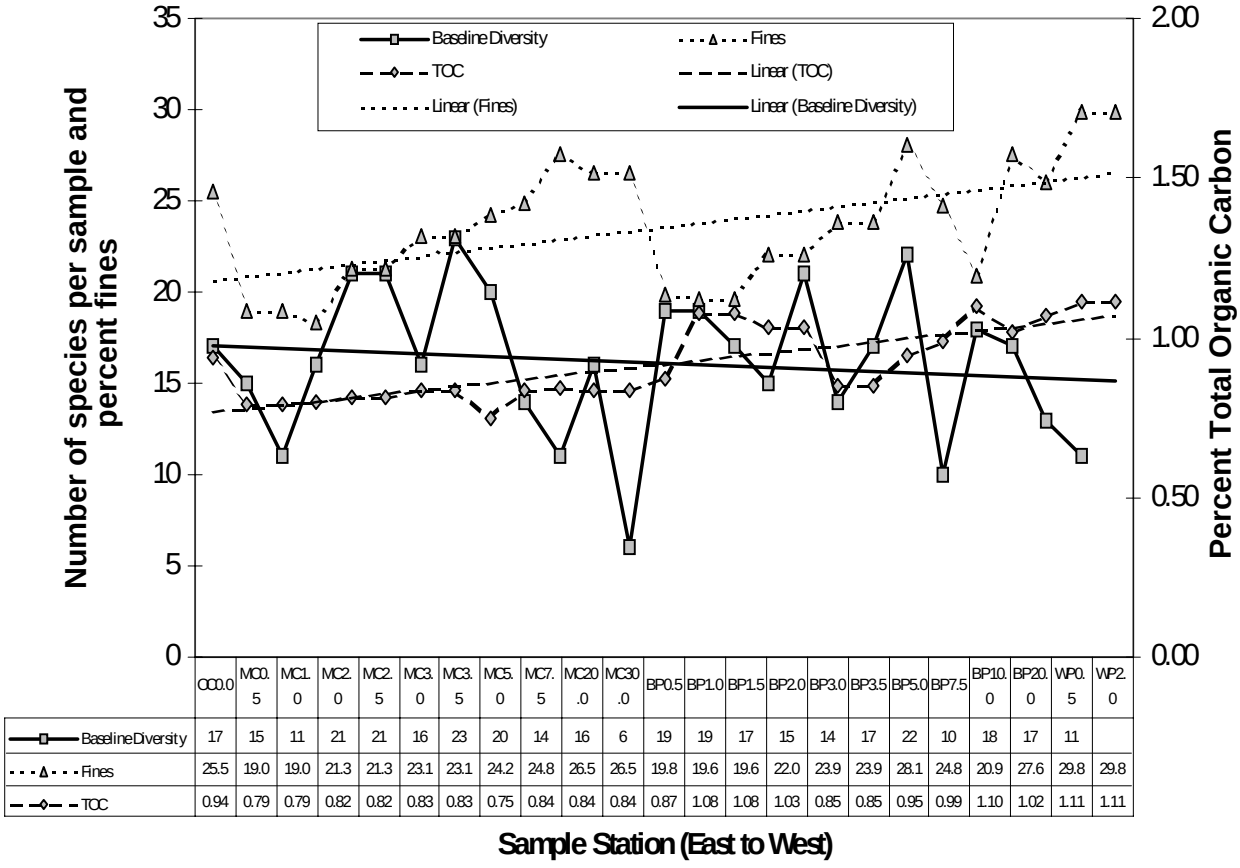
A total of 20,149 infaunal organisms in 106 taxa were identified in the 136 completed samples. The mean number of infauna per sample was 148.2 suggesting a mean abundance of 4,796 infauna/m^2. The minimum abundance observed was 15 and the maximum was 434. The mean and median were reasonably close at 148 and 135 infauna/sample, respectively. All dominant and moderately dominant taxa were distributed in patches with variance to mean ratios exceeding 1.0.

The number of species per sample varied between 6 in a baseline sample at the Mechanical Control site and 27 at a Mechanical Control site on Day14**.** The mean number of species was 17.5 and the median 17.0 suggesting that the distribution was not skewed.

These general observations suggest that this area of Sooke Basin supports an abundant, but not highly diverse infaunal community consisting primarily of echinoderms, polychaetes and molluscs. The lack of arthropods observed in all samples bears comment. It is possible that the often mobile component of the infaunal community avoided the scuba divers. However, numerous arthropods have been collected in other samples from other locations using the same sampling equipment. In addition, some common arthropods, (Tanaids, *Corophium sp.*) are tubicolous and relatively sedentary. These common species should not have been absent. It appears that significant numbers of infaunal arthropods are typically absent from this area of Sooke Basin.

5.6.2 Environmental factors.

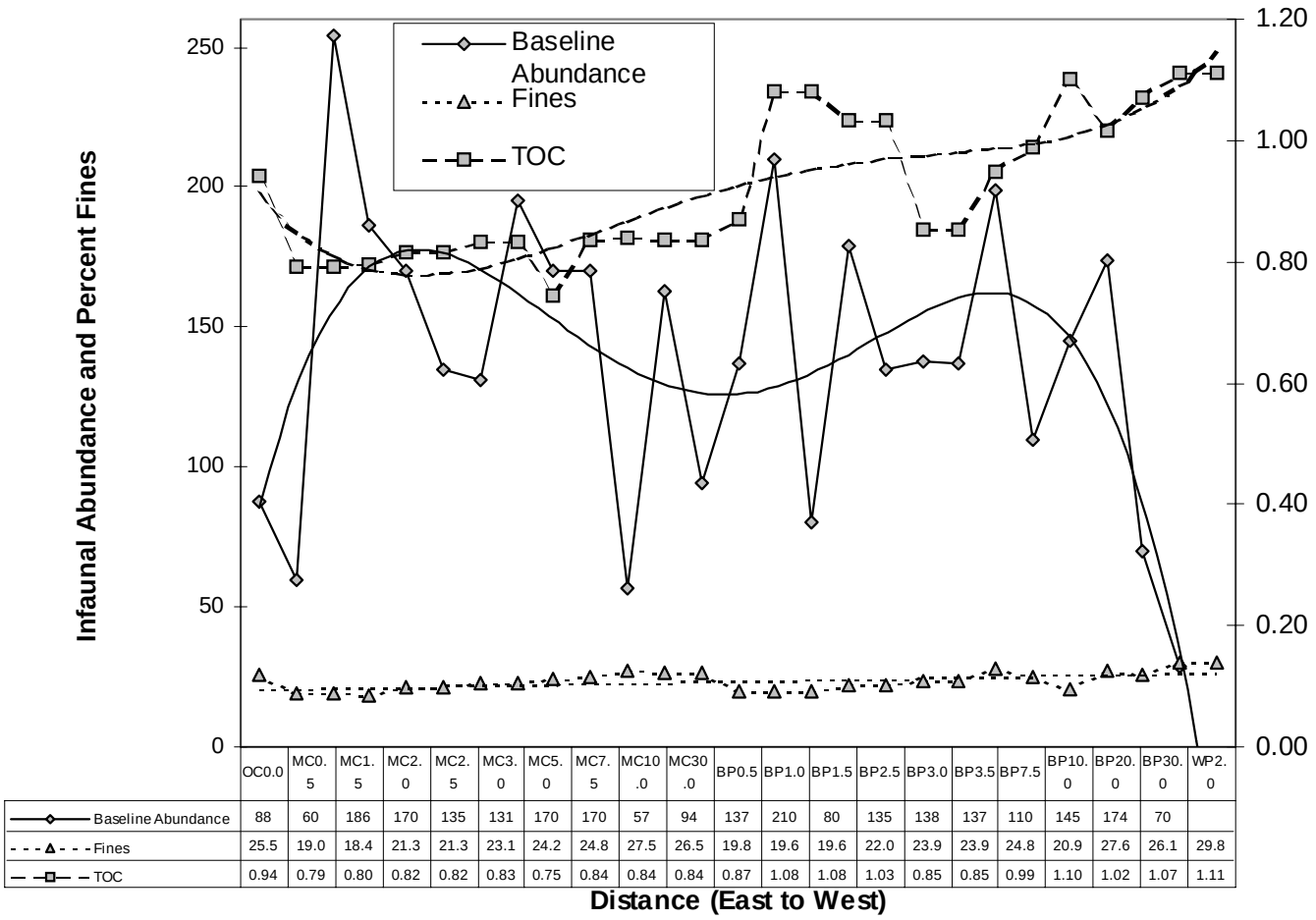
Slight increases, described in Figure 36, were observed in both total organic carbon and percent fines (silt and clay) as a function distance from the Open Control (OC) site. Sediments lying west of the Weathered Piling site were slightly anaerobic and noticeably finer in structure. A decreasing number of species was observed during the baseline study as one proceeded from east to west. Neither Percent Fines nor TOC was significantly correlated with Diversity. However, the Pearson Correlation Coefficients between Diversity and Fines or TOC were negative. When data from all sampling dates was considered, Diversity was significantly negatively correlated with TOC (-0.24) and FINES (-0.33). Correlation analysis will be used in a later section to identify species whose abundance was significantly increased or decreased as a function of TOC and/or Percent Fines.



	CC0.0	MC0.5	MC1.0	MC2.0	MC2.5	MC3.0	MC3.5	MC5.0	MC7.5	MC20.0	MC30.0	BP0.5	BP1.0	BP1.5	BP2.0	BP3.0	BP3.5	BP5.0	BP7.5	BP10.0	BP20.0	WP0.5	WP2.0
Baseline Diversity	17	15	11	21	21	16	23	20	14	16	6	19	19	17	15	14	17	22	10	18	17	11	
Fines	25.5	19.0	19.0	21.3	21.3	23.1	23.1	24.2	24.8	26.5	26.5	19.8	19.6	19.6	22.0	23.9	23.9	28.1	24.8	20.9	27.6	29.8	29.8
TOC	0.94	0.79	0.79	0.82	0.82	0.83	0.83	0.75	0.84	0.84	0.84	0.87	1.08	1.08	1.03	0.85	0.85	0.95	0.99	1.10	1.02	1.11	1.11

Figure 36. Infaunal diversity as a function of location at the Sooke Basin Creosote Evaluation Study site near Pim Head in Sooke Basin, British Columbia. All data are for the baseline study undertaken on October 3, 1995. Sample quadrat size was 0.0320 m^2. Total organic carbon and sediment grain size was determined in the top 2.0 cm of the sediment column.

The abundance of infauna observed during the baseline survey is summarized in Figure 37. Currents in this area flow dominantly from the east to the west on both ebb and flood tides. For this reason, the most easterly portion of the study area was chosen as the Open Control site. During the baseline and indeed, throughout the remainder of the study, this Open Control site held significantly fewer infauna than other stations. The same is true for the down current stations located west of the Weathered Piling site. Baseline infaunal abundance, TOC and Percent Fines are described in Figure 37. Infaunal abundance was significantly negatively correlated with both TOC and FINES during the baseline survey. When all sample dates are included, infaunal abundance was found to be significantly a function of TOC (-0.34) but not of fines.



	OC0.0	MC0.5	MC1.5	MC2.0	MC2.5	MC3.0	MC5.0	MC7.5	MC10.0	MC30.0	BP0.5	BP1.0	BP1.5	BP2.5	BP3.0	BP3.5	BP7.5	BP10.0	BP20.0	BP30.0	WP2.0
Baseline Abundance	88	60	186	170	135	131	170	170	57	94	137	210	80	135	138	137	110	145	174	70	
Fines	25.5	19.0	18.4	21.3	21.3	23.1	24.2	24.8	27.5	26.5	19.8	19.6	19.6	22.0	23.9	23.9	24.8	20.9	27.6	26.1	29.8
TOC	0.94	0.79	0.80	0.82	0.82	0.83	0.75	0.84	0.84	0.84	0.87	1.08	1.08	1.03	0.85	0.85	0.99	1.10	1.02	1.07	1.11

Figure 37. Infaunal abundance as a function of location at the Creosote Evaluation Study site near Pim Head in Sooke Basin British Columbia. All data are for the baseline study undertaken on October 3, 1995. Sample quadrat size was 0.0320 m^2. Total organic carbon and sediment grain size was determined in the top 2.0 cm of the sediment column.

5.6.3. Dominant species.

A search of the infaunal database revealed nine species that occurred in greater than 50% of the samples with a total count greater than 250. These dominant taxa included two polychaetes, five molluscs and one echinoderm. In addition to these highly dominant taxa, 15 fairly common species were identified as those with a total count in the database exceeding 100 or those that were found in greater than 25% of the samples (34 samples). Rare species were defined as those whose total abundance in the survey was less than 10 animals and that occurred in fewer than 5% of the samples (7 samples). A total of 50 of the 106 species were considered rare in this study. The Dominant and Moderately Dominant taxa are described in Table 23.

Table 23. Dominant and Moderately Dominant taxa observed in 136 infaunal samples collected at all stations in the Sooke Basin Creosote Evaluation Study. Total Number refers to the total abundance of that taxa observed in all samples during the study. Occurrences refers to the number of samples in which the taxa was observed**.**

Sooke Basin Infaunal Analysis

	Code	Variable	Total Number	Occurrences	Mean	Median	Variance/ Mean
Dominant species							
Nephtys ferruginea	PNF	37	390	113	2.85	2	2.02
Paraprionospio pinnata	PPP	46	724	135	5.28	5	1.76
Spiophanes berkeleyorum	PSPIB	65	390	99	2.85	2	3.29
Alvania compacta	MAC	69	1703	128	12.43	6	17.99
Mysella tumida	MMT	81	8722	134	63.66	59	32.82
Nassarius mendicus	MNM	83	480	115	3.5	3	4.84
Odostomia sp.	MOS	86	367	96	2.68	2	4.24
Parvilucina tenuisculpta	MPT	87	876	130	6.44	5	4.44
Ophiuroidea (Amphiodia urtica)	EAU & EOPH	106 & 107	2762	133	20.16	19	14.6
Moderately dominant species							
Aphelochaeta multifilis	PAMU	8	474	41	3.46	0	21.15
Glycinde polygnatha	PGP	25	111	59	0.81	0	2.02
Lumbrinderidae sp. Ident.	PLS	31	168	75	1.23	1	2.67
Mediomastus sp.	PMS	34	352	45	2.57	0	13.75
Pholoe minuta	PPM	48	218	84	1.59	1	2.41
Podarkeopsis glabrus	PPODG	54	154	70	1.12	1	2.74
Scoletoma luti	PSL	61	98	42	0.72	0	2.63
Macoma nasuta	MMN	78	336	72	2.45	1	8.15
Macoma species juvenile	MMS	79	140	48	1.02	0	5.4
Nitidella gouldi	MNG	85	97	61	0.71	0	1.33
Protothaca staminea juveniles	MPSJ	89	181	55	1.32	0	6.28
Psephidia lordi	MPL	90	99	37	0.72	0	4.02
Tellina modesta	MTM	91	449	89	3.28	1	8.54
Nematodes	MNEM	109	52	37	0.38	0	1.36
Pinnixa schmitti and Pinnixa sp.	CPS	105	14	12	0.1	0	1.19

The baseline community was further characterized by computing Shannon's Index (Shannon and Weaver, 1949), Pielou's Eveness (Pielou, 1977) and Margalef's Richness Index (Margalef, 1958). The results are presented in Figure 38. The discontinuous lines are the raw data and the smooth lines are a fourth order polynomial fit to the data. Note that Shannon's Index increases at the Open Control (easternmost station) and the Weathered Piling site (westernmost station). The observed increase in Shannon's Index appears inconsistent with the lower abundance observed at these extremes during all sample periods in this study. Likewise, Pielou's Evenness Index increases at the extremes, indicating lower abundance of dominant taxa.

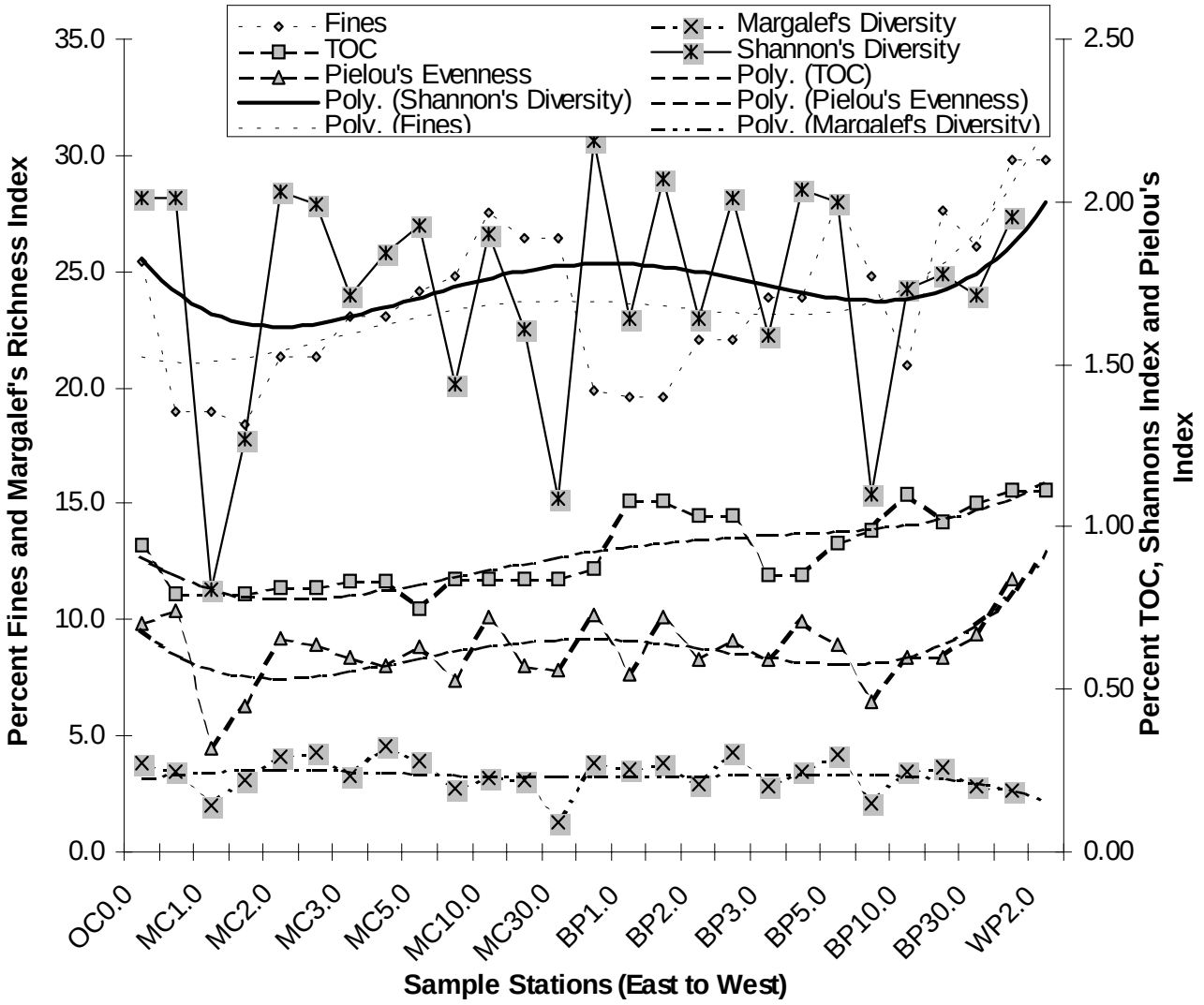


Figure 38. A comparison of percent fines (silt and clay) and total organic carbon with Pielou's Evenness Index, Margalef's Richness Index and Shannon's Diversity index.

Only Margalef's Richness Index shows slight decreases at the Open Control and Weathered Piling sites. To further investigate this, a correlation matrix was produced using Pearson's Correlation Coefficient to determine the relationship between TOC, Percent Fines and each of the taxa in the database (106) species. Significant ($\alpha = 0.05$) correlation coefficients are bolded in Table 24 for Dominant and Moderately Dominant species.

Table 24. Response of dominant and moderately dominant taxa to percent silt and clay (fines) and total organic carbon (TOC) at stations not exposed to PAH associated with creosote treated piling.

	Code	Variable	Total Number	Occurrences	Correlation Coefficient	
Dominant species					Fines	TOC
Nephtys ferruginea	PNF	37	390	113	0.21	0.08
Paraprionospio pinnata	PPP	46	724	135	+0.06	**0.35**
Spiophanes berkeleyorum	PSPIB	65	390	99	-0.11	-0.20
Alvania compacta	MAC	69	1703	128	-0.18	**-0.58**
Mysella tumida	MMT	81	8722	134	-0.20	**-0.40**
Nassarius mendicus	MNM	83	480	115	**-0.27**	0.01
Odostomia sp.	MOS	86	367	96	-0.05	-0.24
Parvilucina tenuisculpta	MPT	87	876	130	0.04	**-0.43**
Ophiuroidea (Amphiodia urtica)	EAU & EOPH	106 & 107	2762	133	0.04	**-0.62**
Moderately dominant species						
Aphelochaeta multifilis	PAMU	8	474	41	0.10	-0.07
Glycinde polygnatha	PGP	25	111	59	0.00	**-0.48**
Lumbrinderidae sp. Ident.	PLS	31	168	75	0.06	**-0.42**
Mediomastus sp.	PMS	34	352	45	0.08	0.20
Pholoe minuta	PPM	48	218	84	-0.01	0.11
Podarkeopsis glabrus	PPODG	54	154	70	-0.11	-0.20
Scoletoma luti	PSL	61	98	42	-0.10	0.13
Macoma nasuta	MMN	78	336	72	0.12	**-0.51**
Macoma species juvenile	MMS	79	140	48	0.10	**-0.25**
Nitidella gouldi	MNG	85	97	61	0.08	**-0.24**
Protothaca staminea juveniles	MPSJ	89	181	55	**-0.25**	**-0.38**
Psephidia lordi	MPL	90	99	37	0.09	**-0.47**
Tellina modesta	MTM	91	449	89	0.01	**-0.56**
Nematodes	MNEM	109	52	37	**-0.29**	-0.08
Pinnixa schmitti and Pinnixa sp.	CPS	105	14	12	-0.10	0.14

Significant correlations with TOC are noted in Table 25. It should be emphasized that no cause and effect relationship was investigated between the abundance of these species and percent TOC. However, in the author's experience, the apparently TOC tolerant polychaete species have been observed in abundance in sediments with moderate amounts of TOC located in the vicinity of salmon farms. These data are presented because they may be of benefit in understanding the relationship between community structure and TOC in other studies and because the subtle effects of TOC cause an insignificant, but apparently real decline in abundance as one proceeds from east to west through this study area.

Table 25. Significant positive and negative Pearson Correlation Coefficients between specific taxa and percent TOC observed in the upper two centimetres of the sediment column at stations unaffected by PAH in the Sooke Basin Creosote Evaluation Study. Occurrence and total count data are for all stations.

TOC **Tolerant** Species		Pearson Correlation Coefficient with TOC	Occurrence	Total Count
PAMU	(*Amphelochaeta multifilis*)	0.59	41	474
PEXOL	(*Exogone lourei*)	0.35	13	34
PMS	(*Mediomastus sp.*)	0.36	6	13
PNF	(*Nephtys ferruginea*)	0.36	113	390
POF	(*Owenia fusiformis*)	0.24	29	43
PPHYS	(*Phyllodoce sp.*)	0.42	3	3
		Totals	205	957

TOC **Intolerant** Species		Pearson Correlation Coefficient with TOC	Occurrence	Total Count
PDORR	(*Dorvillea rudolphi*)	-0.26	20	47
PGP	(*Glycinde polygnatha*)	-0.48	59	111
PLS	(*Lumbrinderidae sp.*)	-0.42	75	168
PMD	(*Micropodarke dubia*)	-0.26	6	13
PNC	(*Nephtys cornuta*)	-0.23	8	9
PPB	(*Platynereis bicanaliculata*)	-0.35	27	94
PPRIS	(*Prionospio sp.*)	-0.25	8	10
PSERS	(*Serpulidae sp.*)	-0.28	14	62
MAC	(*Alvania compacta*)	-0.58	128	1703
MCS	(*Clinocardium cp.*)	-0.34	10	12
MMS	(*Macoma sp.* juveniles)	-0.25	48	140
MMT	(*Mysella tumida*)	-0.40	134	8722
MOS	(*Odostomia sp.*)	-0.41	96	367
MPT	(*Parvilucina tenuisculpta*)	-0.43	130	876
MPSJ	(*Protochaca staminea*, juveniles)	-0.38	55	181
MPL	(*Psephidia lordi*)	-0.47	37	99
MTM	(*Tellina modesta*)	-0.56	89	449
EAU	(*Amphiodia urtica*)	-0.62	133	2762
		Totals	1077	15825

The data in Table 25 also help explain the apparent inconsistency between Pielou's Evenness Index, Shannon's Diversity Index and the total infaunal abundance. The highly dominant species (*Alvania compacta*, *Mysella tumida*, *Parvilucina tenuisculpta* and *Amphiodia urtica*) were significantly negatively correlated with TOC. Reductions in the dominance of these taxa associated with increasing TOC would be seen as increasing community Evenness and Diversity because of the way in which the algorithms defining these metrics are constructed. This simply reiterates the care with which these metrics must be used in assessing infaunal communities.

It should be noted that the nine Dominant taxa comprise less than ten percent of the number of taxa but 81% of the total infaunal abundance. When the 15 Moderately Dominant taxa are added to the Dominants, they represent 23% of the taxa and 96% of the total abundance. Much of this community could be represented by a small subset of the taxa present.

5.6.4. Baseline infauna and environmental physiochemical summary.

Baseline conditions observed on October 3, 1995 at this site suggest a moderately abundant infaunal community dominated by a few polychaete and mollusc species and a single echinoderm. Arthropods were not abundant in any sample. Percent fines (silt and clay) were observed to increase on an east to west transect through the study area. Six polychaete species showed significant positive correlation's with TOC but 18 taxa, including the most abundant molluscs and the dominant echinoderm suffered significant ($\alpha = 0.5$) negative correlations with TOC. This response was unexpected because TOC only varied between 0.46 percent and 2.8 percent in these samples. Currents in this area of Sooke Basin generally flow from east to west on both ebb and flood tides at an exceptionally slow speed averaging 1.89 cm/sec. It is possible that these slow currents inhibit oxygen transport to the sediments. This is most likely in the western portions of the study area. Reduced horizontal oxygen transport may have resulted in reduced oxygen tension in the sediment interstitial water as a result of microbial catabolism and normal infaunal respiration. This would help explain the reducing conditions observed downstream from the Weathered Piling site on the western boundary of the study area. Whatever the reason, the observed decline in infaunal abundance confounds the analysis of the effects of creosote derived PAH on the infaunal community.

5.6.5 Infauna at the Open Control site.

This experimental design involved two levels of control. The Open Control site was selected well upstream from the treatment dolphins and represents background conditions well removed from any anthropogenic disturbances. The second level of control examines the infaunal community's response to the physical presence of an untreated Douglas fir dolphin constructed in an identical manner with the treatment dolphins. This second level of control is referred to as the Mechanical Control. In this section, infauna at the Open Control site are evaluated as a function of time and their suitability as a standard against which to measure effects associated with the creosote treated structures assessed. The abundance and diversity associated with three replicate samples collected at the Open Control site is compared with similar measures at all Mechanical Control Stations in Table 26.

Table 26. Comparison of the abundance and species richness (in brackets) at the Open Control and Mechanical Control stations as a function of time in the Creosote Evaluation Study conducted in Sooke Basin, British Columbia. Abundance is the mean number of infauna per 0.0320 m^2 quadrat and Diversity is the mean number of taxa identified per sample.

	Open Control		All Mechanical Control Stations	
Day	Abundance	(Richness)	Abundance	(Richness)
Baseline	88	(17)	149	(16)
Day14	78	(15)	120	(17)
Day185	124	(16)	172	(18)
Day384	15	(8)	261	(22)

There was a general trend to lower abundance and diversity of infauna at the Open Control site when compared with the mean of all Mechanical Control stations on each sample date. However, those differences were statistically significant ($\alpha = 0.05$) only on Day384. Unfortunately, Day384 is the most important sample day in this study because it represents the time of maximum PAH accumulation at both the BMP and WP creosote treated sites. It is likely that the low values of both abundance and diversity observed at the Open Control Site on Day384 would mask subtle effects on the infaunal community associated with PAH lost from creosote treated wood. Therefore, the Open Control does not appear to represent a suitable reference against which to judge effects at the various treatment sites.

5.6.6 Abundance and diversity as a function of distance and date at the Mechanical Control Site.

The mean number of taxa per sample collected at the Mechanical Control site is summarized in Figure 39 as a function of distance downstream and sample date. The number of taxa varied between 6 and 27 with significant variation between stations on all sample days excepting Day384. No statistically significant trends in the number of taxa were observed on any sample date at the Mechanical Control site in this study.

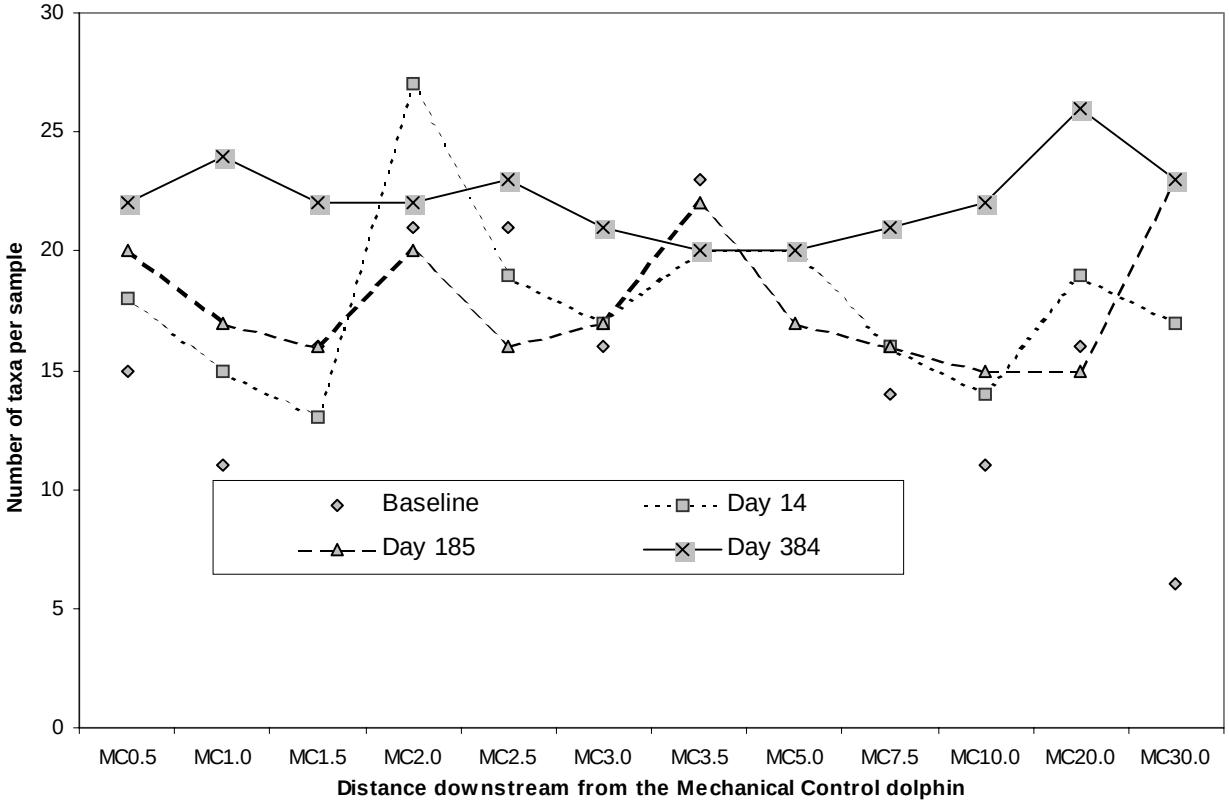


Figure 39. Number of taxa per 0.0320 m^2 sample collected downstream from the Mechanical Control dolphin as a function of sample date and distance in the Sooke Basin Creosote Evaluation Study.

The abundance of infaunal organisms observed downstream from the Mechanical Control dolphin is summarized, by date, in Figure 40. These data are relatively noisy, making significant trends difficult to identify. As will be seen in later sections, the times and distances of most interest are the 185 and 384 day samples taken at distances less than 10 metres from the downstream perimeter of the dolphin.

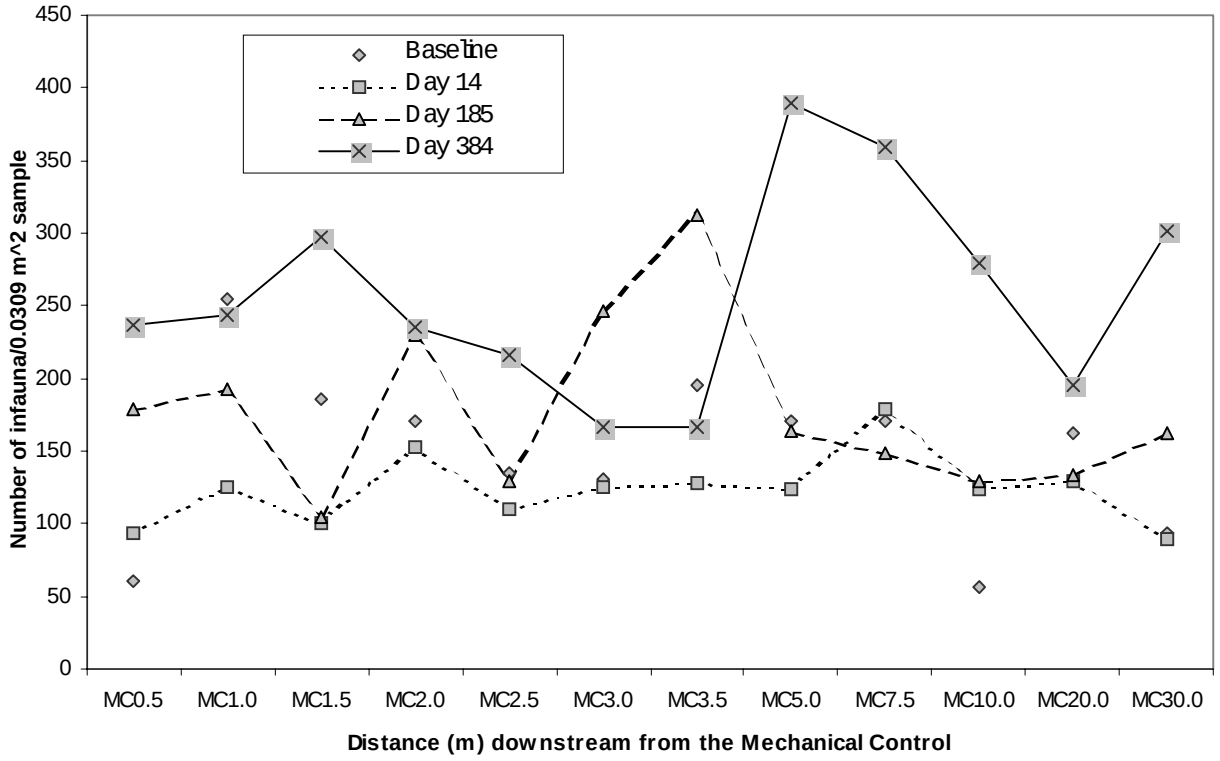


Figure 40. Abundance of infaunal organisms (number/0.0320 m^2) downstream from the untreated Mechanical Control dolphin in the Sooke Basin Creosote Evaluation Study. Distances are in metres.

The Day185 data suggest that the abundance of infauna is increasing from the perimeter to a distance of 3.5 metres. However, non-linear regression analysis indicates that this trend is not significant ($p = 0.14$). Likewise, it appears that infaunal abundance is decreasing from the perimeter to a distance of 3.5 metres on Day384. However, that trend is also not statistically significant ($p = 0.12$). If mechanical effects associated with the dolphin were having an effect on the abundance of infauna, it seems likely that the effect would have been evident on Day185 and that it would have continued on Day384. The observation of insignificant trends, in opposite directions, on these two sample dates suggests that they are simply the result of collecting random samples from the same population. However, it should be noted that the Day185 sample was collected in the Spring (April, 1996) and the Day384 sample was collected in the Fall (October, 1996). The possibility of seasonal interactions cannot be discounted. However, the abundance trend associated with the 14 day sample, collected in the Fall (October, 1995), is more consistent with the Spring (Apr.96) results than with the Fall, 1996 results

further supporting the conclusion that the Mechanical Control dolphin did not have a significant effect on the abundance of downstream infauna.

For purposes of this analysis, the Day185 and Day384 data will be combined. The mean abundance observed on sample days 185 and 384 is summarized in Figure 41. No trends in the abundance of infauna are apparent – although the data remains highly variable, reflecting the patchy nature of infaunal communities. It should be noted that multivariate linear regression analysis on abundance observed at the Mechanical Control treatment indicates that the Constant ($p = 0.0000$) and the Date ($p = 0.0000$) were significant parameters, whereas Distance ($p = 0.49$) was not significant. The regression coefficient on infaunal abundance associated with sample date was positive (0.33) indicating that the number of infauna increased with time following installation.

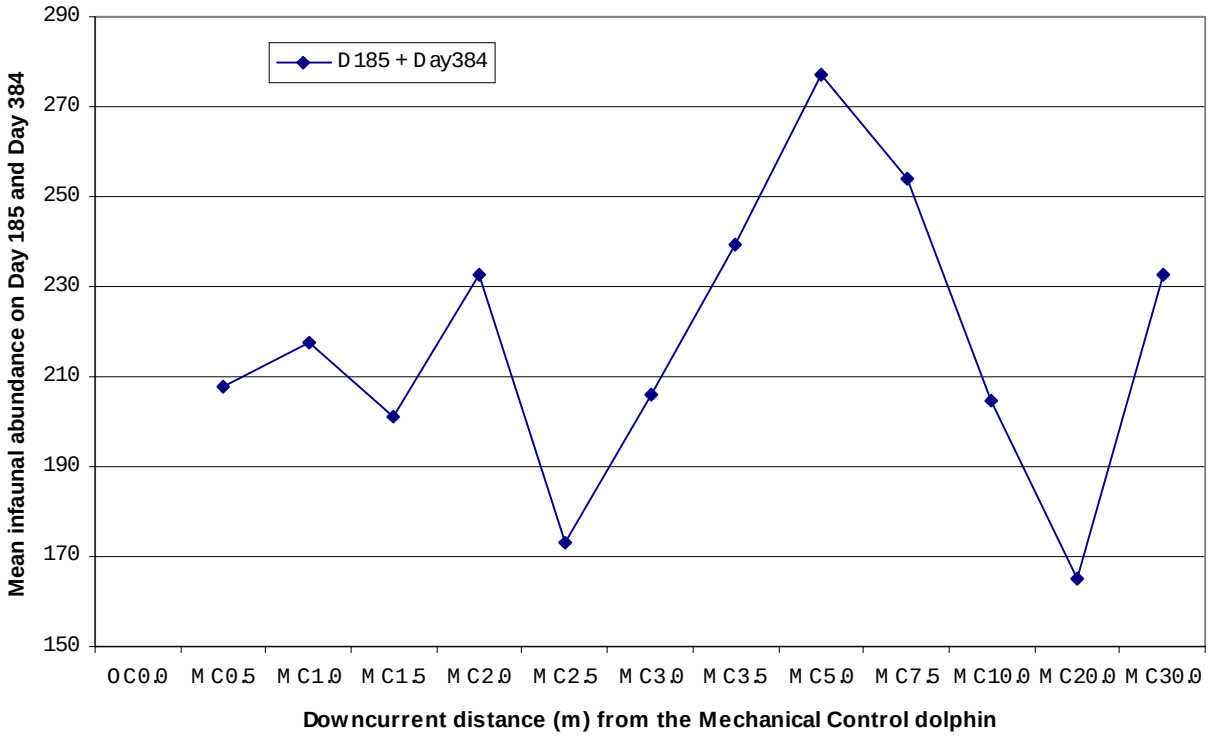


Figure 41. Mean abundance, on sample Days 185 and 384, of infaunal organisms (number/0.0320 m^2) observed downstream from the untreated Mechanical Control dolphin in the Sooke Basin Creosote Evaluation Study. Distances are in metres.

In summary, statistically significant trends in the abundance of infauna at the Mechanical Control site were not observed as a function of distance on individual sample days. Infauna were observed to significantly increase as a function of time following construction. These data suggest that the Mechanical Control dolphin provides a suitable reference database against which to judge the effects of sedimented PAH associated with the creosote treated dolphins. Significant trends in the abundance of infauna, downstream from the creosote treated dolphins, are unlikely to be caused by mechanical effects associated with the structure.

5.6.7 Infauna at the dolphin treated with creosote using Best Management Practices (BMP)

Figure 42 provides a summary of the number of taxa (per sample) observed at the BMP dolphin as a function of time and distance downstream. Multiple regression analysis indicates that there was a significant increase in the number of taxa ($p = 0.0000$) following construction of the dolphin. Distance was not significant ($p = 0.0988$) at $\alpha = 0.05$ but was at $\alpha = 0.10$. The number of taxa observed at the BMP treated dolphin can be defined by the relationship:

Number of taxa = 16 + 0.018 x Days – 0.081 x Distance

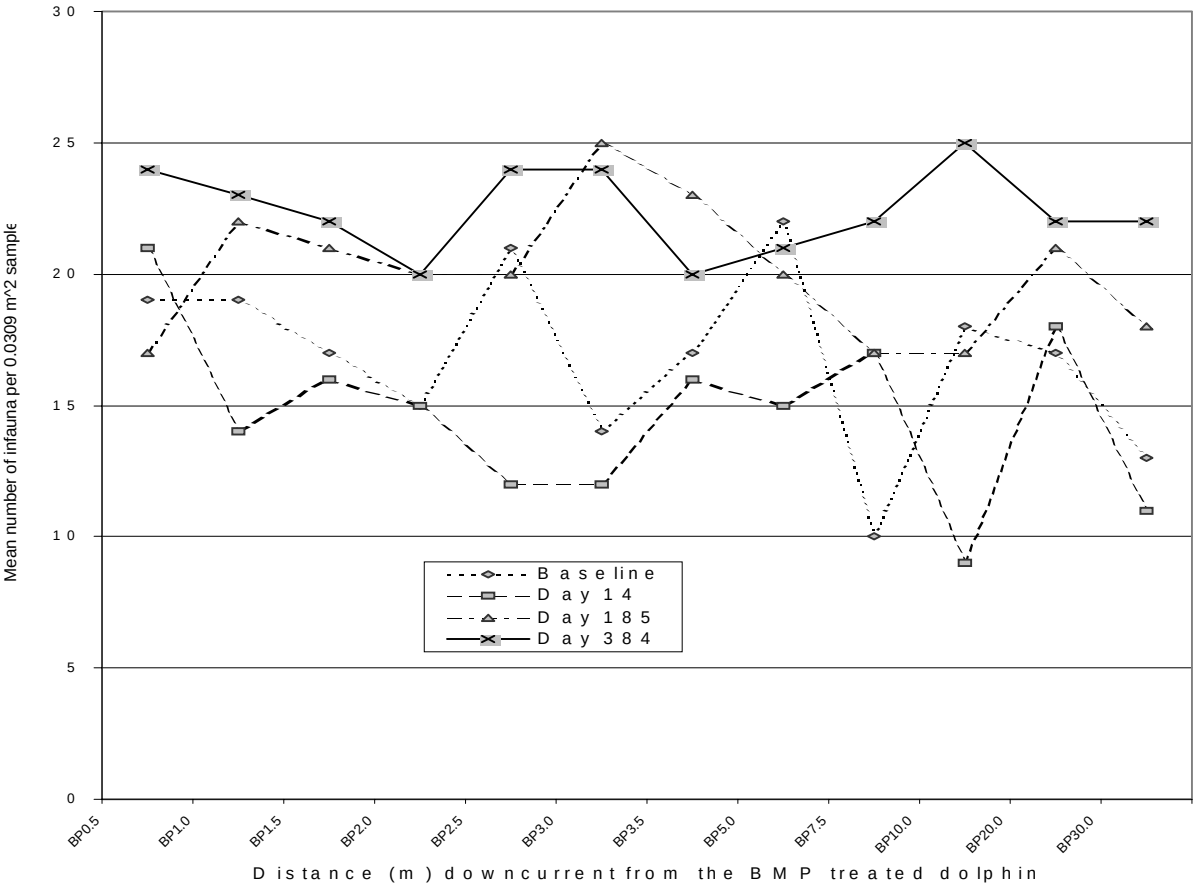


Figure 42. Mean number of taxa observed downstream from the BMP dolphin in the Sooke Basin Creosote Evaluation Study.

This relationship indicates that the number of taxa increased following construction of the BMP Dolphin and that more taxa were observed closer to the dolphin than were observed at increasing distances. The increase in taxa with time is consistent with data from the Mechanical Control dolphin. As discussed earlier, higher PAH concentrations were observed closer to the BMP treated dolphin with an exponential decrease to 7.5 metres and little effect beyond that. These results suggest that when the entire study area is considered, a higher infaunal diversity was observed closer to the dolphin where higher concentrations of PAH were found.

As noted previously, only minor amounts of PAH were observed beyond 7.5 metres in this study. Multi-factor linear regression analysis was used to further examine the relationship between PAH concentration and the number of taxa. The database was restricted to those dates following construction (Day = 14, 185 and 384) and those distances where significant increases in PAH were observed (i.e. < 10 metres). The resulting regression was highly significant ($p < 0.0000$) and explained 59% of the variance in the database. The factor Date remained significant ($p < 0.0000$) and the probability that the coefficient on Distance was zero increased to 0.12 which is marginal. However the results were essentially the same and the predictive equation is given below. It should be noted that the increase in the number of taxa is higher in the nearfield (-0.27) than when all distances were considered (-0.081).

Near field, post construction number of taxa = 16 + 0.02 x Days – 0.27 x Distance

These results suggest that the presence of the creosote treated dolphin did not have a negative effect on the diversity of infaunal organisms. Significant increases in the number of taxa were observed following construction. In addition, these data suggest that marginally significant increases in the number of taxa are predicted closer to the dolphin where increased concentrations of PAH were observed.

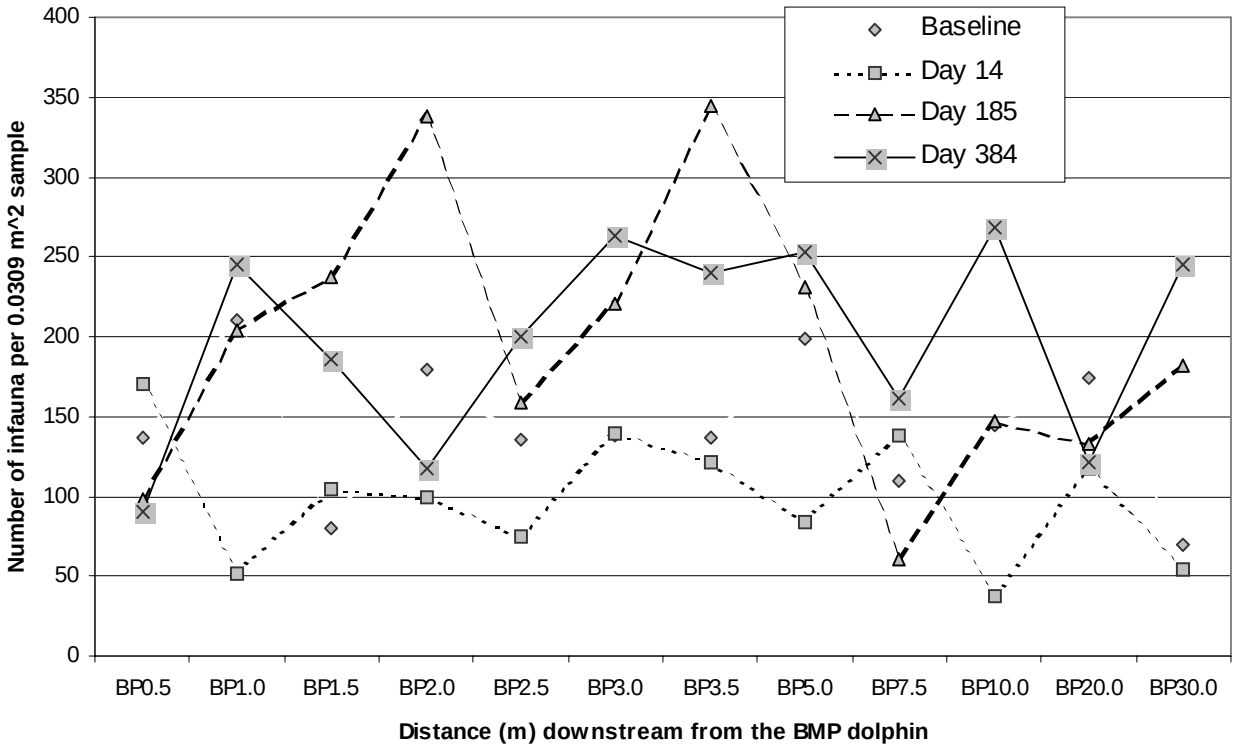


Figure 43. Mean number of infauna, in 0.0320 m^2 samples, observed downstream from the BMP dolphin in the Sooke Basin Creosote Evaluation Study.

Figure 43 describes the abundance of infauna as a function of date and distance downstream from the BMP dolphin. A decrease in abundance was observed in all Day14 samples when compared to the Baseline. However, increases in the abundance of infauna were apparent on sample Days 185 and 384

suggesting that infaunal abundance was generally higher during post construction sampling when compared to the baseline samples. Multiple regression analysis indicates that there is a significant increase in infaunal abundance ($p = 0.0000$), by date, following construction of the dolphin. Distance was not a significant parameter ($p = 0.26$). The relationship was significant ($p = 0.000$), but explained only 22% of the variation in the database. There was however, an apparent decline in the abundance of infauna at sample station BMP 0.5, the station closest to the dolphin.

To further investigate the effects of creosote derived PAH on the infaunal community, the remainder of this analysis will examine combined data from Days 185 and 384. This data is summarized in Figure 44. The 185 and 384 Day data are provided as background and the mean of the number of infauna per sample is provided as a solid line.

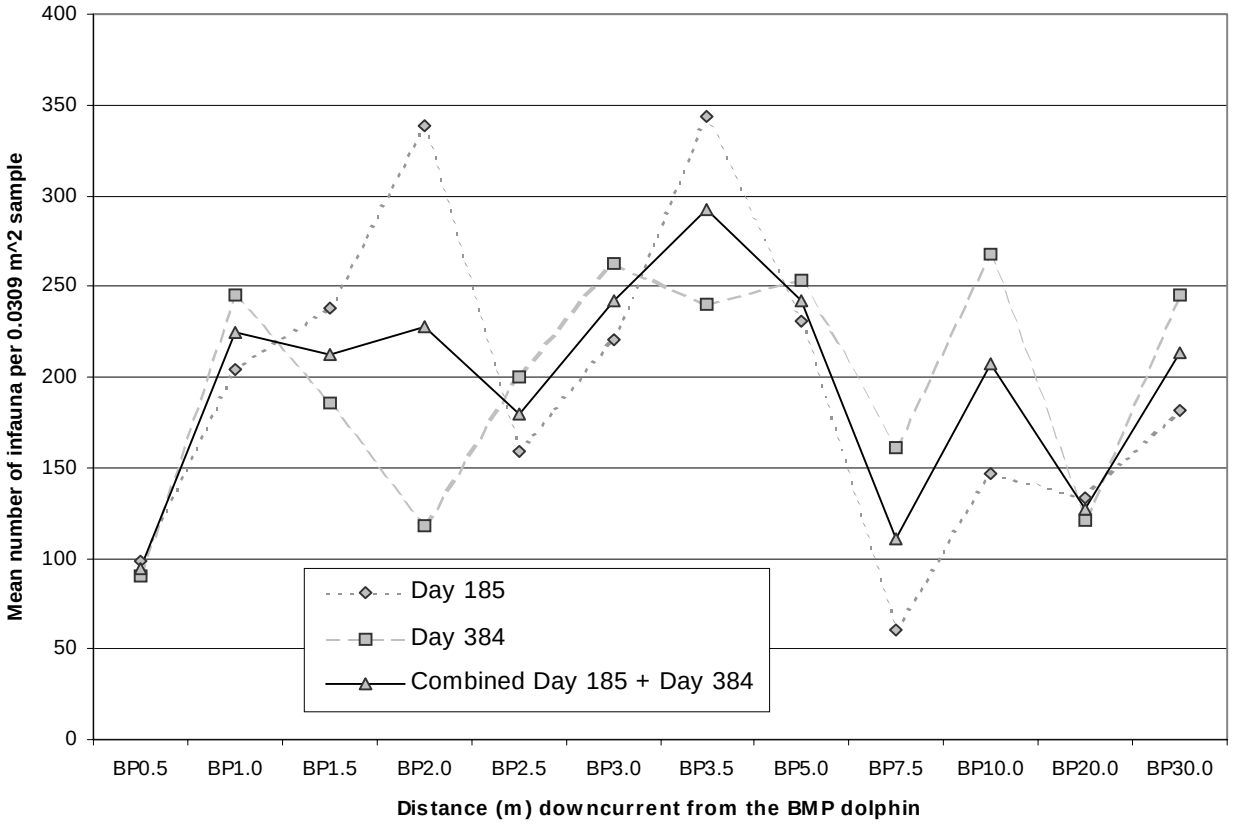


Figure 44. Mean number of infauna, in 0.0320 m^2 samples, observed downstream from the BMP dolphin in the Sooke Basin Creosote Evaluation Study - Day185 and Day384. The average of the number of infauna observed at each station on both days is also included.

Linear regression analysis on this database indicates a significant constant but distance did not have a significant effect on the number of infauna observed downstream from the BMP dolphin. It should be noted that the abundance of infauna is consistently depressed at the station closest to the creosote treated dolphin (BP 0.5). Lower abundance was found on Day384 at the BP 2.0 station and on Day185 at the BP7.5 station, but not at both of these stations on both sample days.

In summary, there is no apparent (or statistically significant) depression in the abundance or diversity of aggregated infauna along downstream transects at BMP treated dolphin. This suggests that spatially, any significant overall effect is limited to the area within 0.5 metres of the dolphin. Creosote treated wood effects on infaunal diversity will not be explored further. Impact on abundance lies at TPAH concentrations greater than 10 µg TPAH/g. The line in Figure 45 represents the distance weighted least square best fit to the data.

This response of infaunal abundance to sedimented PAH was explored by comparing the combined Day185 and Day384 abundance data with sediment concentrations of phenanthrene, fluoranthene, total low molecular weight PAH, total high molecular weight PAH and total PAH. The results are summarized in Figure 45 for total PAH. This scatterplot suggests that the abundance of infauna began to decrease above about 8 µg TPAH/g dry sediment. However, the infaunal abundance in several samples at 16 to 29 µg TPAH/g dry sediment remained above the minimum observed at TPAH values <1.0 µg/g. There does appear to be two clusters on this scatterplot, the first cluster contains relatively high abundance samples and lies within the area bounded by ca. eight to ten µg TPAH/g dry sediment. The second cluster has reduced abundance and is associated with PAH values of greater than or equal to 10 µ/g. The relationship between all species at a station and total PAH concentration

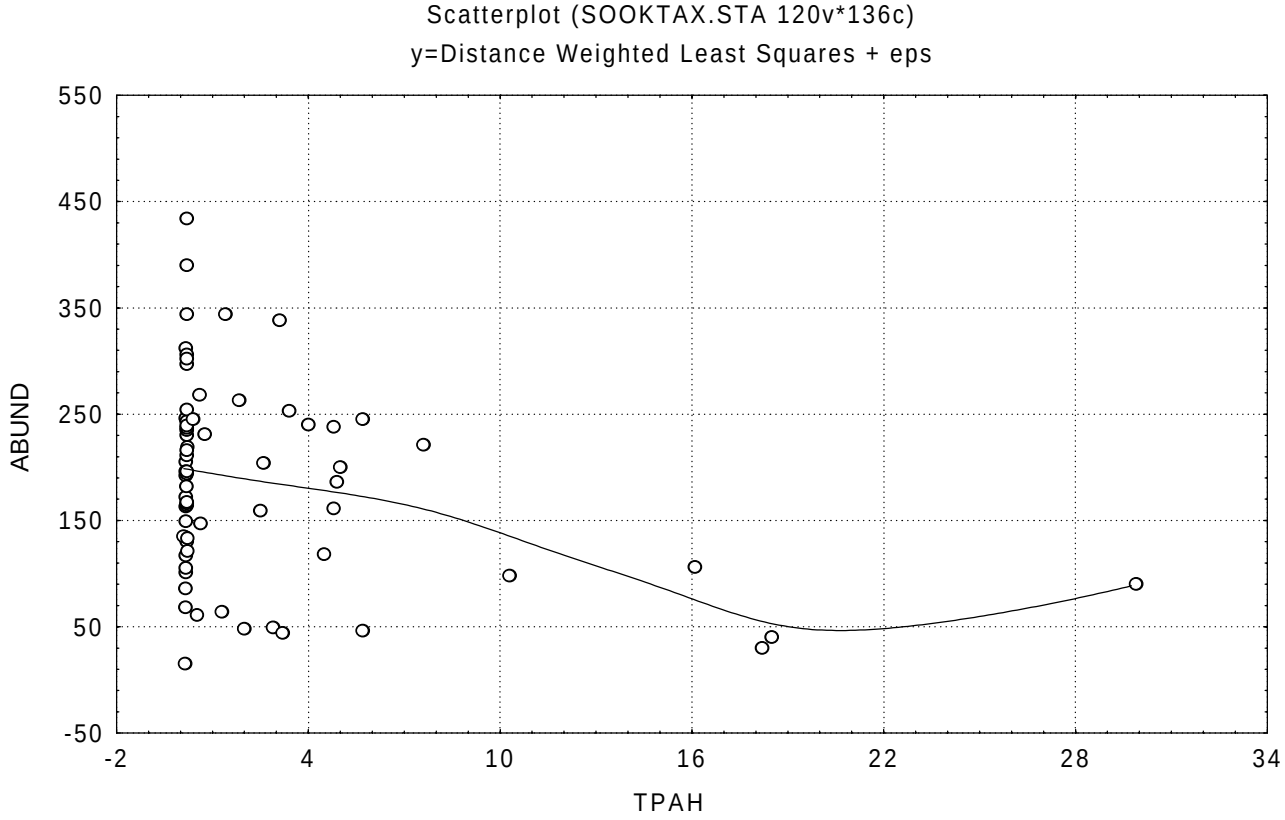


Figure 45. Abundance of all infaunal species in 0.0320 m^2 samples collected downstream from the BP dolphin at 185 and 384 days post construction as a function of the measured concentration of 18 sedimented polycyclic aromatic hydrocarbons (TPAH) in the same location.

measured in the sediments was examined using regression analysis at TPAH values of <4, <6, <8, <10, and <30 µg/g, sediment dry weight. The slopes of the resulting regression equations were positive (increasing abundance with increasing PAH concentrations) at total PAH values up to 10 µg TPAH/g dry sediment. However, none of the TPAH coefficients were statistically significant although the <4 µg TPAH/g dry sediment weight analysis was marginally significant ($p = 0.09$). The coefficient on TPAH became negative when all values <30 µg/g were included in the analysis, but this regression was also not significant ($p = 0.14$).

A similar exercise was conducted with the low and high molecular weight PAH and phenanthrene and fluoranthene. No statistically significant coefficients between total taxa abundance and any of these classes of PAH or individual PAH were obtained. However, the coefficients were all negative with probabilities of being equal to zero or less than 0.20.

It is quite possible that infaunal species differ in their susceptibility to PAH intoxication and that this masks adverse effects associated with PAH at the concentrations observed in this study. To investigate this possibility, the correlation between the various classes of PAH and individual taxa were evaluated for infauna collected at the BMP treatment site. No significant negative correlation coefficients were found between any taxa and TPAH, HPAH, LPAH, fluoranthene or phenanthrene at the BMP dolphin. However, four polychaete, four molluscs, one arthropod and foraminifera species were found to be significantly positively correlated with each of the classes of PAH. These positive correlation coefficients were high with many in the 0.70 to 0.92 range. This significant increase in infaunal abundance with increasing PAH is likely associated with the structure rather than the PAH. The database was then expanded to include the Day185 and Day384 samples at all Mechanical Control stations where only background levels of PAH were observed. These results were similar except that a single species demonstrated a significant negative correlation with PAH (*Mysella tumida*). Species evidencing a negative correlation coefficient (< - 0.20) with PAH at the BMP site are summarized in Table 27.

Table 27. Negative Pearson Correlation Coefficients between individual taxa and a) Total PAH; b) HPAH; c) LPAH, d) phenanthrene and e) fluoranthene.

Taxon	Total PAH	HPAH	LPAH	fluoranthene	phenanthrene
***Eumida longicomuta* (PEL)**	**-0.13**	**-0.10**	**-0.18**	**-0.16**	**-0.22**
***Glycinde polygnatha* (PGP)**	**-0.19**	**-0.18**	**-0.22**	**-0.21**	**-0.23**
***Lumbrineris sp.* (PLS)**	**-0.23**	**-0.24**	**-0.19**	**-0.23**	**-0.17**
***Pholoe minuta* (PPM)**	**-0.26**	**-0.27**	**-0.24**	**-0.25**	**-0.24**
***Alvania compacta* (MAC)**	**-0.21**	**-0.19**	**-0.26**	**-0.23**	**-0.26**
***Turbonilla sp.* (MTS)**	**-0.19**	**-0.20**	**-0.17**	**-0.16**	**-0.16**
***Mysella tumida* (MMT)**	**-0.17**	**-0.18**	**-0.19**	**-0.21**	**-0.20**
***Amphiodia urtica* (EAU)**	**-0.32**	**-0.32**	**-0.32**	**-0.31**	**-0.31**
***Pinnixa sp.* (CPS)**	**-0.21**	**-0.24**	**-0.18**	**-0.18**	**-0.18**

It is worth noting that *Mysella tumida*, *Amphiodia urtica* and *Alvania compacta* are among the Dominant Taxa described in Table 25. In fact, excepting *Eumida longicormuta* and *Turbonilla sp.*, all of these species were found to be either Dominant or Moderately Dominant. Together, the number of these species represent 68% of the total number of infauna identified in this study. Having identified these as the most sensitive species (in this study) to sedimented PAH, the following analysis will focus on an

evaluation of these sensitive species at the dolphin constructed of creosote treated pilings produced using Best Management Practices (BMP).

The following analysis will assess the response of these PAH sensitive species to the observed concentration of total PAH, low molecular weight PAH, high molecular weight PAH, fluoranthene and phenanthrene at the BMP dolphin on test days 185 and 384. These two dates were combined to provide the maximum number of samples with elevated PAH. Figure 46 is a scatterplot describing the response of sensitive benthic infauna to concentrations of all PAH (TPAH). The approach taken in this analysis was to look for significant trends in the response variable (abundance of sensitive species) to observed incremental changes in PAH. The PAH concentration at which the regression coefficient was least significant (highest probability that the coefficient equaled zero) was considered the maximum value of PAH at which no significant effects were observed. The results of a series of regression analyses on this data are provided in Table 28.

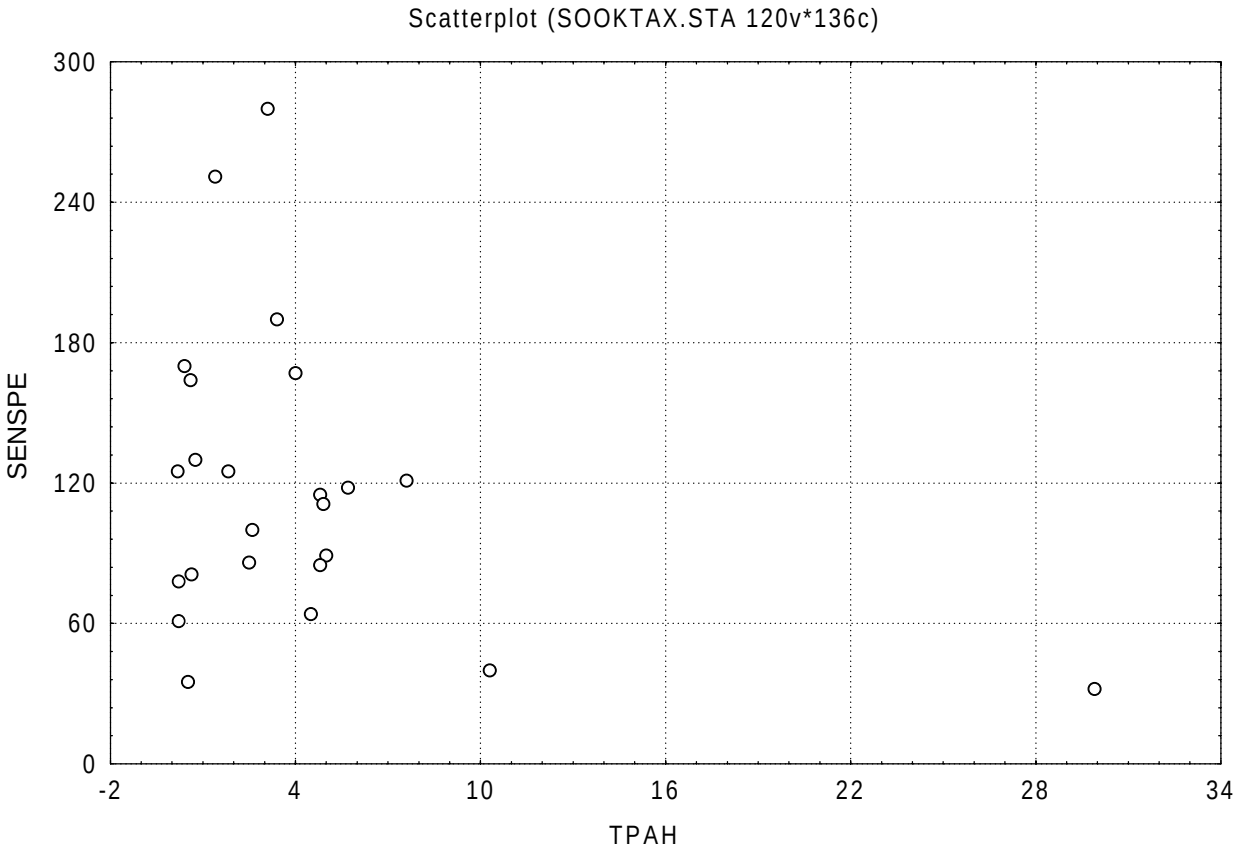


Figure 46. Scatterplot describing the abundance of PAH sensitive taxa at varying levels of total PAH (TPAH) observed in sediments collected on Days 185 and 384 from the creosote treated dolphin constructed using Best Management Practices.

At Total PAH levels equal to or above 11 μg/g, abundance is negatively correlated with TPAH concentrations but the relationship is not significant. The same was true for all higher concentrations of TPAH. At all TPAH levels less than 10 μg/g, the abundance of the most sensitive species is positively correlated with TPAH. The only regression for which the coefficient on TPAH is close to significant is

that for TPAH concentrations less than 4.0 µg/g. That regression predicts abundance equal to 96 infauna plus an additional 28.72 infauna for each additional microgram of PAH.

Table 28. Regression analyses describing the response of sensitive infauna to total PAH concentrations downstream from the BP dolphin in the Sooke Basin Creosote Evaluation Study. Data from Days 185 and 384 were combined for this analysis. (p) is the probability that the coefficient on TPAH equals zero – or that PAH has no effect on the abundance of sensitive species. The linear regression is of the form Abundance = Constant + B x TPAH. Positive values of B imply increasing numbers of infauna with increasing TPAH and negative values of B imply an adverse effect of PAH on infauna.

TPAH Level	Linear Regression (constant + B x TPAH)	(probability that B = zero)
< 11	Abundance = 133 – 3.90 x TPAH	0.43
< 10	Abundance = 125 + 0.07 x TPAH	0.99
< 9	Abundance = 125 + 0.07 x TPAH	0.99
< 8	Abundance = 125 + 0.07 x TPAH	0.99
< 7	Abundance = 124 + 0.35 x TPAH	0.96
< 6	Abundance = 124 + 0.35 x TPAH	0.96
< 5	Abundance = 121 + 2.65 x TPAH	0.76
< 4	Abundance = 96 + 28.72 x TPAH	0.09
< 3	Abundance = 110 + 6.27 x TPAH	0.77
< 2	Abundance = 85 + 54.50 x TPAH	0.17
< 1	Abundance = 85 + 46.14 x TPAH	0.62

It is important to put this discussion in proper perspective. No cause and effect relationship between sedimented levels of TPAH and the abundance of sensitive infauna is claimed. It should be noted that the probability that most of these positive coefficients is equal to zero is very high for all categories except the < 4 µg TPAH/g dry sediment category. The purpose of this analysis is not to suggest that creosote derived PAH enhance the abundance of PAH sensitive infauna – that would be nonsense. The purpose is to clearly demonstrate that in this study, the data indicate that Total PAH levels less than 10 µg TPAH/g dry sediment did not result in decreases in the abundance of PAH sensitive species.

There was a significant reduction in the abundance of infauna at TPAH concentrations $\geq$ 10 µg/g. However there are only two TPAH values greater than 10 µg/g and that is considered insufficient to develop a useful dose response relationship. Development of a meaningful relationship would require additional sampling to increase that portion of the database with TPAH values above the apparent threshold at 10 µg TPAH/g dry sediment.

Figures 47, 48, 49 and 50 are scatter plots describing the abundance of PAH sensitive species downstream from the BMP dolphin on days 185 and 384 as a function of LPAH, HPAH, fluoranthene and phenanthrene sediment concentrations. A similar analysis was completed for the other classes of PAH being considered. Toxicity thresholds resulting from that analysis are provided in Table 29.

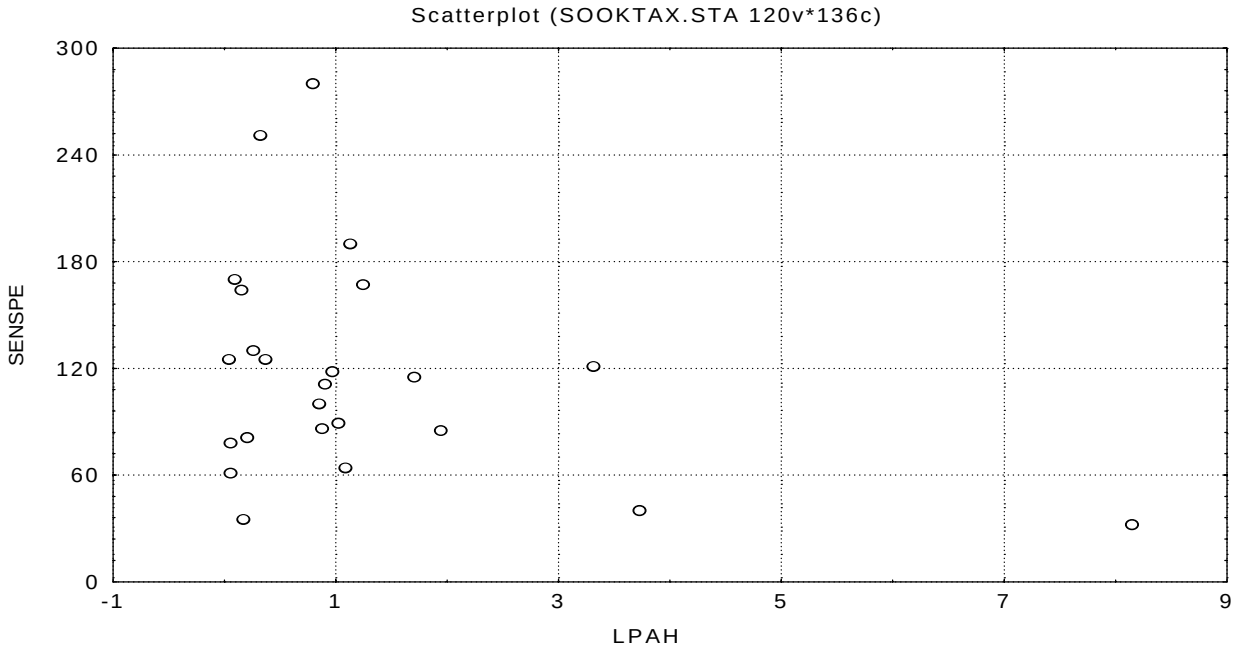


Figure 47. Scatterplot describing the abundance of PAH sensitive taxa at varying levels of low molecular weight PAH (LPAH) observed in sediments collected on Days 185 and 384 from the creosote treated dolphin constructed using Best Management Practices.

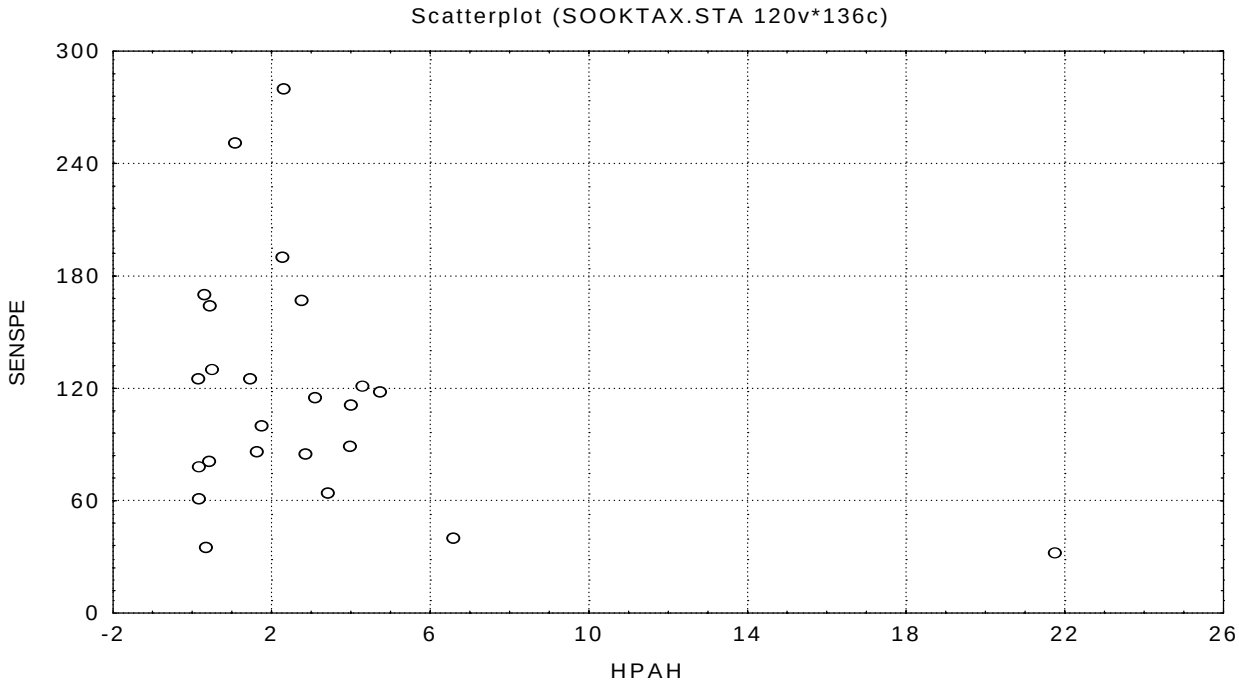


Figure 48. Scatterplot describing the abundance of PAH sensitive taxa at varying levels of high molecular weight PAH (HPAH) observed in sediments collected on Days 185 and 384 from the creosote treated dolphin constructed using Best Management Practices.

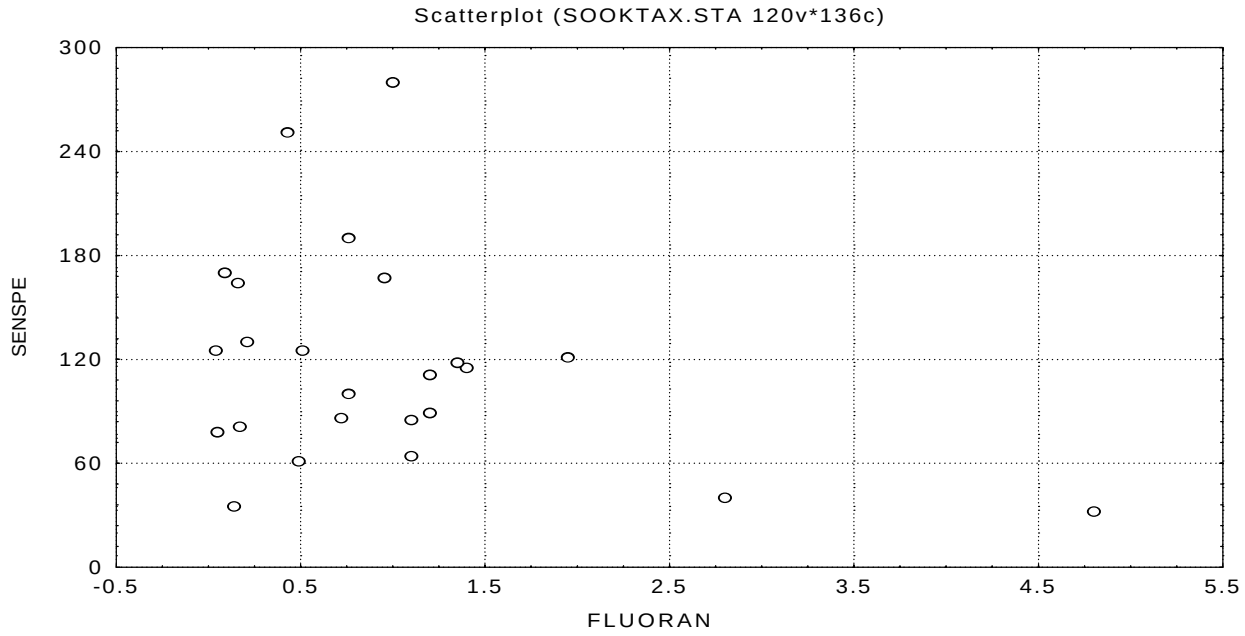


Figure 49. Scatterplot describing the abundance of PAH sensitive taxa at varying levels of fluoranthene observed in sediments collected on Days 185 and 384 from the creosote treated dolphin constructed using Best Management Practices.

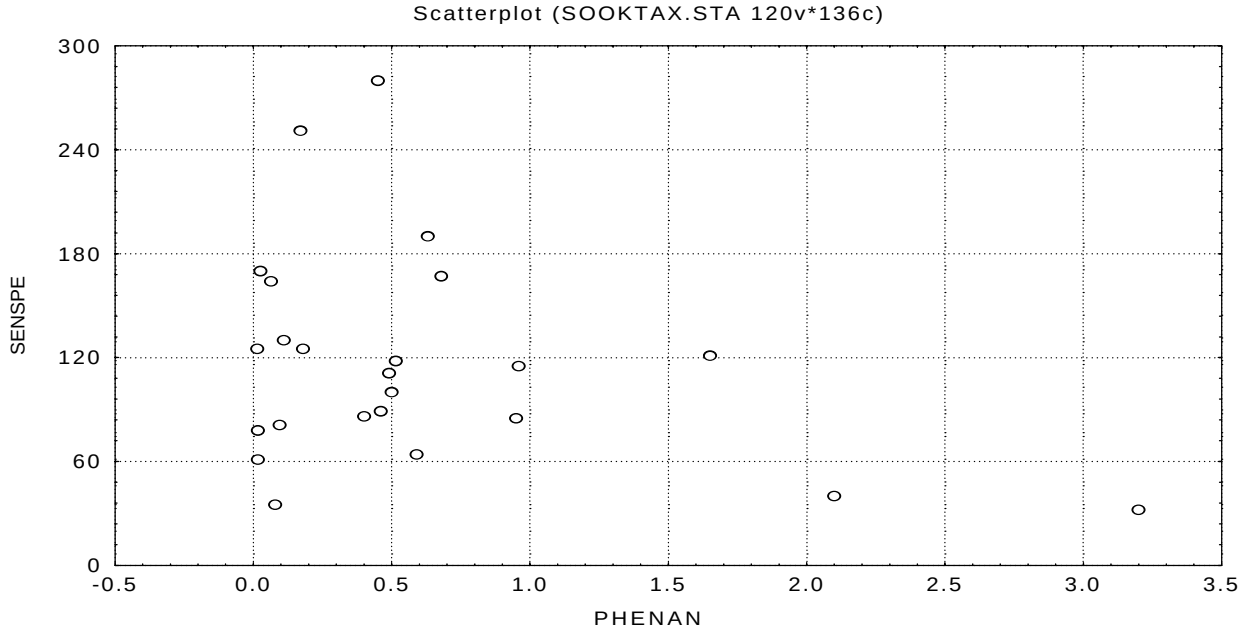


Figure 50. Scatterplot describing the abundance of PAH sensitive taxa at varying levels of phenanthrene observed in sediments collected on Days 185 and 384 from the creosote treated dolphin constructed using Best Management Practices.

Table 29. Toxicity threshold values below which no decreases in the abundance of PAH sensitive species were observed along downstream transects from the BP dolphin in the Sooke Basin Creosote Evaluation Study. Results are based on data collected 185 and 384 days following construction.

Class of PAH	Toxicity Threshold
Phenanthrene	≥ 2 µg phenanthrene/g dry sediment
Low Molecular Weight PAH	≥ 3 µg LPAH/g dry sediment
Fluoranthene	≥ 3 µg fluoranthene/g dry sediment
High Molecular Weight PAH	≥ 6 µg HPAH/g dry sediment
Total PAH	≥ 10 µg TPAH/ g dry sediment

Total Organic Carbon at the BMP treatment site varied between 0.58 and 2.8 with a mean of 0.99. In Table 30, the observed toxicity thresholds are compared with the proposed U.S. EPA marine sediment quality criteria for fluoranthene (300 µg fluoranthene/g TOC) and phenanthrene (240 µg phenanthrene/g TOC). The results of the Sooke Basin study are remarkably consistent with these regulatory levels for each of the PAH classes.

Table 30. Comparison of fluoranthene and phenanthrene toxicity thresholds observed in the Sooke Basin Creosote Evaluation Study with proposed U.S. EPA marine sediment quality criteria for these same compounds and with Washington State marine sediment quality criteria laid out in WAC 173-204. Sediment Quality Standards (SQS) are calculated at the 0.99% mean TOC observed along BMP treatment transects on sample Days 185 and 384.

PAH Class	Sooke Basin Toxicity Threshold	U.S. EPA Marine SQS	Washington State SQS
Phenanthrene	2.0 µg/g	2.3 µg/g	1.0 µg/g
LPAH	3.0 µg/g		3.7 µg/g
Fluoranthene	3.0 µg/g	3.0 µg/g	1.6 µg/g
HPAH	6.0 µg/g		9.6 µg/g
TPAH	10.0 µg/g	NA	NA

Hierarchical cluster analysis was accomplished by clustering species and by clustering cases (samples). Cluster analysis did not provide meaningful results in this study.

Factor Analysis using the Statistica™ Iterated Communalities (MINRES) with Varimax normalized rotation provided the most insightful analysis. The database was restricted to the Dominant and Moderately Dominant species plus the sum of the sensitive species previously identified. Only data from the BMP dolphin on Days 185 and 384 was included. Independent variables included TOC, percent Fines, Total PAH and Date. The analysis explored associations with two and three factors. The three factor analysis explained more variation (55%) than the two factor analysis (46%). However, the

third factor did not include a significant correlation with any of the independent variables and was dropped from the analysis. The results are presented in Table 31 and summarized in Figure 51.

Table 31. Factor Loadings determined by Principal factors (MINRES) with Varimax rotation. Marked loadings are greater than 0.60.

	Factor (1)	Factor (2)
DATE	0.93	-0.05
PAMU (*Apelochaeta multifilis*)	-0.79	0.00
PGP (*Glycinde polygnatha*)	0.47	0.51
PLS (*Lumbrineridae sp.*)	0.23	0.48
PMS (*Mediomastus sp.*)	-0.77	0.34
PNF (*Nephtys ferruginea*)	-0.73	0.28
PPP (*Paraprionospio pinnata*)	-0.21	0.08
PPM (*Pholoe minuta*)	-0.47	0.46
PPODG(*Podarkeopsis glabrus*)	0.66	0.08
PSPIB (*Spiophanes berkeleyorum*)	0.26	0.30
MAC (*Alvania compacta*)	0.64	0.26
MMN (*Macoma nasuta*)	0.77	0.04
MMS (*Macoma species juvenile*)	0.44	0.03
MMT (*Mysella tumida*)	-0.26	0.82
MNM (*Nassarius mendicus*)	0.49	-0.23
MOS (*Odostomia sp.*)	0.60	-0.17
MPT (*Parvilucina tenuisculpta*)	0.49	0.42
MPSJ (*Protothaca staminea juveniles*)	0.85	0.05
MTM (*Tellina modesta*)	0.44	0.10
EAU (*Amphiodia urtica*)	-0.31	0.74
Total PAH concentration	0.02	-0.40
Percent Fines (Silt and Clay)	-0.03	0.20
Total Organic Carbon	-0.61	0.00
Sensitive Species	-0.02	0.98
Proportion of the Total Variation	0.30	0.16

This analysis is consistent with the previous results. Factor (1) is defined by independent variables Date and Total Organic Carbon. Factor (2) is defined by Sensitive species. There were only three stations in the BMP database at which TPAH concentrations exceeded the toxicity threshold of 10 µg/g above which decreases in abundance were observed. The same is true for the other classes of PAH examined in this analysis. The result is that TPAH is only a marginally significant independent variable in Factor (1).

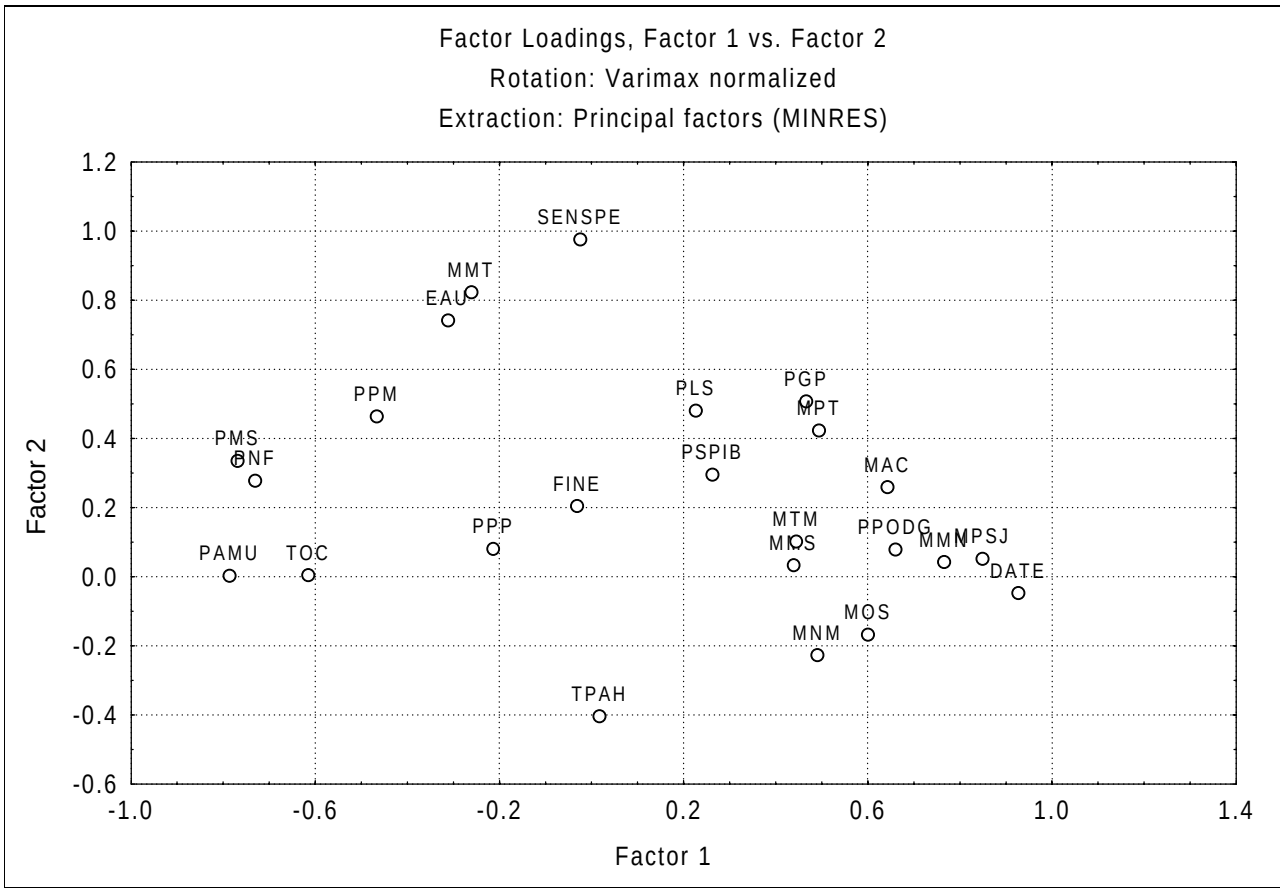


Figure 51. **Summary of the relationship between Dominant Species, PAH sensitive species and independent variables Date, Total PAH, Percent Fines and Percent Silt and Clay.** The analysis was completed using the Iterated Communalities (MINRES) algorithm with Varimax rotation provided in the Statistic™ software package. The data analyzed are for infaunal abundance downstream from the BMP dolphin on Days 185 and 384 during the Sooke Basin Creosote Evaluation Study.

Figure 51 depicts the negative correlation between PAH sensitive species and concentrations of 18 PAH defining Factor (2). One way of interpreting this data is to suggest that species located nearest the bottom of the chart are least susceptible to PAH intoxication. Those would include MNM (*Nassarius mendicus*) and MOS (*Odostomia sp.*). Species located above the axis become increasingly intolerant of polycyclic aromatic hydrocarbons. Those least tolerant include MMT (*Mysella tumida*) and EAU (*Amphiodia urtica*). This data may be useful for identifying indicator species in future PAH studies.

Observe that percent fines lies in the center of the chart and does not define any clear trend in species abundance. However, Factor (1) is principally defined by Date at the extreme right and TOC at the left of the chart. The polychaetes located furthest to the left are likely TOC tolerant and those located furthest to the right appear TOC intolerant. *Nephtys ferruginea* (PNF), *Mediomastus sp.* (PMS in the family Capitellidae), *Aphelochaeta multifilis* (PAMU) and *Paraprionospio pinnata* (PPP) are polychaetes frequently found in association with moderately elevated sediment TOC in the vicinity of

salmon farms. In this environment, it appears that most of the dominant bivalves responded negatively to increases in TOC.

5.6.8. Spatial extent of adverse effects associated with the dolphin constructed of creosote treated piling produced using Best Management Practices (BMP).

Figure 31 provided a regression model for predicting nearfield (<10 metres) concentrations of sedimented Total PAH.

$$\text{Total PAH} = 3.08 + 25.04 \times \exp^{-1.99 \times \text{Distance}}$$

Decreases in the abundance or diversity of either total infauna or only those species identified as sensitive to PAH intoxication were observed in the study only at concentrations greater than 10 µg TPAH/g dry sediment. Solving the predictive equation given above for Distance gives the following:

$$\text{Distance} = -\{\ln[(\text{TPAH} - 3.08)/25.04]\}/1.989$$

Substituting the toxic threshold of 10 µg TPAH/g dry sediment suggests that these observable negative effects extended to a distance of 0.65 metres from the downstream perimeter of the dolphin. It should be emphasized that in this model, the abundance of sensitive species at 0.5 metres downstream from the dolphin was not significantly different from the 20 metre and 30 metre stations where PAH levels were not elevated. Therefore it is possibly more correct to say that the boundary of observable adverse infaunal effects will lie closer than 0.65 metres from the dolphin's perimeter.

5.6.9. Infaunal response at the Weathered Piling Dolphin (WP).

Infaunal samples were collected and analyzed only at the 0.5 and 2.0 metre stations downstream from the Weathered Piling (WP) site. As noted in the analysis of baseline conditions in Sooke Basin, very few infauna were collected on the western perimeter of the study area where the WP dolphin was constructed. Figure 52 describes the number of PAH sensitive species present within two metres of the dolphin as a function of time. Significant amounts of PAH were identified at the 0.5 metre station associated with the Weathered Piling dolphin (up to 138 µg TPAH/g dry sediment). Significantly less TPAH was observed at the two metre station (<5.3 µg/g) and it would be reasonable to expect that more infauna would have been associated with the more distant station. That was not the case and the highest number of sensitive species (or total infauna) was observed at the 0.5 metre station on the last sampling Day. A Pearson Correlation Coefficient matrix was constructed to compare individual and aggregated species abundance and diversity with the various classes of PAH, Date, Distance, TOC and Percent Fines. All of the significant correlation coefficients between infauna and any class of PAH were positive – indicating that more infauna were associated with higher concentrations of sedimented PAH. Similar to the previous findings, all of the significant coefficients ($\alpha = 0.05$) between individual taxa or aggregated taxa and percent fines or TOC were negative – indicating reduced number of all infauna with increasing TOC or percent fines.

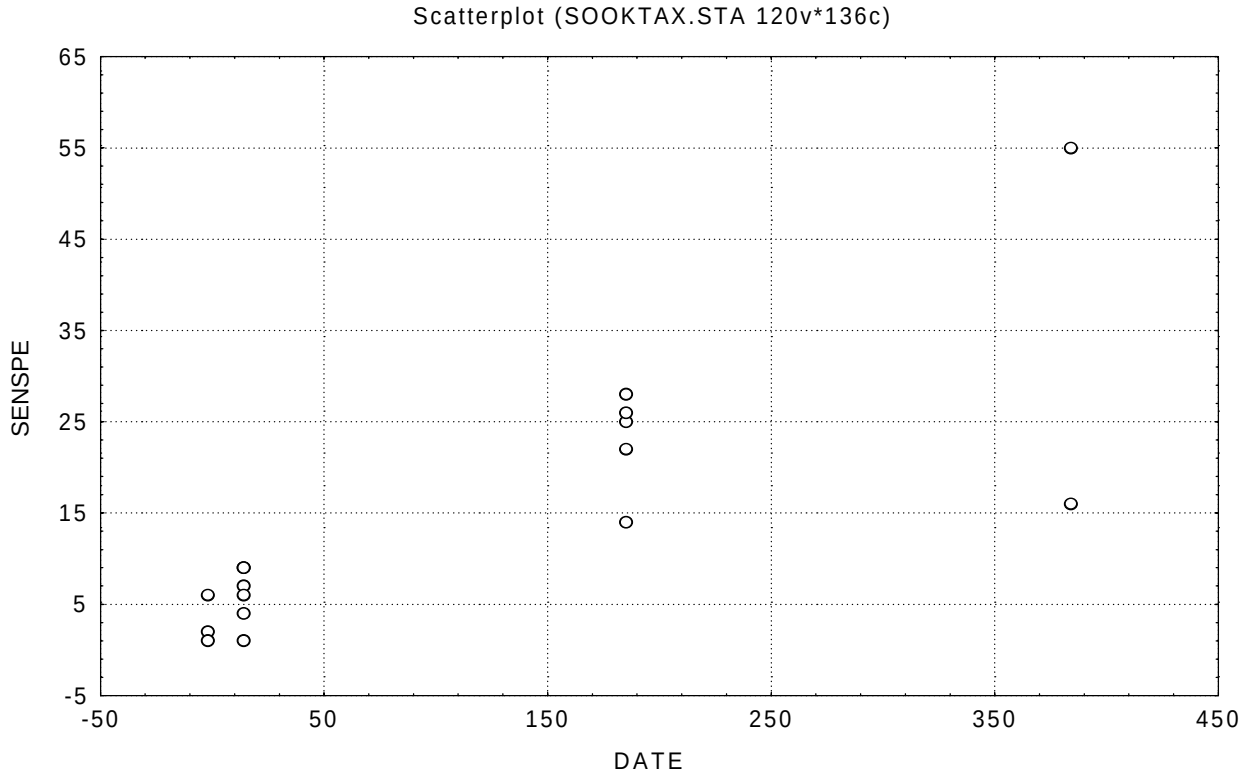


Figure 52. Abundance of PAH sensitive species observed downstream from the Weathered Piling dolphin as a function of sample date during the Sooke Basin Creosote Evaluation Study. Infauna were analyzed only at the 0.5 and 2.0 metre stations.

There are several points evident in Figure 52. Fewer infauna were observed during the baseline study than at any time following construction of the dolphin and migration of PAH into near field sediments. Therefore, any attempt to assess adverse effects associated with the accumulation of PAH is unwarranted because only statistically significant increases in abundance as a function of increasing PAH could possibly be revealed. A reasonable hypothesis is that the effects of moderate increases in organic carbon are masking any adverse effects associated with the accumulation of PAH – even at moderately high PAH levels.

5.6.10. Infaunal assessment summary.

The following statements follow from this analysis:

- No significant trends in infaunal diversity or abundance were observed at the Mechanical Control Dolphin suggesting that the structure, in and of itself, did not affect the infaunal community.

- Threshold concentrations of various classes of PAH have been identified where no decrease in either the abundance or diversity of PAH sensitive species was observed. Those threshold values were found to be consistent with U.S. EPA marine sediment quality standards for fluoranthene and phenanthrene and with Washington State Sediment

Quality Standards for high and low molecular weight PAH. Table 30 is repeated below for ease of reading.

Table 30 (repeated). Comparison of fluoranthene and phenanthrene toxicity thresholds observed in the Sooke Basin Creosote Evaluation Study with proposed U.S. EPA marine sediment quality criteria for these same compounds and with Washington State marine sediment quality criteria laid out in WAC 173-204. Sediment Quality Standards (SQS) are calculated at the 0.99% mean TOC observed along BP treatment transects on sample Days 185 and 384.

PAH Class	Sooke Basin Toxicity Threshold	U.S. EPA Marine SQS	Washington State SQS
Phenanthrene	2.0 µg/g	2.3 µg/g	1.0 µg/g
LPAH	3.0 µg/g		3.7 µg/g
Fluoranthene	3.0 µg/g	3.0 µg/g	1.6 µg/g
HPAH	6.0 µg/g		9.6 µg/g
TPAH	10.0 µg/g	NA	NA

- Infauna at this location in Sooke Basin were found to be affected by small increases in total organic carbon – especially on the east and west perimeters of the study area where the Open Control and Weathered Piling sites were located. Organic carbon tolerant and sensitive taxa were identified. The list of organic carbon tolerant species is consistent with those taxa previously found in association with sediments containing moderately high levels of TOC in the vicinity of salmon farms.

- The abundance of four polychaete, four mollusc and one arthropod species was found to be significantly, positively, correlated with PAH concentrations suggesting that they are at least tolerant of moderate levels of PAH. No infaunal species were identified that were significantly ($\alpha = 0.05$) negatively correlated with any class of PAH. However, the following species were identified as those most intolerant of PAH in this study. It should be emphasized that the Pearson Correlation Cofficients between the abundance of these species and sediment PAH concentration were all less than –0.32 and therefore the relationship is weak.

Polychaetes	Molluscs	Echinoderms	Arthropods
Eumida longicomuta	*Alvania compacta*	*Amphiodia urtica*	*Pinnixa sp.*
Glycinde polygnatha	*Turbonilla sp.*		
Lumbrineris sp.	*Mysella tumida*		
Pholoe minuta			

- Significant decreases in the abundance of all infaunal organisms, including these most sensitive species, is predicted to not extend beyond 0.65 metres from the perimeter of the dolphin under environmental conditions similar to this worst case study (deep water, moderately low TOC and very slow currents).

5.7 Sediment Bioassays as a Function of Time and Distance from Various Treatments.

5.7.1 Microtox™ Bioassay Results.

Results on the liquid and solid phase sediment Microtox™ bioassay tests by Environment Canada's Aquatic Toxicity Laboratory, North Vancouver are presented in Appendix IV. Microtox™ results are summarized in Table 32 and compared to the average total PAH concentration (µg/g, dry weight) found in field replicates taken from the same location in a similar manner. Composite samples were collected from the top 2 cm sediment layer at the 0.5m, 2.0m, and 5.0m BMP stations; 0.5m and 2.0m Weathered Piling stations; 0.5m Mechanical Control station and; the Open Control were tested routinely throughout the study. Samples were collected in the same manner as the chemistry samples and therefore, should not be affected by inclusion of less contaminated underlying sediments demonstrated by the amphipod bioassays (see following section on the amphipod bioassay results). Additional composite samples from inside the dolphin perimeter (i.e. BP0.0 and WP0.0) and along an offshore transect at 0.5m, 2.0m, 5.0m and 10m intervals at the BMP site were also tested on Day384 and Day535. Only solid phase toxicity tests were done on samples taken at the Open Control and BMP site on Day270. Liquid phase results are derived from a single composite sample of pore water extracted from the seven centrifuge tubes collected at each sampling site. Solid phase tests were conducted on sediment from one of the seven centrifuge tubes. Liquid phase tests were first screened at 100% concentration to determine if a positive response occurred (i.e. >50% decrease in light output) at either the 5 or 15 minute exposure interval. If so, further tests were done with serial dilutions to determine the IC_{50} value at the 95% confidence interval. IC_{50} values were then derived after 5 and 15 minute exposure periods. The exposure interval for solid phase testing was 25 minutes. Toxicity was then determined by the degree of light loss.

For liquid phase testing, samples with IC_{50} values of >100% are considered practically non-toxic; 50 - 100%, moderately toxic and <50% are toxic. For the solid phase results, samples >1.0% are considered non-toxic; 0.5% - 1.0%, slightly toxic; 0.1% - 0.5%, moderately toxic and <0.1%, highly toxic. Moderately toxic results have been underlined in Table 32. Samples considered to be toxic are in bold.

Liquid phase testing on the pore water samples from samples collected on Day0, Day14, Day185 and Day270 were not acutely toxic to the bacteria. The highest, although "practically non-toxic" response was noted in samples from station MC0.5 on Day185 which caused a 25% and 20% decrease in light production after 5 and 15 minutes of exposure, respectively. 100%-concentration screening tests on all the 384 day samples produced a greater than 50% decrease in light production at all Sooke Basin sample stations including the Open Control and Mechanical Control when compared to the laboratory controls. Further tests showed toxic responses at stations BP0.0, BP2.0, WP0.5 and again at MC0.5. Stations BP0.5, BP5.0, WP2.0 and OC0.0 were marginally toxic. However, when the results were normalized to light output at the Mechanical Control station, none of the stations at either the BP or WP sites were acutely toxic. The BP 0.0 and the WP 0.5 stations were considered marginally toxic with light inhibitions of 30% and 18% respectively. It was not possible to compare treatment sites with the Open Control because the smallest dilution was 50% and the IC_{50} values reported at the Open Control, BP 5.0 and WP 2.0 sites were reported only as >50%.

Table 32. Sooke Basin Creosote Evaluation Study: Results of Liquid and Solid Phase (LC_{50}) Sediment Microtox™ Tests - Day0 to Day535. Sediment PAH concentrations have been surrogate recovery corrected but not for the CRM standard. Results may overestimate the actual PAH concentration by 10 percent.

Surface Sediment PAH Concentration	Station/Exposure Period	Liquid Phase 100% Screen (%)	Liquid Phase (IC_{50} at 95% CI) (%)	Liquid Phase (IC_{50} at 95% CI) (%)	Solid Phase
TPAH (µg/g)	Station	15 min. Exposure	5 min. Exposure	15 min. Exposure	LC_{50} (%)
Open Control					
0.13	BOC0.0	No decrease	---	---	0.79 (0.65-0.97)
0.18	14OC0.0	No decrease	---	---	0.94 (0.80-1.1)
0.18	180OC0.0	No decrease	---	---	1.5 (1.4-1.8)
---	270OC0.0	8.6			3.1 (1.5-6.5)
0.73	384OC0.0	>50	->50	>50	1.8 (1.5-2.0)
Mechanical Control					
0.11	BMC0.5	No decrease	---	---	0.80 (0.75-0.85)
0.18	14MC0.5	No decrease	---	---	0.57 (0.47-0.70)
0.13	180MC0.5	20	not performed (n/p)	n/p	1.0 (0.94-1.1)
0.2	384MC0.5	>50	43.0 (27.4 - 67.4)	35.7 (24.4 - 52.2)	1.2 (1.0-1.4)
---	535MC0.5	99.6	16.4 (12.6 - 21.3)	12.8 (9.3 - 17.5)	0.53 (0.49-0.59)
BMP Pilings					
30.8	384BP0.0	>50	27.8 (23.9 - 32.3)	25.1 (21.6 - 29.0)	0.72 (0.7-0.74)
---	535BP0.0	82.0	34.6 (29.1 - 41.1)	38.9 (30.1 - 50.4)	0.54 (0.50-0.59)
0.17	BBP0.5	No decrease	---	---	0.49 (0.45-0.52)
7.8	14BP0.5	No decrease	---	---	0.79 (0.69-0.90)
8.8	180BP0.5	No decrease	---	---	1.6 (0.96-2.7)
54.4	270BP0.5	n/p	n/p	n/p	4.4 (1.6-10)
18.9	384BP0.5	>50	>50	67.2 (41.0-110.4)	1.0 (0.92-1.2)
---	535BP0.5	91.4	24.7 (21.9 - 27.9)	23.2 (20.2 - 26.7)	0.34 (0.31-0.38)
---	535BP0.5 (offshore)	>50	n/p	n/p	0.35 (0.32-0.38)
0.18	14BP2.0	No decrease	---	---	0.49 (0.39-0.63)
3.1	180BP2.0	No decrease	---	---	1.0 (0.99-0.74-1.3)
8.2	384BP2.0	>50	>50	47.2 (26.1 - 85.4)	0.77 (0.7-0.82)
---	535BP2.0	3.0	n/p	n/p	0.40 (0.37-0.43)
---	535BP2.0 (offshore)	31.5	n/p	n/p	0.60 (0.52-0.69)
0.49	14BP5.0	No decrease	---	---	0.53 (0.52-0.55)
0.81	180BP5.0	No decrease	---	---	0.79 (0.68-0.92)
2.9	384BP5.0	>50	>50	>50	0.98 (0.97-0.99)
---	535BP5.0	78.8	>50	>50	0.83 (0.82-0.84)
---	535BP5.0 (offshore)	25.5	n/p	n/p	0.57 (0.51-0.64)

Table 32 (cont'd)

Surface Sediment PAH Concentration	Station/Exposure Period	Liquid Phase 100% Screen (%)	Liquid Phase (IC_{50} at 95% CI) (%)	Liquid Phase (IC_{50} at 95% CI) (%)	Solid Phase
0.29	**14BP10**	**No decrease**	**---**	**---**	**0.75 (0.70-0.81)**
0.62	**180BP10**	**n/p**	**---**	**---**	**----**
0.15	**BBP30**	**No decrease**	**---**	**---**	**0.67 (0.53-0.85)**
Weathered Pilings					
---	**535WP0.0**	**99.3**	**15.6 (12.5-19.5)**	**11.4 (8.5-15.3)**	**<u>0.28 (0.27-0.29)</u>**
0.19	**BWP0.5**	**No decrease**	**---**	**---**	**1.4 (1.2-1.5)**
105	**14WP0.5**	**No decrease**	**---**	**---**	**0.71 (0.64-0.80)**
17.8	**180WP0.5**	**No decrease**	**---**	**---**	**2.9 (2.2-3.8)**
10.8	**384WP0.5**	**>50**	**33.7 (29.3-38.7)**	**29.2 (25.5-33.5)**	**1.3 (1.1-1.5)**
2.9	**14WP2.0**	**No decrease**	**---**	**---**	**0.98 (0.78-1.2)**
4.8	**180WP2.0**	**No decrease**	**---**	**---**	**1.6 (1.1-2.2)**
6.3	**384WP2.0**	**>50**	**<u>>50</u>**	**<u>>50</u>**	**1.1 (1.0-1.3)**

Bold = toxic; underlined = marginally toxic.

These results suggest that all Sooke Basin sites, including the Open Control site were toxic when compared to laboratory controls on Day384. However, samples collected inside the perimeter of the dolphin treated with creosote using Best Management Practices and the 0.5 metre downstream station from the Weathered Piling dolphin were marginally toxic when compared with results from the untreated Mechanical Control.

Solid phase testing on the Day384 samples, in general, produced no significant light inhibition from any of the samples collected during all exposure periods, including samples from station BP0.5 on Day270 where the total PAH concentration in the field sample collected at the same time from the same homogenate was 54.4 µg/g. On Day535, solid phase results indicated moderate toxicity for all sediment samples, including those from the Mechanical Control site.

Further analysis of the Solid Phase Microtox™ results for Day 384 was accomplished by normalizing the results to the IC_{50} concentrations observed at the Open Control and Mechanical Control sites. The results are provided in Table 33.

Table 33. Results of 15 minutes Solid Phase Microtox™ testing on sediments collected at Sooke Basin during Day384 of the Sooke Basin Creosote Evaluation Study.

Station	LC_{50}	LC_{50} normalized to The Open Control	LC_{50} normalized to The Mechanical Control
Open Control	1.80	1.00	1.50
Mechanical Control	1.20	0.67	1.00
BP 0.0	0.72	0.40	0.60
BP 0.5	1.00	0.56	0.83
BP 2.0	0.77	0.43	0.64
BP 5.0	0.98	0.54	0.82
WP 0.5	1.30	0.72	1.08
WP 2.0	1.10	0.61	0.92

As previously noted, none of the LC_{50} values derived by comparing Sooke samples with a laboratory control were toxic or moderately toxic. The BP 0.0, BP 2.0 and BP 5.0 samples were slightly toxic. However, when these samples were normalized to the increased light output at the Mechanical Control and Open Control Stations, the results suggest that all of the stations associated with structures (MC, BP and WP) were slightly toxic and the BP 0.0 and the BP 2.0 stations were moderately toxic (0.1% to 0.5%). The fourth column provides a comparison of the creosote treated dolphins with the untreated Mechanical Control. In this comparison, it appears that sites associated with the Weathered Piling are not toxic whereas those associated with the 0.0 and 2.0 metre stations downstream from the dolphin treated with creosote using Best Management Practices are slightly toxic.

5.7.2 Mutatox™ Bioassay Results.

Certain PAH compounds are known to have mutagenic and carcinogenic effects. Mutatox testing using a dark strain of luminescent bacteria was incorporated into the initial study design to provide a measure of sediment genotoxicity. The presence of a genotoxic agent causes the bacteria to revert back to their luminescent state. Laboratory results are given in Appendix IV. Tests were done on samples collected on Day0, Day14 and Day185. The Day185 testing revealed some suspect samples suggesting the presence of a genotoxic agent. However, for marine samples, several factors can lead to false responses by the bacteria, one of which is the salt content. Initially, the Azur Environmental (formerly Microbics Corporation) test system provided a salt solution separately as an osmoregulator for the marine bioluminescent bacteria. For marine samples, which contain salt already, the salinity could be adjusted accordingly. However, it was determined during the study that the salt had become an integral part of the test media and could not be independently adjusted or eliminated. Consequently, the salinity of the test samples would be increased to inappropriate levels and the Mutatox™ tests were abandoned after Day185.

5.7.3 Amphipod Bioassay Results.

Static 10-day sediment bioassays using two amphipod species were routinely performed on samples from the BMP treatment site (0.5m, 2.0m and 5.0m distance intervals), the Weathered Piling site (0.5m and 2.0m intervals), the Mechanical Control (0.5m) and the Open Control (0.0m). Tests were

also conducted on samples from inside the BMP dolphin perimeter on Day384. The two species of amphipod, *Rhepoxynius abronius* and *Eohaustorius washingtonianus*, are two of four recommended for use in sediment testing for the Pacific coast (Environment Canada, 1992a). The sensitivity of amphipods can differ in response to contaminants, as well as non-contaminant effects, such as particle size and salinity. *Rhepoxynius* can tolerate prolonged periods outside the test sediment, whereas, *Eohaustorius* prefers to remain in the sediment and therefore, may have a greater exposure to the contaminant. Results of the amphipod tests and statistical treatment of the data are given in Appendix IV. Results on five replicate samples prepared by the laboratory are summarized in Table 34 for *Rhepoxynius* and Table 35 for *E. wash.* PAH concentrations measured in field samples from each bioassay station and those from each composite sample submitted to the toxicity laboratory are also included in Table 34 and Table 35. Samples showing a statistically significant decrease in survival compared to the control sediment are marked by **'*'**. Those showing a statistically and biologically significant acutely lethal response according to Lee et al. (1995) have been bolded.

During the first 185 days, bioassay tests were conducted on the entire contents of the benthic sampler (Figure 4). A number of the samples, including the Open Control and the Mechanical Control, showed a significant decrease in survival for both species compared to the controls. However, the results didn't appear to produce the type of response one would expect based on the PAH concentrations measured in the field samples and effects levels reported in the literature. PAH concentrations in the surface sediment samples from WP0.5m on Day14, for example, averaged 105 µg/g, likely caused by pieces of creosote treated wood originating from the piling driving operation (Table 34). This was well above the 22 µg/g Puget Sound Apparent Effects Threshold (or AET) reported by Long and Morgan (1990). Yet, the mean survival rate for *Rhepoxynius*, although significantly different from the controls, was still 90±10.0%. For *E. wash*. the survival rate was 89±10.8%, not significantly different from the laboratory control. On Day185, the mean survival was 92% for *Rhepoxynius* and 88% for *E. wash.* The PAH concentration in the field samples averaged 17.8 µg/g, total PAH, still sufficient to cause some response based on literature values. Analysis of the bioassay test sediment on Day14 and Day185 , however, showed much lower PAH concentrations (0.81 µg/g and 6.1 µg/g, respectively) than those found in the surface samples (top 2 cm) taken in the field. By including the entire contents of the benthic sampler, which sampled to a depth of 10 cm, it was apparent that the PAH concentrations in the bioassay test samples were being diluted substantially by the less contaminated underlying sediment. This was further substantiated by core samples taken on Day384, which showed an exponential decline in PAH concentration with sediment depth (Section 5.3.5.3) and very low concentrations in the 8 to 10 cm segment. PAH concentrations at the 2-4 cm core depth in samples from the BMP site were only 50% of the concentration found in the top 2 centimetres and only 25% in core samples from the Weathered Piling site.

On Day270, additional bioassay samples were collected from the BP0.5 and Open Control stations using only the top 2 cm layer rather than the entire contents of the sampler. This required about five separate grabs to obtain sufficient material for 5 replicate bioassays/species. These were composited into one field sample/station, thoroughly mixed and later divided into five replicates/ species. The survival rate for BP0.5 dropped substantially to 69±12.9% for *Rhepoxynius* (Table 34) and 19±12.9% for *E. wash.* (Table 35) and Appendix VI. A greater number of individuals were also observed at the surface

Table 34. Amphipod (*Rhepoxynius abronius)* 10-day Sediment Bioassay Results. Statistically significant decreases in survival compared to the laboratory are marked by '*'. Statistically and biologically significant acutely lethal responses according to Lee *et al.* (1995) are marked by 'o'

Station/Time Period	Sediment TPAH			Replicates						
	Treatment Site	Bioassay Sample		1	2	3	4	5	Mean	sd
Whidbey Island (Control)	(µg/g)	(µg/g)								
Day0	---	---	% survival	100	95	100	100	100	99	2.2
			% at surface	0	5	0	0	0	1	2.2
Day14	---	---	% survival	100	95	100	100	100	99	2.2
			% at surface	0	5	0	5	0	2	2.7
Day180	---	---	% survival	90	85	85	90	95	89	4.2
			% at surface	0	0	0	0	0	0	0.0
Day270	---	---	% survival	100	100	100	100	100	100	0.0
			% at surface	0	0	0	0	5	1	2.2
Day384	---	---	% survival	100	100	100	95	100	99	2.2
			% at surface	0	0	0	0	0	0	0.0
Open Control										
BOC	0.13	---	% survival	90	95	95	95	100	95	3.5
			% at surface	0	0	0	0	5	1	2.2
14OC 0.0	0.18	---	% survival	100	95	95	90	90	94*	4.2
			% at surface	0	0	0	5	0	1	2.2
180OC0.0	0.18	0.2	% survival	75	80	95	75	80	81*	8.2
			% at surface	0	0	0	0	0	0	0.0
270OC0.0 (top 2 cm only)	---	0.24	% survival	80	90	95	75	85	85*	7.9
			% at surface	10	5	0	0	0	3	4.5
384OC0.0 (top 2 cm only)	0.2	0.2	% survival	95	90	95	95	85	92*	4.5
			% at surface	0	0	0	0	0	0	0.0
Mechanical Control										
BMC0.5	0.11	---	% survival	100	85	100	80	100	93	9.8
			% at surface	0	5	0	5	0	2	2.7
14MC 0.5	0.18	---	% survival	90	95	95	100	95	95*	3.5
			% at surface	0	0	0	0	0	0	0.0
180MC0.5	0.13	0.11	% survival	95	85	95	90	90	91	4.2
			% at surface	5	5	0	0	0	2	2.7
384MC0.5 (top 2 cm only)	0.17	0.17	% survival	90	90	100	90	75	89*	8.9
			% at surface	0	5	0	0	0	1	2.2
BMP Site										
384BP0.0 (top 2 cm only)	30.8	30.8	% survival	90	60	65	---	---	72*	16.1
			% at surface	0	0	0	---	---	0	0.0
0.5m										
BBP 0.5	0.17	---	% survival	100	90	95	90	95	94*	4.2
			% at surface	0	5	0	0	0	1	2.2
14BP 0.5	7.8	1.2	% survival	85	90	85	85	85	86*	2.2
			% at surface	0	0	0	5	0	1	2.2

Table 34 (cont'd).

Station/Time Period	Sediment TPAH			Replicates						
	Treatment Site	Bioassay Sample		1	2	3	4	5	Mean	sd
180BP0.5	8.8	1.6	% survival	75	95	95	90	95	90	8.7
			% at surface	10	0	0	0	5	3	4.5
270BP0.5 (top 2 cm only)	---	54.7	% survival	55	80	65	85	60	**69°***	12.9
			% at surface	25	40	30	5	20	24	12.9
384BP0.5 (top 2 cm only)	14.8	14.8	% survival	85	40	65	95	60	**69°***	21.6
			% at surface	0	0	5	5	10	4	4.2
2.0m										
14BP 2.0	0.18	---	% survival	90	95	85	95	95	92*	4.5
			% at surface	0	0	0	0	0	0	0.0
180BP2.0	3.1	0.67	% survival	70	95	85	95	0	86	11.8
			% at surface	0	0	10	0	0	2.5	5.0
384BP2.0 (top 2 cm only)	4.5	4.5	% survival	15	80	95	100	0	**58°***	47.0
			% at surface	0	0	0	0	0	0	0.0
5.0m										
14BP 5.0	0.4	---	% survival	100	95	80	100	85	92	9.1
			% at surface	0	5	5	0	5	3	2.7
180BP5.0	0.81	0.34	% survival	95	80	85	85	90	87	5.7
			% at surface	0	15	0	0	5	4	6.5
384BP5.0 (top 2cm only)	3.3	3.3	% survival	95	80	100	90	90	91	7.4
			% at surface	0	0	0	0	0	0	0.0
10m										
14BP 10.0	0.29	---	% survival	85	90	95	95	95	92*	4.5
			% at surface	5	0	0	0	5	2	2.7
30m										
BBP30 (baseline)	---	---	% survival	95	95	100	100	100	98	2.7
			% at surface	5	0	0	0	0	1	2.2
Weathered Pilings										
0.5m										
BWP (baseline)	0.19	---	% survival	95	90	95	100	100	96	4.2
			% at surface	5	0	0	0	5	2	2.7
14WP 0.5	105	0.81	% survival	100	95	85	95	75	90*	10.0
			% at surface	0	5	5	5	10	5	3.5
180WP0.5	17.8	6.1	% survival	100	90	75	100	95	92	10.4
			% at surface	0	0	20	0	0	4	8.9
384WP0.5 (top 2cm only)	10.8	2.0	% survival	100	95	95	80	80	90*	9.4
			% at surface	0	10	0	0	0	2	4.5
2.0m										
14WP 2.0	2.9	---	% survival	95	100	90	90	95	94*	4.2
			% at surface	0	0	10	0	0	2	4.5
180WP2.0	4.8	3.1	% survival	85	80	90	90	85	86	4.2
			% at surface	0	10	0	5	5	4	4.2
384WP2.0 (top 2cm only)	39.4	39.4	% survival	85	90	75	100	95	89*	9.6
			% at surface	0	0	0	0	0	0	0.0

Table 35. Amphipod (*Eohaustorius washingtonianus)* 10-day Sediment Bioassay Results.
Statistically significant decreases in survival compared to the laboratory are marked by '*'. Statistically and biologically significant acutely lethal responses according to Lee *et al.* (1995) are marked by '°'.

Station/Time Period	Sediment TPAH			Replicates						
	Treatment Site	Bioassay Sample		1	2	3	4	5	Mean	sd
Esquimalt Lagoon (Control)	(µg/g)	(µg/g)								
Day0 (baseline)	---	---	% survival	95	100	100	100	100	99	2.2
			% at surface	0	0	0	0	0	0	0.0
Day14	---	---	% survival	85	80	80	90	90	85	5.0
			% at surface	0	0	0	0	0	0	0.0
Day180	---	---	% survival	95	100	95	85	95	94	5.5
			% at surface	0	0	0	0	0	0	0.0
Day270	---	---	% survival	90	100	95	95	90	94	4.2
			% at surface	5	0	0	0	0	1	2.2
Day384	---	---	% survival	90	90	50	100	100	86	20.7
			% at surface	0	0	20	0	0	4	8.9
Open Control										
BOC (baseline)	0.13	---	% survival	95	100	95	100	---	98	2.9
			% at surface	0	0	0	0	0	0	0.0
14OC0.0	0.18	---	% survival	95	45	85	80	100	81	21.6
			% at surface	0	0	0	5	0	1	2.2
180OC0.0	0.18	0.2	% survival	90	75	75	85	95	84*	8.9
			% at surface	20	5	20	10	0	11	8.9
270OC0.0 (top 2 cm only)	---	0.24	% survival	85	90	90	95	100	92	5.7
			% at surface	0	0	10	5	15	6	6.7
384OC0.0 (top 2 cm only)	0.2	0.2	% survival	90	90	90	90	90	90	0.0
			% at surface	10	0	0	0	0	2	4.5
Mechanical Control										
BMC (baseline)	0.11	---	% survival	85	85	100	85	95	90*	7.1
			% at surface	50	25	40	95	50	52	26.1
14MC0.5	0.18	---	% survival	75	95	85	90	--	86	8.5
			% at surface	0	0	0	5	90	19	39.7
180MC0.5	0.13	0.11	% survival	80	90	75	75	100	84	10.8
			% at surface	0	10	5	10	15	8	5.7
384MC0.5 (top 2cm only)	0.17	0.17	% survival	40	50	80	70	40	**56°***	18.2
			% at surface	20	0	0	40	20	16	16.7
BMP Site										
0.0m										
384BP0.0 (top 2 cm only)	30.8	30.8	% survival	20	30	40	---	---	**30°***	10.0
			% at surface	0	0	0	---	---	0	0.0
0.5m										
BBP 0.5 (baseline)	0.17	---	% survival	75	95	80	90	90	86*	8.2
			% at surface	0	0	0	0	0	0	0.0
14BP 0.5	7.8	1.2	% survival	95	80	95	70	90	86	10.8
			% at surface	0	0	10	5	5	4	4.2

Table 35 (cont'd)

Station/Time Period	Sediment TPAH			Replicates						
	Treatment Site	Bioassay Sample		1	2	3	4	5	Mean	sd
180BP0.5	8.8	1.6	% survival	85	100	90	100	80	91	8.9
			% at surface	0	5	10	15	0	6	6.5
270BP0.5 (top 2 cm only)	---	54.7	% survival	20	35	0	15	25	**19°***	12.9
			% at surface	15	25	15	35	25	23	8.4
384BP0.5 (top 2cm only)	14.8	14.8	% survival	40	10	30	30	70	**36°***	21.9
			% at surface	30	0	0	0	0	6	13.4
2.0m										
14BP 2.0	0.18	---	% survival	90	80	75	90	90	85	7.1
			% at surface	0	5	0	5	0	2	2.7
180BP2.0	3.1	0.67	% survival	90	90	90	95	95	92	2.7
			% at surface	10	10	0	5	5	6	4.2
384BP2.0 (top 2cm only)	4.5	4.5	% survival	60	20	60	70	20	**46°***	24.1
			% at surface	50	0	0	10	0	12	21.7
5.0m										
14BP 5.0	0.4	---	% survival	75	100	80	85	90	86	9.6
			% at surface	0	0	0	0	0	0	0.0
180BP5.0	0.81	0.34	% survival	80	90	35	85	90	76*	23.3
			% at surface	0	0	5	5	0	2	2.7
384BP5.0 (top 2cm only)	3.3	3..3	% survival	90	60	90	90	---	83	15.0
			% at surface	20	0	0	10	---	7.5	9.6
10m										
14BP 10.0	0.29	---	% survival	100	90	75	85	45	88	10.4
			% at surface	15	5	0	0	0	5	7.1
30m										
BBP30 (baseline)	---	---	% survival	100	90	95	100	90	95	5.0
			% at surface	5	0	0	0	5	2	2.7
Weathered Pilings										
0.5m										
BWP (baseline)	0.19	---	% survival	100	95	100	100	95	98	2.7
			% at surface	0	0	0	0	0	0	0.0
14WP 0.5	105	0.81	% survival	100	95	80	75	95	89	10.8
			% at surface	0	0	0	0	0	0	0.0
180WP0.5	17.8	6.1	% survival	90	95	85	85	85	88*	4.5
			% at surface	0	5	5	5	20	7	7.6
384WP0.5 (top 2cm only)	10.8	2.0	% survival	100	90	80	90	70	86	11.4
			% at surface	20	0	0	20	30	14	13.4
2.0m										
14WP 2.0	2.9	---	% survival	75	95	75	90	95	86	10.3
			% at surface	0	0	0	0	0	0	0.0
180WP2.0	4.8	3.1	% survival	90	95	80	90	90	89	5.5
			% at surface	5	15	0	10	5	7	5.7
384WP2.0 (top 2cm only)	39.8	39.8	% survival	80	70	80	80	80	78	4.5
			% at surface	10	0	0	20	20	10	10.0

of the test sediment than in earlier tests. Results were both statistically and biologically significant. Analysis of the composite sample from BP0.5 showed a total PAH concentration of 54.7 µg/g. This was approximately ½ the concentration measured on Day 14 at WP0.5 that produced no biologically significant responses in the amphipod tests.

All subsequent amphipod bioassays were confined to only the top 2 cm. Although requiring a greater number of grab samples per station, this was considered to be more representative of the sediment toxicity and its relationship to the PAH concentration. Since the bioassay tests were confined to a selected number of stations, additional homogenized (mixed) samples were collected from each distance interval for parental PAH analysis, along with the normal field samples (Table 7 and Table 9), Appendix VI (B) & VI (C)). This was to permit comparisons between the bioassay results and sediment chemistry at locations where toxicity tests were not being done. This also provided the opportunity to compare replicate field samples with composite samples

The following analysis focuses on samples collected on Days 270 and 384 when only the top two centimetres of the sediment column were retained for bioassay. These sample days are also considered most relevant to assessing the risks associated with creosote treated wood because a significant amount of time had elapsed – during which sediment PAH concentrations were approaching maximum predictions.

Three levels of control were applied in these amphipod bioassay tests. The first level uses reference sediments collected at Whidbey Island (for *Rhepoxynius*) and Esquimalt Lagoon (for *E. wash.*). The second level of control exists at the Open Control site located well upstream from the treatment sites. Effects observed at the Open Control site would relate to at least this area of Sooke Basin and are independent of any of the treatment dolphins. The third level of control exists at the Mechanical Control dolphin. This control was established to examine effects associated with the use of untreated wood. Significant differences between the Mechanical Control and the Open Control are assumed to be associated with either the mechanical effects of the structure or with toxins released from untreated Douglas fir piling. Effects associated with the PAH released from creosote treated piling could then be isolated from any mechanical or natural chemical effects from the Mechanical Control. These levels of control provide for evaluation of a number of null hypotheses given below. Each of these null hypotheses is important to evaluating conditions in Sooke Basin and to developing a management policy for the use of untreated piling, aged or weathered piling and piling treated using CITW sponsored Best Management Practices.

1. H_o: Amphipod survival in sediments from undisturbed areas of Sooke Basin is equal to survival in control sediments from either Whidbey Island or Esquimalt Lagoon.
2. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of untreated Douglas fir piling is equal to survival in sediments from Whidbey Island or Esquimalt Lagoon.
3. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of untreated Douglas fir piling is equal to survival in reference sediments collected from an unaffected area of Sooke Basin.
4. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of Douglas fir piling treated to 27 pounds retention using Best Management Practices is equal to survival in sediments collected from Whidbey Island or Esquimalt Lagoon.

5. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of Douglas fir piling treated to 27 pounds retention using Best management Practices is equal to survival in sediments collected from an unaffected area of Sooke Basin.
6. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of Douglas fir piling treated to 27 pounds retention using Best management Practices is equal to survival in sediments collected downstream from a similar dolphin constructed of untreated Douglas Fir.
7. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old creosote treated Douglas fir piling is equal to survival in sediments collected from Whidbey Island or Esquimalt Lagoon.
8. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old creosote treated Douglas fir piling is equal to survival in sediments collected from an unaffected area of Sooke Basin.
9. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old Douglas fir piling is equal to survival in sediments collected downstream from a similar dolphin constructed of untreated Douglas Fir.
10. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old Douglas fir piling is equal to survival in sediments collected downstream from a dolphin treated to 27 pounds retention using Best Management Practices.

These null hypotheses were assessed using Analysis of Variance with Post Hoc testing using Scheffe-Test and by a *t*-test for each of the hypotheses. Survival data was transformed using an arcsine(square root(proportion surviving)) transformation prior to analysis. The Analysis of Variance revealed that Treatment, Amphipod Species, and Distance were significant parameters. Date (270 or 384) was not significant and the data from those two dates were pooled in the analysis. The Analysis of Variance also revealed that the survival of *E. wash.* was reduced when compared with *Rhepoxynius* ($p = 0.013$). However, for purposes of this analysis, the two species were pooled because the increased robustness associated with a larger number of tests was considered more important than recognizing the difference. The ten null hypotheses described above will be evaluated using the combined data for Days 270 and 384 and the combined response of *R. abronius* and *E. wash.*

Null Hypothesis 1). H_o: Amphipod survival in sediments from undisturbed areas of Sooke Basin is equal to survival in control sediments from either Whidbey Island or Esquimalt Lagoon.
Survival at the Sooke Basin Open Control site was significantly less (*t*-test, $p = 0.0001$) than survival in the Esquimalt or Whidbey control sediments from which the amphipods were collected. This may reflect conditions in Sooke Basin that are generally stressful to amphipods. This observation is consistent with the lack of amphipods found in all samples on all sampling dates, including the baseline sampling that occurred prior to construction of the treatment dolphins. Alternatively, it may imply that the test animals were not sufficiently acclimated to Sooke Basin sediments prior to conducting the tests. No cause and effect relationships were investigated with respect to these results.

Null Hypothesis 2). H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of untreated Douglas fir piling is equal to survival in sediments from Whidbey Island or Esquimalt Lagoon. A *t*-test revealed that amphipod survival at Mechanical Control sites was significantly less than survival in Whidbey or Esquimalt sediments ($p = 0.000327$). This is consistent with the results of Null Hypothesis 1.

Null Hypothesis 3). H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of untreated Douglas fir piling is equal to survival in reference sediments collected from an unaffected area of Sooke Basin. The computed value of *t* was –2.77 and the null hypothesis was rejected ($p = 0.0097$) at $\alpha = 0.05$ or 0.01. This suggests that negative effects on amphipod survival were associated with the presence of the Mechanical Control dolphin constructed of untreated Douglas fir.

Null hypothesis 4). H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of Douglas fir piling treated to 27 pounds retention using Best Management Practices is equal to survival in sediments collected from Whidbey Island or Esquimalt Lagoon.
The calculated value of *t* was –6.196 and the null hypothesis was rejected ($p < 0.0000$). This result is expected from the rejection of H_a (1). The high value of *t* and the lower p indicates that the differences are more significant than observed in the previous hypotheses.

Null hypothesis 5). H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of Douglas fir piling treated to 27 pounds retention using Best Management Practices is equal to survival in sediments collected from an unaffected area of Sooke Basin.
The calculated value of *t* in this case was –4.476 and the null hypothesis was rejected with a probability that the two survival rates were equal of $p = 0.0000$.

Null hyopothesis 6). H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of Douglas fir piling treated to 27 pounds retention using Best Management Practices is equal to survival in sediments collected downstream from a similar dolphin constructed of untreated Douglas Fir. The calculated value of *t* is –1.488 and even though survival was lower at the BP site than at the MC site, the difference is not significant ($p = 0.143$) and we conclude that when all of the amphipod survival at all BMP and MC stations is considered as a whole, the survival rates are not different at $\alpha = 0.05$ or $\alpha = 0.10$.

This analysis ignores distance as an important factor because this study has demonstrated higher PAH (and more likely toxic effects) in close proximity to the piling. Therefore, a new null hypothesis is considered.

Null hypothesis 6a. H_o: Amphipod survival in sediments taken at distances less than or equal to 0.5 metres downstream from a six piling dolphin constructed of Douglas fir piling treated to 27 pounds retention using Best management Practices is equal to survival in sediments collected at distances less than or equal to 0.5 metres downstream from a similar dolphin constructed of untreated Douglas Fir. When only the 0.0 metre and 0.5 metre stations at the BMP dolphin are compared with the 0.5 metre station at the Mechanical Control, the null hypothesis is rejected ($p = 0.0148$) suggesting lower survival in proximity to the BMP dolphin when compared with the most appropriate control. Similar tests were conducted on the 2.0 and 5.0 metre downstream stations at the BMP dolphin. The null hypothesis was not rejected ($p = 0.14$ and $p = 0.13$ respectively) at either of

these stations and in fact, higher survival was observed at the BP 5.0 station than was observed at the Mechanical Control. The conclusion is that amphipod survival at distances $\leq$ 0.5 metres downstream from the BMP treated dolphin is significantly reduced when compared with survival at an appropriate mechanical control.

Null hypothesis 7. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old creosote treated Douglas fir piling is equal to survival in sediments collected from Whidbey Island or Esquimalt Lagoon. This null hypothesis was rejected with p = 0.0015.

Null hypothesis 8. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old creosote treated Douglas fir piling is equal to survival in sediments collected from an unaffected area of Sooke Basin. This null hypothesis was rejected with p = 0.0015 suggesting that the combined mechanical and PAH effects are associated with significantly reduced amphipod survival at the Weathered Piling site.

Null hypothesis 9. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old Douglas fir piling is equal to survival in sediments collected downstream from a similar dolphin constructed of untreated Douglas Fir. The calculated value of *t* was 1.87 and the null hypothesis was not rejected at $\alpha = 0.05$ (p = 0.08). This null hypothesis was also not rejected when only the WP and MC 0.5 stations were compared. The apparent conclusion is that amphipod survival was not significantly ($\alpha = 0.05$) reduced at the Weathered Piling site when compared with the Mechanical Control site.

Null hypothesis 10. H_o: Amphipod survival in sediments associated with a six piling dolphin constructed of five year old Douglas fir piling is equal to survival in sediments collected downstream from a dolphin treated to 27 pounds retention using Best Management Practices. The null hypothesis was rejected in this test ($t = 4.88$; $p < 0.0000$) leading to the conclusion that amphipod survival was not equal at these two sites. Further analysis indicates that amphipod survival was significantly less at the BMP dolphin when compared with the Weathered Piling dolphin. This was true whether one considered all stations or just the 0.5 metre stations.

This analysis suggests that amphipod survival in sediments from an Open Control site in Sooke Basin is significantly less than survival in control sediments collected with the test animals at Esquimalt Lagoon and Whidbey Island. This is consistent with the notable lack of amphipods collected in any infaunal sample from Sooke Basin.

There is an apparent negative effect on amphipod survival associated with proximity to an untreated dolphin constructed of Douglas fir. The cause of this reduced survival was not investigated in this study. It may have been associated with physicochemical effects created by the mechanical presence of the structure or natural chemicals lost from the untreated Douglas fir piling.

Significantly reduced amphipod survival was associated with sediments collected 0.5 metres downstream from the BMP dolphin when compared with similar sediments from any one of the controls, including the Mechanical Control. Reduction in amphipod survival was not apparent at the 2.0 or 5.0 metre downstream intervals. The comparison with the Mechanical Control suggests that there are

significant negative effects on amphipod survival at distances $\leq$ 0.5 metres associated with just the presence of the treated wood.

The possible contribution of acenapthene, fluoranthene and phenanthrene to the reduced amphipod survival observed in sediments collected at distances $\leq$ 0.5 metres is discussed in the following paragraphs.

Acenaphthene concentration on Day384 at the BP 0.5 station where significant reductions in amphipod survival occurred was 32.4 µg acenaphthene/g organic carbon. At station BP 2.0 where significant decreases were not observed, the concentration was 15.9 µg/g organic carbon. The US EPA (EPA 1993a) has proposed a sediment quality criterion of 230 µg acenaphthene/g organic carbon. The acenaphthene concentrations observed at either the BP 0.5 or the BP 2.0 stations did not exceed or approach this value and it does not appear that this low molecular weight PAH contributed to the apparent toxicity observed at stations $\leq$ 0.5 metres downstream from the BMP dolphin. On a dry weight basis, not accounting for organic carbon content or other modifying effects such as, particle size, the ISQG or TEL value for acenaphthene is 0.01 µg/g (Table 8). At the BMP site, exceedences extended out to the 10 metre downstream station.

For phenanthrene, Long, et al., (1995) placed the ER-L value at 0.240 µg/g and the ER-M value at 1.5 µg/g. The US EPA criteria for providing an acceptable level of protection for benthic organisms in saltwater sediments is 240 µg phenanthrene/g of organic carbon (EPA 1993b). The phenanthrene concentration in the Station BP0.5 bioassay sample on Day384 was 271.4 µg phenanthrene/g organic carbon and it was 87.7 µg phenanthrene/g organic carbon at 2.0 metres (Appendix VI C). These values both exceed the ER-L of Long *et al.* (1995). The value at the 0.5 metre station experiencing significantly reduced amphipod survival exceeds the U.S. EPA criteria (240 µg phenanthrene/g organic carbon) at the 0.69% TOC measured in these samples but the value at 2.0 metres, where a significant decrease in survival was not noted, did not exceed the EPA criteria. The ISQG value for phenanthrene is 0.09 µg/g, dry sediment weight. Exceedences at the BMP site occurred downstream about 7.5 metres.

One of the single most dominant PAH compounds in the Sooke Basin sediment samples was fluoranthene. Long, et al., (1995) did not specifically address fluoranthene, however, the US EPA guidance criteria in saltwater sediments is given as greater than or equal to 300 µg fluoranthene/g organic carbon (EPA 1993c). At the BMP site, the fluoranthene concentration at 0.5 metres, where reduced survival was noted, was 669 µg fluoranthene/g organic carbon. This is over twice the U.S. EPA standard and we should expect toxicity. Sediment fluoranthene concentration at the BP 2.0 station where significantly decreased amphipod survival was not observed, was 152 µg fluoranthene/g organic carbon a value which is less than the U.S. EPA sediment standard. The ISQG value for fluoranthene is 0.11 µg/g, dry weight. Being the most dominant compound, exceedences at the BMP site extended downstream to about 20 metres at 0.13 µg/g, but unlikely to be a significant factor in sediment toxicity beyond 7.5 metres (1.1 µg/g). Background fluoranthene concentrations at this site, before piling installation, were between 0.02 and 0.03 µg/g.

This discussion suggests that acenaphthene did not contribute to sediment toxicity at the BMP station. However, reduced survival of the amphipods *Rhepoxynius abronius* and *Eohaustorius estuarius* appears to be well predicted by comparison of sediment levels of fluoranthene and phenanthrene with the U.S. EPA sediment quality standards for these compounds.

5.7.4. Echinoderm fertilization inhibition and Microtox™ testing on Day535.

Solid and liquid phase Microtox™ and echinoid fertilization inhibition tests were accomplished during an ancillary study on Day535 following construction. The results are consistent with those from Day384 and are summarized in Table 36. A station is assumed to be toxic in Table 37 if two of the three indicators show at least a moderately toxic response. Solid phase tests at the BP 2.0 station suggest moderate toxicity. However the liquid phase Microtox™ and echinoid fertilization tests indicated no toxicity at this station. This suggests minor toxicity at the station located 2.0 metres downstream from the BMP dolphin. These data are consistent with other bioassay results and the infaunal assessment. It appears that identifiable toxicity occurs at distances $\leq$ 0.5 metres from either the treated or untreated piling dolphins. The data in Table 36 may be somewhat biased because tests of Sooke Basin sediments collected at the Open Control were not conducted on Day535. Microtox™ and echinoid fertilization should more properly be compared with a local control rather than with reference sediments because significant adverse effects were associated with Sooke Basin control sediments in previous bioassays.

Table 36. Summary of Microtox™ and echinoid fertilization inhibition tests completed 535 days following construction of three six piling dolphins in Sooke Basin. MC = Mechanical Control dolphin constructed of untreated Douglas fir piling; BP = new piling treated to a creosote retention of 27 pcf using Best Management Practices; WP = five year old weathered piling. The numbers following the station designation indicate the distance downstream at which the samples were collected. Significantly toxic responses are bolded.

Station	Liquid phase 15 minute IC_{50}	Solid Phase IC_{50}	Significantly inhibited echinoid fertilization	Toxicity assessment
MC 0.5	**12.79%**	0.529	**Yes (27%)**	**Moderately toxic**
BP 0.0	**38.93%**	0.541	**Yes (8%)**	**Moderately toxic**
BP 0.5	**23.21 %**	**0.341**	**Yes (0%)**	**Toxic**
BP 2.0	Not performed –passed screening test	**0.400**	No (90%)	Slightly Toxic
BP 5.0	>50.00%	0.833	No (94%)	Not Toxic
BP 0.5 Offshore	>50.00%	**0.351**	**Yes (0%)**	**Moderately Toxic**
BP 2.0 Offshore	Not performed –passed screening test	0.601	No (90%)	Not Toxic
BP 5.0 Offshore	Not performed –passed screening test	0.574	No (98%)	Not Toxic
WP 0.0	**11.39%**	**0.280**	**Yes (0%)**	**Toxic**

5.7.5. Bioassay summary.

This study has examined the toxicity associated with treated and untreated dolphins when compared with an Open Control in Sooke Basin and with Esquimalt Lagoon or Whidbey Island reference sediments. Survival of the amphipods *Rhepoxynius abronius* and *Eohaustorius washingtonianus* was significantly reduced in Sooke Basin control sediments during this study. This is consistent with the lack of amphipods reported in the intensive benthic community analysis conducted in support of this study. For these reasons, a multi-tiered approach was used in which bioassay results at sites associated with creosote treated wood were compared with reference sediments, Sooke Basin

Control Sediments and Mechanical Control sediments. The results of amphipod, Microtox™, and echinoderm fertilization inhibition tests were consistent with each other and with the U.S. EPA sediment quality criteria for phenanthrene and fluoranthene. These results suggest that under conditions similar to the Sooke Basin site and within a similar time frame, toxic responses can be anticipated at distances $\leq$ 0.5 metres from the perimeter of dolphins constructed of untreated Douglas fir, and creosote treated Douglas fir whether or not the treated piling were aged or newly treated using Best Management Practices sponsored by the Canadian Institute of Treated Wood.

5.8 Additional Studies

5.8.1 Distribution of *parental* PAHs and toxicity tests on sediments inside the dolphin perimeter and offshore to 10m - Day384 and Day535.

Day384. After a year, a thick layer of shell debris had built up around the base of the pilings, largely from starfish grazing on the mussels attached to the pilings. This could potentially affect the adsorption properties of the sediment, particularly at the 0.5m interval. Although the larger debris, small rocks, wood etc. were removed prior to analysis, shell debris was not. During the Day384 sampling period, single sediment samples were collected from inside the dolphin perimeter at the BMP and Weathered Piling treatment sites (384BP0.0 and 384WP0.0) for PAH analysis and toxicity testing. Samples consisted of a composite of the top 2 cm. taken from four quadrants inside the dolphin perimeter. Each sampling site was equidistant between the center piling and the outer pilings. These inner perimeter samples contained less shell debris and had greater exposure to the dolphin mass. Results from the toxicity tests are given in Table 33 (Microtox™), Table 35 (*Rhepoxynius*) and Table 36 (*E. wash*.). PAH results are given in Appendix VI B & C.

TPAH concentrations at 384BP0.0 and 384WP0.0 were 30.8 µg/g and 47.7µg/g, respectively, compared to the 14.8 µg/g and 2.0 µg/g in comparable mixed samples taken outside the perimeter at the 0.5m downstream sites on Day384. Replicate samples from the 0.5m station averaged 18.9±10.2 µg/g, for the BMP site and 10.8 ± 5.1 µg/g, for the WP site. Liquid phase Microtox™ tests revealed that both samples were toxic (Table 33). Solid phase tests, however, showed no evidence of toxicity. Survival rates for the amphipod, *Eohaustorius washingtononius* were significantly reduced in samples from BP0.0. Results for *Rhepoxynius abronius*, although showing a significantly lower survival than the controls, but were not considered toxic using Lee *et al's.*,(1995) criteria. *Rhepoxynius* appears to be the least sensitive of the two species. Tests were not done on samples from the Weathered Piling site due to laboratory constraints.

In addition to the inner perimeter stations, sediment samples from the top 2 cm layer were collected on Day384 at 0.5m, 2.0m, 5.0 and 10m intervals along a transect line extending directly offshore from the BMP and Weathered Piling sites for PAH analysis. This was to determine if any offshore movement of creosote contamination had occurred. Drogue studies prior to piling installation had indicated that the tidal currents (flood and ebb), although generally following the shoreline, had a tendency to drift offshore. Offshore samples consisted of a single composite at each station after thoroughly mixing the top 2 cm from several grabs. Samples from the inner perimeter and along the offshore transects were additional to the original study design. Results for Day384 are shown graphically in Figure 53 (BMP treatment site) and Figure 54 (WP treatment site). Included in the graphs are PAH data from the perimeter stations, offshore stations and the routine upstream and downstream sampling sites from Day0 through to Day384. Raw data are given in Appendix VI B & C.

The BMP 0.5m offshore station on Day384 was higher than both the inner perimeter station and the 0.5m downstream station with a total PAH concentration of 68.3µg/g. Similarly, the 0.5m offshore station at the Weathered Pilings site was 33.8 µg/g compared to an average of 10.8±5.1 µg/g at the 0.5m downstream station on Day384. Offshore PAH contamination at both treatment sites, however, did not go much beyond 5.0 metres. Due to logistical and cost considerations, toxicity tests and infauna community analyses were not performed on the offshore samples.

Day535. Because the offshore samples at the BMP and Weathered Piling site on Day384 were much higher than those collected from the downstream transects, an additional survey was conducted on Day535 to confirm the results from Day384. Sampling was restricted to selected stations at the BMP site, namely the inner perimeter station (BP0.0), the 0.5m downstream station and the 0.5, 2.0, 5.0 and 10m. offshore intervals. PAH analysis was carried out by the National Environmental Testing Inc. laboratory using a different analytical method, i.e. HPLC (EPA 8310). Since all previous sediment samples had been analyzed by Axys Analytical Services Ltd. using GC/MS methods, duplicate samples were collected at two locations for comparison, the 0.5m downstream and 0.5m offshore stations. The duplicate samples were thoroughly mixed beforehand, then divided into two equal portions, alternating between two sample jars. Results are given in Table 38, along with results from liquid phase Microtox™ tests done by Environment Canada. Overall, the results from the National Environmental Testing laboratory were consistently lower than those obtained by Axys Analytical Services Ltd. on Day384. Results from Axys using high resolution GC/MS were, however, lower than previous samples collected on Day384. The TPAH concentration in the BP0.5 offshore sample on Day535, for example, was 5.83 µg/g compared to 68.3 µg/g on Day384. Both samples were analyzed by Axys.

It is unclear whether the difference in the results by Axys between Day384 and 535 are due to the variability between field samples, the patchy nature of the creosote contamination, seasonal differences or more likely, analytical methodology. The HPLC method, for example, showed no indication of PAHs in samples from the 10 metre station on Day535 (Table 36), despite relatively low detection limits of <0.02 µg/g. It is unlikely, considering the ubiquitous nature of PAHs, that at least some PAHs would not be found in the samples in trace amounts. This, however, requires a more detailed QA/QC review and comparison of the two analytical methodologies.

Amphipod bioassays were not conducted on the Day535 samples. Preliminary echinoid fertilization inhibition tests were, however, performed on five samples selected from the BMP, Weathered Piling and Mechanical Control sites on a trial basis. The inner perimeter stations (WP0.0 and BP0.0), BP0.5 (downstream) and the Mechanical Control (MC0.5) stations were toxic. No effects were observed in the offshore samples at the BMP site taken at 0.5, 2.0 and 5.0 metre intervals nor were toxic responses observed at the 2.0 and 5.0 metre downstream stations at the BMP site.

It's worth emphasizing the results from the Mechanical Control site. This site has periodically been toxic. Microtox™ liquid phase tests on Day384 and Day535, for example, both showed evidence of toxicity. Samples from MC0.5 on Day384 also produced a toxic response to both species of amphipod (Table 36 & Table 37). The mechanical control site is not directly exposed to creosote

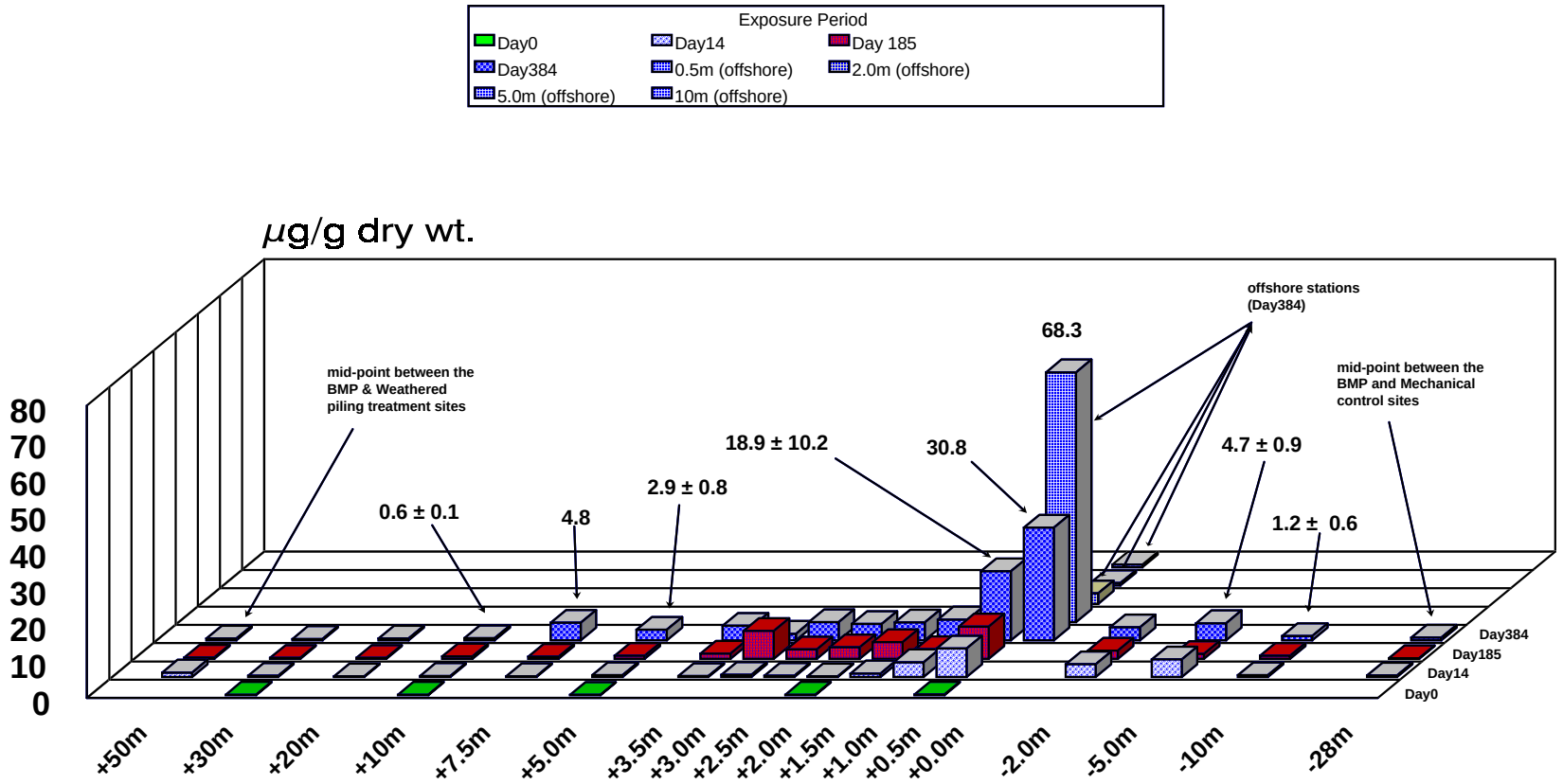
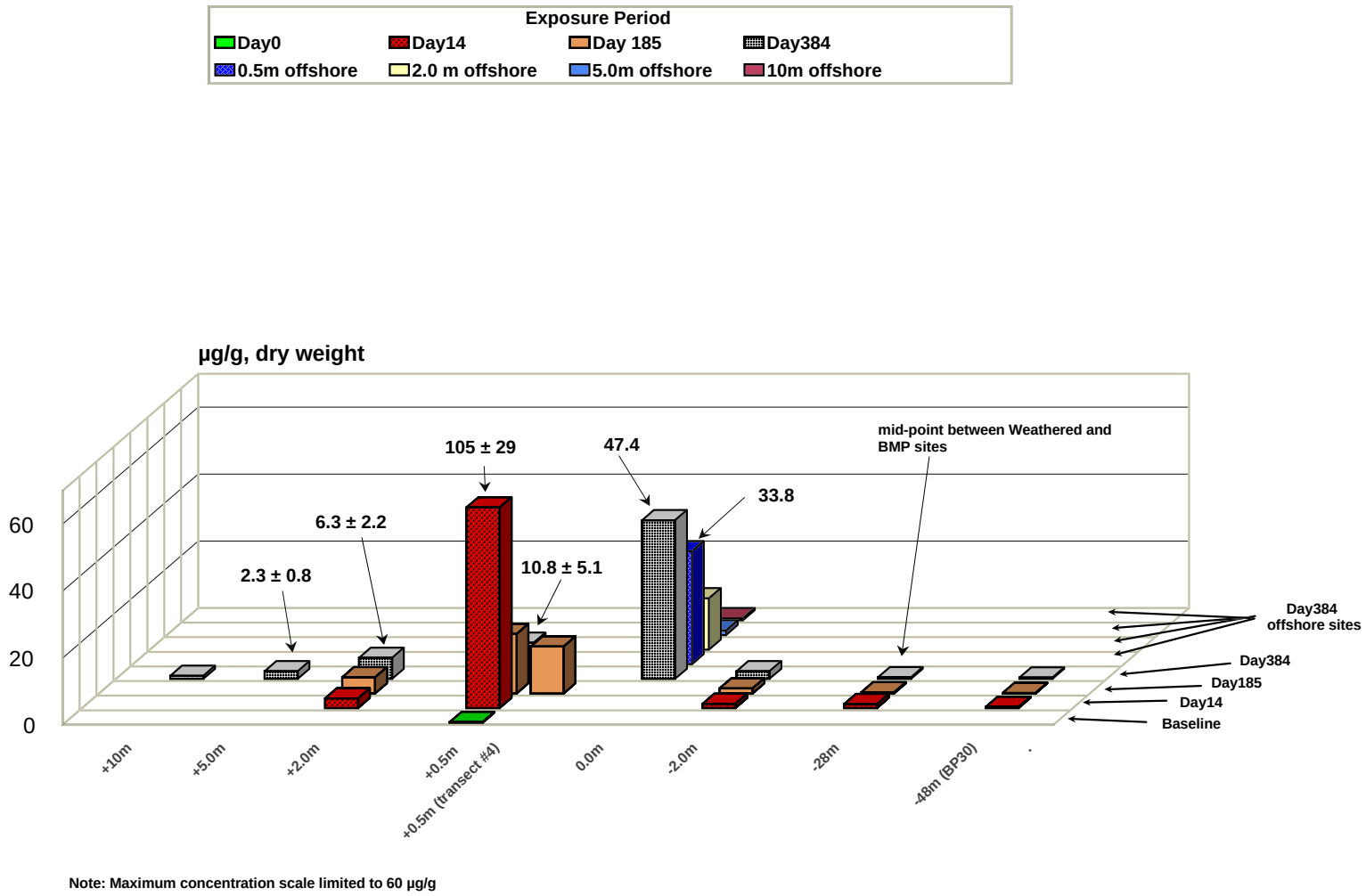


Figure 53. Graph showing the surface sediment PAH concentrations (µg/g, dry weight) inside the BMP Piling dolphin perimeter and offshore sampling stations on Day384 in relation to the upstream and downstream stations (Day0 to Day384) - Sooke Basin Creosote Evaluation Study.



Note: Maximum concentration scale limited to 60 µg/g

Figure 54. Graph showing the surface sediment PAH concentrations (µg/g, dry weight) inside the Weathered Piling dolphin perimeter and offshore sampling stations on Day384 in relation to the upstream and downstream stations (Day0 to Day384) - Sooke Basin Creosote Evaluation Study.

Table 37. Surface sediment PAH concentrations (µg/g, dry weight) in selected samples on Day535: Sooke Basin Creosote Evaluation Study.

Station	535BP0.0 NET (perimeter)	535BP0.5 NET (downstream)	535BP0.5 Axys (downstream)	535BP0.5 NET (offshore)		535BP0.5 Axys (offshore)	535BP2.0 NET (offshore)		535BP5.0 NET (offshore)	535BP10 NET (offshore)
				Mean (n=3)	Std. Dev.	Mean (dupl.)	Mean (n=3)	Std. Dev.		
Naphthalene	<0.02	<0.02	0.012	<0.02	---	0.014	<0.02	---	<0.02	<0.02
Acenaphthylene	<0.02	<0.02	0.019	<0.02	---	0.02	<0.02	---	<0.02	<0.02
Acenaphthene	<0.02	<0.02	0.079	<0.02	---	0.12	<0.02	---	<0.02	<0.02
Fluorene	<0.02	<0.02	0.13	0.027	---	0.135	0.037	---	<0.02	<0.02
Phenanthrene	0.06	<0.02	0.42	0.074	0.033	0.36	0.065	0.011	<0.02	<0.02
Anthracene	0.021	<0.02	0.87	0.042	0.014	0.57	0.035	0.016	<0.02	<0.02
LPAH	0.081	0.0	1.5	0.129	0.062	1.2	0.079	0.070	0.0	0.0
Fluoranthene	0.21	0.059	1.3	0.118	0.057	1.2	0.609	0.979	0.021	<0.02
Pyrene	0.128	0.029	0.72	0.069	0.037	0.44	0.060	0.052	<0.02	<0.02
Benz(a)anthracene	0.07	0.0906	0.69	0.139	0.084	0.75	0.069	0.081	0.132	<0.0026
Chrysene	<0.02	<0.02	0.99	<0.02	---	1.2	0.078	---	<0.02	<0.02
Benzofluoranthenes	0.038	0.0411	0.55	0.0459	0.021	0.62	0.077	0.061	<0.0036	<0.0036
Benzo(a)pyrene	0.027	<.0046	0.25	0.0186	0.007	0.27	0.035	0.028	<0.0046	<0.0046
Dibenz(ah)anthracene	<.006	<0.006	0.023	<0.006	---	NDR	<0.006	---	<0.006	<0.006
Indeno(1,2,3-cd)pyrene	<.0086	<0.0086	0.11	0.0106	---	0.12	<0.0086	---	<0.0065	<0.0086
Benzo(ghi)perylene	<0.02	<0.02	0.076	0.024	---	0.083	<0.02	---	<0.02	<0.02
HPAH	0.473	0.220	4.71	0.4078	0.225	4.61	0.815	1.13	0.153	0.0
TPAH	0.55	0.22	6.24	0.5368	0.286	5.83	0.894	1.18	0.153	0.0
Microtox™ (liquid phase)	Toxic	Toxic	Toxic	Moderately Toxic		Moderately Toxic	Nontoxic		Nontoxic	na

contamination, but, does have untreated Douglas fir pilings. Naturally occurring compounds being released from these untreated pilings may act additively, synergistically, or antagonistically to marine organisms. This was not specifically addressed in this study but needs to be explored further.

5.8.2 Alkylated (substituted) PAH.

Alkylated PAHs, like their unsubstituted counterparts, can be routinely found in hydrocarbon-contaminated sediments. Alkyl PAH distribution patterns relative to unsubstituted PAHs are often used to isolate various anthropogenic sources in environments with mixed inputs (Yunker and Macdonald, 1995; Yunker, et al., 1997). Petrogenic sources are characterized by higher concentrations of alkylated PAH than unsubstituted or parent PAH. Although the focus was primarily on the parental PAHs, the Sooke Basin study also provided an opportunity to collect additional data on alkylated PAHs. As mentioned earlier, significantly more effort would be required to evaluate all aspects of the database acquired during this study than is currently available. Data on the alkylated PAHs have been provided in Appendix VII A-C (sediment), Appendix IX (piling cores), Appendix X (post-construction surface water samples) and Appendix XII B (mussel, (*Mytilus edulis edulis*) tissue for future consideration. Dibenzofuran concentrations determined at the same time are also included in the appendices. The introduction of the BMP treated and Weathered pilings did produce a measurable increase in both sedimented alkylated PAHs and dibenzofuran concentration. Understanding the significance of these increases will require a more detailed analysis of the field data and further review of available scientific literature. Its worth noting that several of the C4 and C5 alkylated PAHs were not identified in either the piling core samples or the sediment samples. This may help to isolate creosote sources from other PAH sources in environments where a mixture of anthropogenic inputs exist.

Very little is known about the environmental fate (e.g. persistence) and toxicological significance of alkylated PAH. Bright (1996), in a review of the environmental, toxicological and regulatory significance of alkylated-substituted PAHs, concluded that while data was limited, alkylated PAHs may be more or less toxic, or of comparable toxicity to their unsubstituted PAH counterparts. The environmental and toxicological effects would depend upon the position and number of alkyl-groups around the ring structure. Overall, review of the scientific literature, albeit limited, “did not provide any compelling reason to dismiss alkylated PAHs as any less toxic than unsubstituted forms, either in association with their acute toxicity or carcinogenicity to mammals or other vertebrates”. There is no regulatory guidance or limit on alkylated PAH currently in place in Canada or the US. It should be noted, however, that infaunal responses, *in situ*, and laboratory bioassay responses observed in this study were subjected to all of the toxic compounds associated with the treated and untreated pilings.

5.8.3 Kaolin Tray Experiments.

Shortly after piling installation, it was apparent that creosote contamination may be occurring in the form of distinct minute droplets creating micro-sheens. Oily patches were frequently observed on the surface of the sediment samples, as well as in the underlying sediment, especially those taken near the base of the pilings. Even after vigorous mixing, these oily droplets would quickly re-form. In an effort to isolate the source, stainless steel baking trays

were mounted inside the dolphin just below the intertidal zone and 0.6 metres off the bottom at the BMP, WP and MC treatment sites on Day270. These were recovered on Day384, after 114 days exposure. Kaolin clay, an anhydrous aluminum silicate powder, was used because of its pure white colour, in contrast to the black creosote tar, and it's fine texture to maximize adsorption. Although a two week bench test indicated that the clay remained as a slurry in salt water, ultimately it became very compact after prolonged exposure. In addition, an electrolytic reaction developed between the clay and the stainless steel tray, which was enough to burn through the steel and caused large dark patches in the clay mixture making it difficult to visually detect the presence of creosote within the clay. Droplets on the surface of the clay were, however, clearly visible. A clean, fine construction sand might have been a better choice of material.

All trays, regardless of depth contained numerous distinctive droplets of creosote mixed with a layer of mussel shell debris. PAH concentrations did not differ substantially between the upper and lower trays at either the BMP piling or the Weathered Piling site. While the BMP trays appeared to contain slightly more creosote than those mounted at the Weathered Piling site, concentrations of PAH in the upper and lower trays at the Weathered Piling site were measurably higher than those at the BMP site, 118 µg/g and 109 µg/g, respectively, compared to 28.5 and 51.5 µg/g. (Table 38).

Although the inner perimeter and offshore sedimented PAH levels at the BMP piling site on Day384 could not be reproduced on Day525, the concentrations measured in the Kaolin trays at both creosote treatment sites give some indication of the exposure level on the benthic sediments at the base of the pilings. Had the PAH concentrations in the upper trays remained low, the source would likely be the wetted portion of the pilings. The fact that PAHs at each treatment site were present in the upper and lower trays at relatively equal proportions suggests that much, if not most, of the creosote originates from the upper portion of the pilings. Heat from the sun during low tides could draw the creosote out from the interior of the piling in the form of tar droplets. These either form oily microsheens on the surface of the water as the tide rises or, at some point, the weight becomes great enough to cause tar droplets to fall from the piling and descend directly to the bottom as minute droplets without releasing significant amounts of PAH. Below low tide, algal and mussel growth on the pilings physically limits the release of creosote in the form of droplets and may also provide an insulating layer from the sun.

Table 38. PAH concentrations (ng/g, dry weight) in Kaolin trays installed immediately below the intertidal zone and 0.6 metres from the bottom at the BMP and Weathered Piling Treatment Sites - Sooke Basin Creosote Evaluation Study.

Station	Kaolin (new)	384BP0.5 Top (A)	384BP0.5 Top (B)		384BP0.5 (Bottom)	384WP0.5 (Top)	384WP0.5 (Bottom)
Batch I.D.	PH-0961	PH-0991	PH-0991		PH-0991	PH-0991	PH-0991
Lab No.	9611-78	9611-176A	9611-176B	Mean	9611-177	9611-178	9611-179
Naphthalene	4.1	50	50	50	48	20	19
Acenaphthylene	ND(0.13)	47	36	41.5	84	140	110
Acenaphthene	0.58	1300	1200	1250	720	640	530
Fluorene	3.1	1200	1100	1150	1200	1400	1200
Phenanthrene	2.6	4100	3600	3850	7000	18000	16000
Anthracene	ND(0.1)	700	690	695	2400	1400	1100
LPAH	10.4	7397	6676	7037	2400	21600	18959
Fluoranthene	0.92	10000	6300	8150	15000	37000	36000
Pyrene	NDR(0.15)	5800	3400	4600	7200	21000	19000
Benz(a)anthracene	ND(0.04)	2400	1600	2000	5800	5100	3900
Chrysene	ND(0.07)	3100	2300	2700	8700	15000	12000
Benzofluoranthenes	ND(0.05)	2200	1600	1900	6300	11000	10000
Benzo(e)pyrene	ND(0.05)	690	520	605	1600	2800	3500
Benzo(a)pyrene	ND(0.08)	1000	770	885	2700	2600	3000
Dibenz(ah)anthracene	ND(0.09)	80	54	67	210	220	210
Indeno(1,2,3-cd)pyrene	ND(0.08)	340	260	300	900	1200	1100
Benzo(ghi)perylene	ND(0.05)	240	190	215	660	880	850
HPAH	0.92	25850	16994	21422	49070	96800	89560
TPAH	11.3	33247	23670	28459	51470	118400	108519
TPAH (µg/g)	0.01	33.2	23.7	28.5	51.5	118	109
Perylene	ND(0.06)	200	150	175	590	390	370
Surrogate Recovery							
Naph d-8	57	110	100	105	110	120	110
Acen d-10	85	120	120	120	120	130	120
Phen d-10	86	100	99	99	100	110	110
Pyr d-10	88	87	82	84	81	88	82
Cry d-12	90	80	75	77	72	86	71
B(a)P d-12	94	100	97	98	87	94	85
Perylene d-12	88	95	91	93	81	88	77
DiB(ah)A d-14	77	120	110	115	92	120	85
B(ghi)P d-12	79	110	100	105	86	98	77

5.9 Relationship between laboratory bioassay results and Canadian Interim Sediment Quality Guidelines (ISQG) and other sediment quality criteria.

A variety of numerical targets have been developed for PAHs in sediment to assist regulators and others in assessing their potential impact on marine and freshwater ecosystems. Canada has developed a set of numerical interim sediment quality guidelines (ISQG's) for a number of chemical substances in marine and freshwater environments, including individual *parental* PAH compounds. Effects based sediment quality assessment values were originally developed by Long and Morgan,1990 and later refined by Long, et al., 1995 by matching chemical and biological data obtained from numerous studies throughout the US and parts of Canada. These data were based on a variety of biological measurements, generally related to acute toxicity. The ISQG's were derived from this biological effects database (BEDS), by separating the data into either *effect* or *no-effect* data set for each guideline. The **ISQG TEL** (*threshold effects level*) guideline was calculated as the geometric mean of the 50th percentile concentration of the *no-effect* data set and the lower 15th percentile of the *effect* data set. This value represents the level below which biological effects are rarely expected. The **PEL** (*probable effects level*) guideline was calculated as the geometric mean of the 50th percentile concentration of the *effect* data set and the 85th percentile of the *no-effect* data set. The PEL represents the level above which adverse effects are expected to occur frequently under all conditions tested. The BEDS database was not evaluated for environmental mediators in making these determinations and includes laboratory toxicity data conducted under conditions where no environmental mediators were present. Therefore the PEL and TEL are not predictive of all natural environments. This is perhaps best seen in that PEL and TEL levels for metals (copper, arsenic, etc.) which can be lower than levels observed in many pristine natural environments where no adverse effects are documented.

The ISQG's are intended to be conservative values designed for the protection of aquatic life in all environments. They provide some national consistency and a scientific benchmark for assessing potential impact but must be modified by site specific information, such as local natural background levels of the chemical, the presence of environmental mediators of toxicity such as the total organic carbon, dissolved organic carbon, etc., and biological sensitivity when developing site specific criteria. It is not appropriate to apply these guidelines, without site specific modification, when interpreting the potential toxicity of listed chemicals at a given location. In that light, the ISQG's are intended as a guide and not as specific sediment management standards in the way the Washington State Apparent Effects Threshold Sediment Quality Standards or EPA Sediment Quality Criteria are intended.

Several other criteria have also been developed for assessing the affects of PAHs and other chemical substances. The U.S. National Oceanic and Atmospheric Administration (NOAA) has developed benchmarks based only on the effects data set. The Effects Range Low (ER-L) represents the lower 10th percentile concentration at which effects were observed. Effects are rarely expected below this value. The Effects Range-Median (ER-M) refers to the median or 50th percentile where effects are expected to occur often.

Long et al.(1998) found that the probability of toxicity increases with the number of PEL or ER-M values exceeded. They concluded that the probability of highly toxic responses occurring when one or more ER-L's or TEL's are exceeded and no ER-M's or PEL's exceeded

are 16 to 18% in amphipod tests alone and 60 to 64% in any one of a battery of sensitive tests performed. The percentages increased as the number of PEL's or ER-M's were exceeded. They also found that the PEL and ER-M values were considerably better in predicting toxicity than the ER-L's and TEL's.

Washington State (WAC 173-204) has established Apparent Effects Threshold (AET) based Sediment Quality Criteria that are enforceable standards. The AET approach uses data from matched sediment chemistry and biological effects measures. Biological effects were assessed by either benthic community surveys or sediment toxicity tests. An AET concentration is the sediment concentration of a selected chemical, above which statistically significant biological effects always occur. This approach is less conservative from the environment's point of view than TEL's or PEL's and are close to the ER-M values of Long *et al.* (1995). Washington State standards are provided for 16 priority pollutant PAHs on the basis of Total Organic Carbon (TOC). The potential for fewer false positive findings associated with the AET standards enhances their enforceability.

The U.S. EPA (EPA-822-R-93-012; 1993) has proposed Sediment Quality Criteria for the Protection of Benthic Organisms for fluoranthene, phenanthrene and acenaphthene. The criteria represent EPA's best recommendation for Sediment Quality Criteria (SQC) that will not adversely affect most benthic organisms. The criteria do not address the question of possible contamination of upper trophic level organisms or the synergistic, additive or antagonistic effects of multiple chemicals. The EPA methodology is based on Equilibrium Partitioning Theory (EPT). An assumption is made that the bioavailability and toxicity of a non-ionic organic compound is related to its concentration in pore-water, which is determined in large part by the chemical's organic carbon partition coefficient (K_{oc}). The toxicity of each PAH was determined by evaluating acute and chronic toxicity tests (bioassays) on the most sensitive species as a function of the dissolved concentration of the compound. Concentrations known to cause chronic toxicity in the most sensitive species were combined with the partitioning of that chemical between sediments and pore water to develop the SQC. The numerical value of the criterion depends on TOC concentrations in sediments governing the concentration of the compound in porewater.

The province of B.C. has also developed provisional water quality objectives specifically for Burrard Inlet (BI WQO's) (Nijman and Swain, 1990) and Water Quality Criteria Guidelines for the province as a whole (Nagpal, 1994). In addition, Canada, under Schedule III of the Canadian Environmental Protection ACT (CEPA) has a rejection limit of 2.5 µg/g total PAH for sediment intended for ocean disposal, which needs to be recognized if dredging and ocean disposal is contemplated in the future.

The Sooke Basin study represents another data set of matching chemistry and biological measurements. Although toxicity testing could not be carried out at every chemical sampling location, the Sooke Basin study provides a unique opportunity to compare matching time series chemical and biological measurements at varying distance intervals from the source over a one year period, beginning as a natural undisturbed environment followed by the introduction of creosote treated pilings. The site was carefully selected to maintain a consistency in test conditions at each treatment site, such as exposure to light and weather conditions, constant depth, low tidal circulation and uniformity in fine grain sediments throughout to maximize the

potential for PAH contamination, overall, representing a 'worst case condition'. The following discusses the relationships between the biological and chemical data collected during the Sooke Basin study with various sediment quality criteria currently in use.

The results of bioassays conducted at the Open Control and Mechanical Control sites in Sooke Basin are summarized in Table 39. As discussed in Section 5.7, Sooke Basin sediments at the Open Control and Mechanical Control sites were found to be toxic on numerous occasions. Therefore, an assessment of the toxic response to sedimented PAH should use the Mechanical Control site (where PAH remained at background levels) to compare biological effects with the various creosote treatments. Using the Open Control as a reference site would confound the effects associated with PAH with effects associated with either the structure or the loss of natural toxins from untreated Douglas fir piling which have been shown to create adverse effects. Using laboratory controls would ignore both the effects associated with the untreated structure and toxic effects documented at the Open Control site that are likely common to all of this part of Sooke Basin. However, this study did not fully investigate the toxicity observed at the Open Control or Mechanical Control sites and no cause and effect relationships were developed. Bioassay responses were normalized to the response observed at the Mechanical control during each sample period. Bioassay responses in comparison with laboratory controls are summarized for the Open Control and Mechanical Control sites in Table 39. Samples that were toxic in comparison with laboratory controls are bolded in Table 39. Amphipod bioassay results that were significantly less than the laboratory controls are noted with an asterisk.

Table 39. Summary of bioassay results conducted at the Open Control (OC) site and Mechanical Control (MC) dolphin during the Sooke Basin Creosote Evaluation Study. Treatment codes are followed by the distance from the dolphin and sample date in parentheses. Amphipod survival is in percent, Solid Phase and Liquid Phase Microtox values are IC_{50} concentrations for whole sediments (Microtox Solid) and pore water (Microtox Liquid). The Echninoid Fertilization results are percent normal fertilization. The Evaluation is based on a weight-of-evidence approach. Significant responses are bolded.

Open Control

Station (Date)	Rhepox. Survival	E. wash. Survival	Microtox Solid	Microtox Liquid	Echinoid Ferilization	Laboratory Evaluation
OC (B)		98	**0.79**	100		**Slightly toxic**
OC (14)	**94***	81	**0.94**	100		**Slightly toxic**
OC (185)	**81***	**84***	1.60	100		**Slightly toxic**
OC (270)	**85***	92	3.10			**Slightly toxic**
OC (384)	**92***	90	1.80	>50		**Slightly toxic**

Mechanical Control

MC0.5 (B)	93	**90***	**0.80**	**0.80**		**Slightly toxic**
MC0.5 (14)	**95***	86	**0.57**	**0.57**		**Moderately toxic**
MC0.5 (185)		84	1.00	1.00		Non toxic
MC0.5 (384)	**89***	**56***	1.20	**0.36**		**Toxic**
MC0.5 (535)			**0.53**	**0.13**	**27%**	**Toxic**

The results of comparing the creosote treated (WP and BP) bioassay data to values observed at the Mechanical Control structure are presented in Table 40. The raw (not

normalized) survival data for describing amphipod survival at the WP and BP dolphins was compared against same day results at the MC dolphin using *t*-tests on arcsine (square-root(proportion surviving amphipod)) transformed data. Survival at the WP and BP sites was not significantly less than survival at the MC in any bioassay. Survival of *Eohaustorius washingtonianus* was significantly higher at the WP 0.5 and WP 2.0 stations on Day 384 than at the Mechanical Control site.

The amphipod bioassays do not appear to be sensitive to differences in sediments associated with the Mechanical Control and creosote treated dolphins. Two apparent false positive results are seen in the Microtox Solid Phase (WP 2.0 (384) and WP 5.0 (535)) and two false positive results are apparent in the Microtox Liquid Phase (porewater) tests at WP 0.5 (384). Stations BP 0.0 (384), WP 0.0 (535) and BP 0.5 (535) were obviously toxic in laboratory bioassays. The results at other stations are equivocal with some tests indicating toxicity and other tests suggesting no toxic response. A weight-of-evidence approach was used to evaluate each station. All stations considered at all toxic are bolded. Stations that show some evidence of toxicity are bolded and italicized.

Table 40. Summary of bioassay results at the Weathered Piling (WP) and Best Management Practices Piling (BP) dolphins when compared with results at the untreated Mechanical Control (MC) during the Sooke Basin Creosote Evaluation Study. Treatment codes are followed by the distance from the dolphin and sample date. Amphipod survival is in percent normalized to the Mechanical Control, Solid Phase and Liquid Phase Microtox values are IC_{50} concentrations for whole sediments (Microtox Solid) and pore water (Microtox Liquid). The Echninoid Fertilization results are percent normal fertilization. Offshore stations are preceded by the letters (OS). The Evaluation is based on a weight-of-evidence approach.

Station (Date)	Rhepox Survival	E. Wash Survival	Microtox Solid	Microtox Liquid	Echinoid Fertilization	Laboratory Evaluation
BP0.0 (384)	82	54	**0.60**	**0.70**		**Toxic**
BP0.0 (535)			1.02	3.04	**8**	**Toxic**
WP0.0 (535)			**0.53**	**0.89**	**0**	**Toxic**
BP0.5 (384)	78	64	**0.83**	1.88		**Moderately toxic**
BP0.5 (535)			**0.64**	1.81	**0**	**Toxic**
OS BP0.5 (535)			**0.66**	>50%	86	*Slightly toxic*
WP0.5 (384)	101	154	1.08	**0.82**		Non-toxic
WP2.0 (384)	100	139	**0.92**	>100%		Non-toxic
BP2.0 (384)	65	82	**0.64**	1.32		*Slightly toxic*
BP2.0 (535)			**0.75**		90	*Slightly toxic*
BP5.0 (384)	102	148	**0.82**	>100%		Non-toxic
BP5.0 (535)			1.57		94	Non-toxic

It should be emphasized that this assessment is not intended to describe the toxicity of Sooke Basin sediments to the organisms tested. As demonstrated in Table 39, sediments at the Open Control and Mechanical Control evidenced some degree of toxicity in 9 of 10 (90%) of the

samples. The analysis in Table 40 is intended to elucidate the additional toxicity associated with sedimented PAH at the creosote treated dolphins by comparing results there with results at the Mechanical Control dolphin constructed of untreated wood. The analysis suggests that sediments inside (Distance = 0.0 m) the perimeter of either dolphin are generally toxic. Sediments at the BP dolphin show evidence of toxicity at the 0.5 and slight toxicity at the 2.0 metre stations while sediments at the Weathered Piling site are not toxic outside the perimeter of the dolphin. These results are consistent with the benthic community analysis previously described for the 0.5 metre station but not the 2.0 metre station. The results presented in Table 40 are superimposed on sediment PAH chemistry in Table 41.

The 0.5 metre station at the Mechanical Control site was toxic on Day384 and Day525. Sediment concentrations of PAH were below any of the reviewed effects levels and it is obvious that some other factor (natural toxin(s) or physical condition such as TOC or percent silt and clay) is responsible for the negative bioassay results. Likewise, the Open Control was judged in Table 39 to be Slightly Toxic on each day evaluated when compared with laboratory controls without any exceedance in sedimented PAH concentrations. This simply points out the need to compare bioassay results at the creosote treated structures with results at the Mechanical Control, as well as field controls if the adverse effects associated with PAH are to be evaluated properly.

The sites judged to be Toxic or Slightly Toxic in Table 41 for which matching sediment PAH data are available [BP0.0 (384), BP0.5 (384), BP0.5 (535), OSBP0.5 (535)(offshore), and BP2.0 (384)] all held PAH concentrations exceeding each of the benchmarks evaluated – except for the EPA DRAFT SQC. The EPA DRAFT SQC for acenaphthene, phenanthrene and fluoranthene did not predict observed toxicity at BP0.5 (535), offshore BP0.5 (535) or BP2.0 (384). This suggests that excepting the EPA criteria, each of the benchmarks was effective in predicting adverse effects.

Table 41. Summary Table Showing the Relationship of Surface Sediment PAH Concentrations (µg/kg, dry wt.) to Bioassay Results and Various Sediment Quality Criteria - Sooke Basin Creosote Evaluation Study. PAH concentrations exceeding the TEL are lightly shaded, those exceeding the PEL are darkly shaded. Those exceeding the Washington State SQS are bolded and those exceeding the BC SQC at 1% TOC are boxed.

PAH	Naph	Aceny	Acen	Fluor	Phen	Anth	Fluoranth	Pyrene	B(a) anth	Chry	B(a)P	B(a,h) anth	TPAH			Laboratory Toxicity Tests			
TEL (ISQG)	34.6	5.9	6.7	21	86.7	46.9	113	153	74.8	108	88.8	6.2		Rhepox survival	E. wash. survival	Microtox (solid)	Microtox (liquid)	Echinoid	Overall Rating
PEL	391	128	88.9	144	544	245	1494	1398	693	846	763	135		(%)	(%)	IC_{50}	IC_{50}	% fertile	
ER-L	160	44	16	19	240	85.3	600	665	261	384	430	63.4	4.0						
ER-M	2100	640	500	540	1500	1100	5100	2600	1600	2800	1600	260	44.8						
EPA Std.			2390		2500		3120												
BI SQO	200	60	50	50	150	100	170	260	130	140	160	60	1.7						
B.C SQC (@1%C)	10	660	150	200	225	---	600	350	---	200	60	60							
Wash. State Stds. (@1.04%C)	1030	670	170	240	1040	2290	1660	10400	1140	1140	1030	120							
BP0.0 (mixed)	43	46	**350**	**740**	**3600**	1800	**6700**	**3400**	**3100**	**4600**	**1600**	120	30.8	82	**54**	**0.60**	**0.70**	np	**Toxic**
BP0.0 (Day535)	---	---	---	---	---	---	---	---	---	---	---	---	---	np[1]	np	1.02	3.04	**8.0**	**Toxic**
WP0.0 (Day 535)	---	---	---	---	---	---	---	---	---	---	---	---	---	np	np	**0.53**	**0.89**	**0.0**	**Toxic**
BP0.5 (Day 384)	29	32	165	**300**	**1300**	615	**3550**	1600	**1500**	**2350**	785	59	14.8	78	**64**	**0.83**	1.88		***Slightly Toxic***
BP0.5 (Day535)	12	19	79	130	420	870	1300	**720**	690	990	250	23	6.4	np	np	**0.64**	1.81	**0.0**	**Toxic**
OSBP0.5 (Day535)	14	20	120	135	360	570	1150	435	750	1185	270	NDR	6.0	np	np	**0.66**	>50%	86	***Slightly Toxic***
WP0.5 (Day 384)	33	4.1	65	74	170	35	510	290	110	250	75	6.8	2.0	101	154	1.08	**0.82**	np	Not Toxic
WP2.0 (Day 384)	14	21	**320**	**660**	**6300**	740	**11000**	7500	**2500**	**4500**	**1100**	91	39.4	100	139	**0.92**	>100%	np	Not Toxic
BP2.0 (Day 384)	18	21	110	180	620	340	**1800**	710	950	**1400**	480	37	8.2	65	82	**0.64**	1.32	np	***Slightly Toxic***
BP2.0 (Day535)	---	---	---	---	---	---	---	---	---	---	---	---	---	np	np	**0.75**	np	90	***Slightly Toxic***
BP5.0 (Day 384)	20	4.2	99	100	380	150	860	520	300	380	120	8.3	3.3	102	148	**0.82**	>100%	np	Not Toxic
BP5.0 (Day535)	---	---	---	---	---	---	---	---	---	---	---	---	---	np	np	1.57	np	94	Not Toxic
OSBP5.0 (Day 535)	---	---	---	---	---	---	---	---	---	---	---	---	---	np	np	>1.00	1.09	98	Not Toxic
MC0.5 (Day 384)	NDR	NDR	2.1	3.7	22	4.2	39	27	10	14	6.8	NDR	0.2	**89**	**56**	1.20	**0.36**	np	**Toxic**
MC0.5 (Day535)	--	---	---	---	---	---	---	---	---	---	---	---	---	np	np	**0.53**	**0.13**	**27**	**Toxic**
OC0.5 (Day 384)	8.8	2.2	6.8	9.8	24	5.9	43	33	13	18	19	1.1	0.2	**92**	90	1.80	>50	np	Not Toxic

[1] np = not performed

There were numerous false positive results, where one or more PAH concentrations exceeded the benchmark and the site was not judged to be toxic on the basis of either laboratory bioassays or infaunal community assessment. These are reviewed in Table 42. In this database, 60 individual PAH compounds exceeded the Threshold Effects Level (TEL) in seven samples where no toxicity was observed. False positives associated with the TEL were observed for every PAH compound except naphthalene.

Table 42. Summary of Weathered Piling (WP) and Best Management Practices Piling dolphin sites where various PAH benchmarks were exceeded but at which toxicity was not found. The number in each cell is the number of compounds for which exceedances were observed.

Station	TEL	PEL	TEL+PEL/2	WA SQS	US EPA	BC SQC
BP0.5 (384)	11	9	9	5	1	10
BP0.5 (535)	11	2	7	1	0	6
WP0.5 (384)	8	0	1	0	0	1
WP2.0 (384)	12	9	10	6	2	9
BP5.0 (384)	10	1	3	0	0	6
False Negatives	0	0	0	0	3	0
False Positives	52	21	30	12	3	32

Note: A false positive implies the sediment quality criteria were exceeded but toxicity was not observed. False negatives imply that sediment quality criteria were not exceeded but toxic responses were observed.

The Probable Effects Levels (PEL's) resulted in no false negatives but 21 compounds were involved in false positive evaluations at four stations. The British Columbia Sediment Quality Criteria (BC SQC's) gave an intermediate, but still large number of false positive results (32 false positives in six samples) and no false negatives. Similarly, the TEL+PEL/2. a provisional target used locally for remediation of contaminated sites, gave 30 false positives and no false negatives. The less environmentally conservative Washington State Sediment Quality Standards resulted in no false negatives and 12 false positive responses at 3 stations. The Washington State Standard was most efficient at predicting adverse effects. The DRAFT U.S. EPA SQC resulted in three false positive results and three false negative results and did not appear very sensitive in this study.

The reader should bear in mind that these results pertain only to laboratory bioassays. No significant adverse effects were observed in the infaunal community, except possibly within 0.5 metres of the dolphin, suggesting that the above conclusions may be conservative for creosote from the environment's point of view. This is likely due to the nature of the creosote contamination in the sediments, it’s patchy distribution and tendency to remain intact as minute tar droplets or microsheens.

The 2.5 µg/g (dry sediment weight) rejection limit applied to material for ocean disposal was exceeded within 14 days following piling installation at the 0.5 metre downstream station at both the BMP and Weathered piling treatment sites. By 384 days, this trigger was exceeded in the top 2 cm of the sediment column at distances of 7.5 metres downstream from the BP site and 5.0 metres at the WP site. However, assuming this standard applies to the bulk sediment

removed, dredging to a depth of approximately 30 cm would reduce the concentration to a level less than the criterion at all stations. Sampling for ocean disposal, however, does not allow dilution of contaminated sediments by mixing with less contaminated sediment.

Bioassay tests used during the Sooke Basin study suggest that solid phase Microtox™ were sensitive to the PAH contamination without creating a significant number of false positives. Of the fifteen solid phase bioassays conducted, the solid phase test accurately reflected sediment toxicity in twelve cases. There were two false positive results and one false negative response. The Microtox™ porewater tests were overly sensitive to conditions in Sooke Basin and routinely indicated toxic conditions at the Open Control and Mechanical Control stations when compared with laboratory controls. When Microtox™ results were normalized to the Mechanical Control station, the Microtox™ porewater results were highly variable with four false negative and two false positive responses out of 13 tests. Amphipod tests were not sensitive to PAH in Sooke Basin Sediments. No significant negative differences in amphipod survival were observed at the WP and BP sites when compared with survival at the Mechanical Control station. This is consistent with the lack of effects observed in the infaunal community analysis but was inconsistent with the results of the Microtox™ and Echinoid fertilization tests at eight stations. Too few Echinoid fertilization tests were conducted to evaluate their efficiency in predicting results. They did accurately predict toxicity at the most toxic stations but showed only slight decreases (86% and 90%) at the two stations judged to be *Slightly Toxic*.

When bioassay results at the Mechanical Control site are used as a basis for evaluating PAH toxicity associated with the WP and BP sites, the results are very consistent with the infaunal community analysis. This discussion points out the need to carefully define the question being asked when conducting bioassays and to choose an appropriate control. In this study, using laboratory controls as a basis for evaluating conditions in Sooke Basin would have resulted in judging all sites to be toxic – greatly complicating the evaluation of toxicity associated with PAH released from the creosote treated wood structures.

All indications are that the toxicity observed in samples from the Mechanical Control site, despite the absence of measurable increases in PAH chemistry, is real and not simply an artifact. It must be assumed that the same unknown factor(s) is also present at the two treatment sites and therefore, normalizing the toxicity results to the Mechanical Control is appropriate. Toxicity at the treatment sites, however, may be solely due to the presence of the creosote treated pilings and resultant changes in PAH chemistry. Establishing this relationship would allow a more direct comparison between toxicity, concentrations of specific PAH compounds and various sediment quality criteria. Further studies into the exact cause and effect relationship is advisable. This would be a complex issue and require detailed chemical analyses.

6.0 Summary and Conclusions

6.1 Water Column and Surface Sediment PAH Chemistry

- Sediment background total PAH or TPAH (sum of 16 *parental* PAH compounds) concentrations across the Sooke Basin test site prior to the study were low, averaging 0.13 µg/g, dry sediment weight.

- The pilings created a small sheen on the surface of the water during installation. This sheen extended for about a metre around rafted pilings. Sediment PAH characteristics changed appreciably by 14 days post construction. It is assumed that this rapid increase in PAH concentration was largely due to the pile driving operation, deposition of treated wood debris and presence of treated pilings rafted alongside.

- Water column analysis using SPMD devices and mussel tissue as indicators indicated that, beneath the surface, water column concentrations of PAH within 15 to 30 cm of the creosote treated piling are very low (31 ng/L). Application of the methodology described by Swartz *et al*. (1995), indicated a sum of toxic units of 0.0007 in the water column immediately adjacent to the BMP dolphin. This suggests little or no potential for acutely toxic effects from dissolved PAHs. The potential for chronic or sublethal effects was not examined. Model predictions of Brooks (1994) also predicted no potential biological effects in the water column associated with dissolved PAH from creosote treated wood.

- The proportion of low molecular weight PAH compounds (LPAH) in new creosote oil, particularly naphthalene, is significantly reduced during the treatment process. The composition of sedimented PAHs originating from creosote treated wood changes with time. Initially, sedimented PAHs include a high proportion of intermediate compounds (phenanthrene, fluorene, fluoranthene, anthracene). The proportion of these intermediate weight compounds in the benthic sediments declined with time – leading to a higher proportion of the more refractory high molecular weight (HPAH) compounds. These observations are consistent with the physicochemical properties of the various PAHs and literature describing their susceptibility to microbial and other forms of environmental degradation.

- Maximum predicted and observed total PAH concentrations after 384 days exposure are significantly elevated (5.5 µg/g and 4.8 µg/g, respectively) to a distance of 7.5 metres downstream from the BMP dolphin, but not 10 metres and beyond. At 384 days, observed PAH concentrations declined sharply between 7.5 and 10 metres, averaging 0.53 µg/g (n=13), well below the Threshold Effects Level or TEL of 0.75 µg/g, dry weight. Small increases of 0.2 to 0.3 µg/g TPAH dry weight sediment, which have no documented biological significance, were observed downstream to a distance of 50 metres and were considered to be real. Sediment concentrations were similar at both the BMP and Weathered Piling treatment sites.

- Predictions of peak sedimented PAH concentrations using the model of Brooks (1994) are higher at all distance intervals (Figure 55 below) than observed sediment concentrations, suggesting the model is somewhat conservative from an environmental standpoint. Empirical observations, however, suggests caution when large numbers of similar structures are proposed in close proximity to each other. The construction of fifteen similar dolphins within 50 metres of a common point, for example, would elevate sediment concentrations to a level exceeding the Effects Range Low (ER-L) value of 4.0 µg/g suggested by Long et al. (1995).

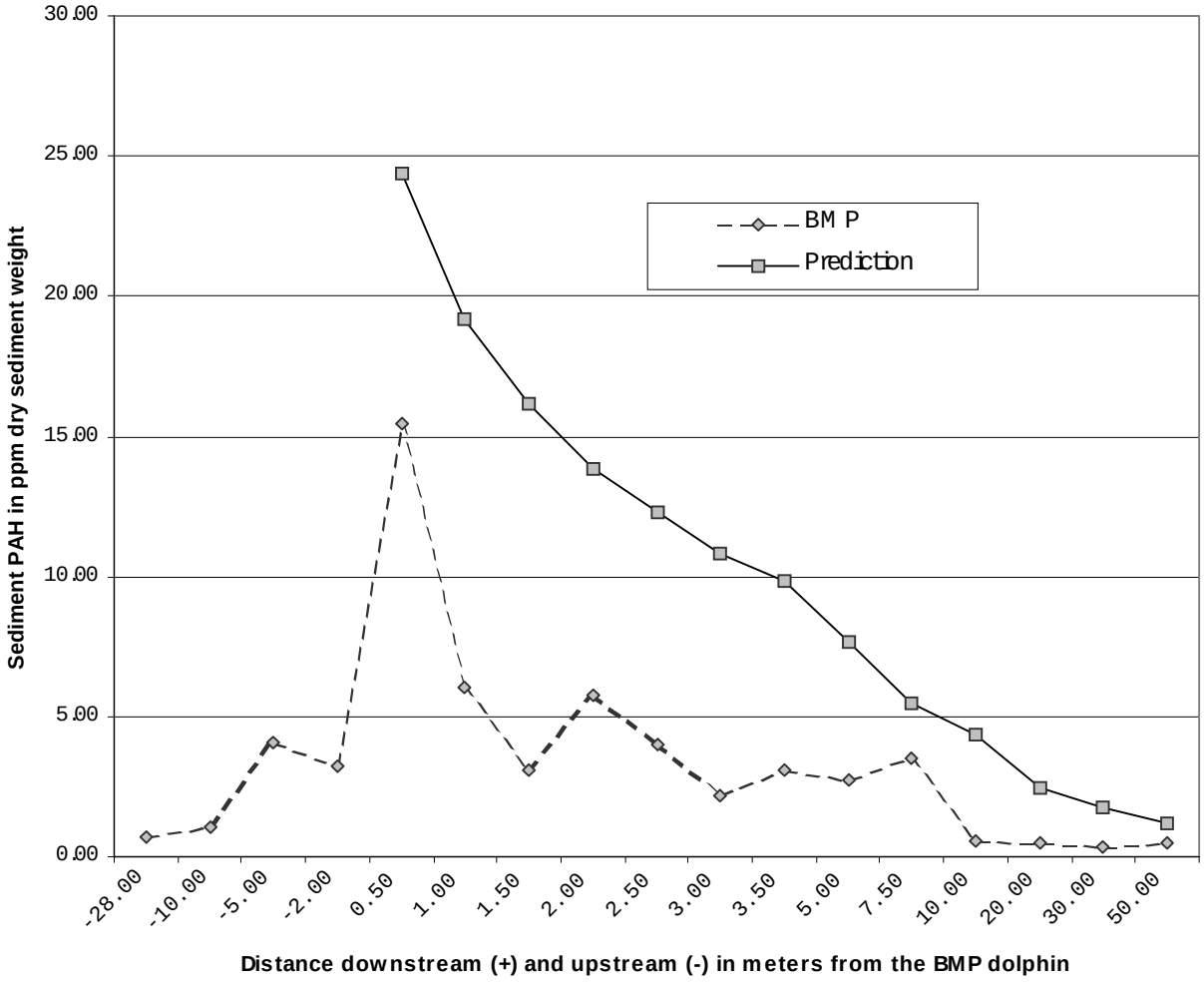


Figure 55. Figure showing predicted maximum PAH concentrations associated with the BMP Dolphin in the Sooke Basin Creosote Evaluation Study and observed sediment PAH concentrations corrected for anticipated additional accumulation before a peak is reached at about three years post construction.

- Observed values at the Sooke Basin Study BMP site were estimated to increase by 18% before reaching the maximum predicted value at about three years post construction.

- Due to the uneven nature of the creosote contamination, a high degree of variability in PAH concentrations was observed in replicate samples from the BMP and Weathered Piling sites, particularly approaching the dolphin structure. Total PAH concentrations in three replicates from the BMP 0.5m station on Day384, for example, varied between 9.9 µg/g and 29.9 µg/g. A fourth homogenized sample contained 14.8 µgTPAH/g. Using non-linear regression analysis of 17 PAHs to a distance of 7.5 metres downstream, a maximum sediment total PAH concentration of 12.3 µg/ g, dry weight at the BMP 0.5 metre station is predicted (Figure 56 below). This is followed by an exponential decline to less than the Long et al., (1995) Effects Range Low or ER-L value of 4.0 µg/g at distances greater than 1.5 metres. Some biological effects associated with PAH would be anticipated within 1.5 metres of the creosote treated structure.

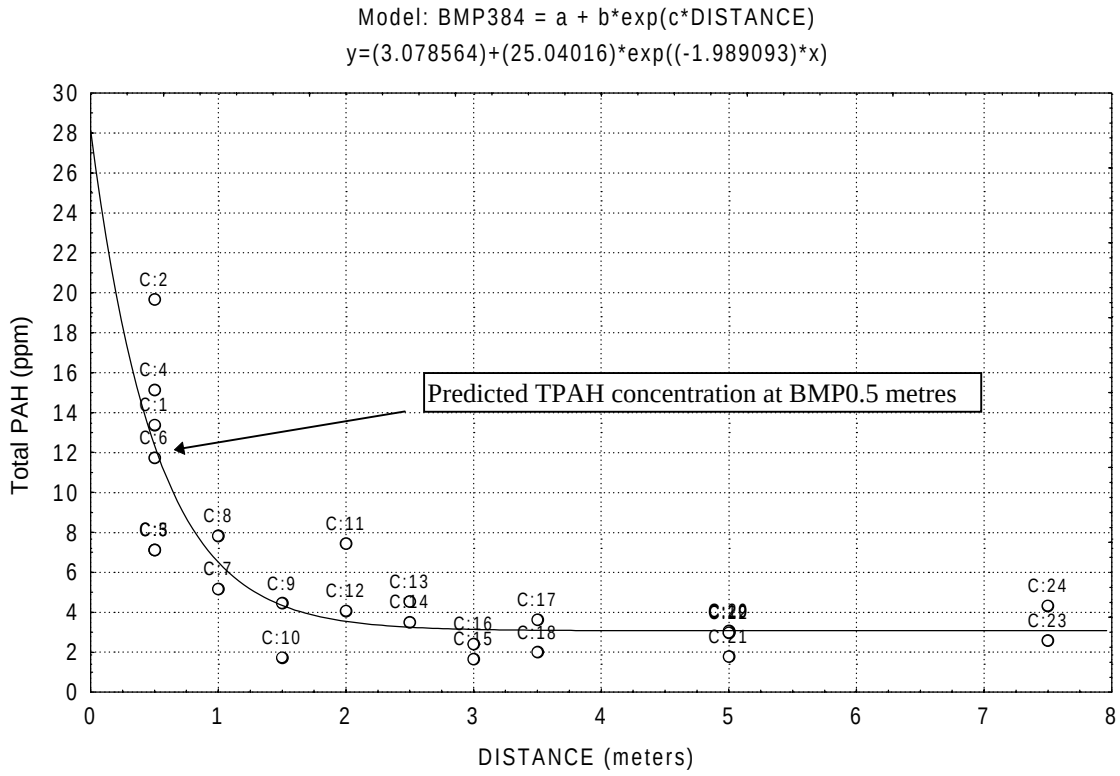


Figure 56. Scatterplot describing sediment accumulations (µg/g, dry sediment weight) of total parental PAH observed 384 days following construction as a function of distance downstream from a six piling dolphin treated using Best Management Practices for the Sooke Basin Creosote Evaluation Study. The accumulations are modeled between 0.5 metres and 7.5 metres downstream using non-linear regression techniques.

6.2 Sediment Toxicity Testing

- When testing for sediment toxicity, care must be taken to select only the most relevant segment of the sediment column, regardless of possible logistical concerns. Ten day amphipod bioassay tests on the entire contents of a benthic sampler, which sampled to a depth of 10 cm showed no effects, even when sediment PAH concentrations in the top 2.0 cm

suggested that effects should have been observed. It was not until sampling was confined only to material from the top 2 cm layer that the bioassays results were more consistent with the sediment chemistry and reported toxicity thresholds. Although requiring multiple grabs, nearly depleting available sites for one-time sampling, this produced more meaningful and realistic results. Analysis of sediment core segments on Day384 at 2 cm intervals revealed an exponential decline in PAH concentration with core depth. It is highly recommended that sediments should not be sampled at depths which exceed the zone of bioturbation when studying biological responses to polycyclic aromatic hydrocarbons. In general, that depth will be approximately 4.0 cm. This normally requires multiple grabs and careful positioning of the replicate grabs to avoid re-sampling the same location.

- Multi-tiered toxicity testing based on 10-day amphipod bioassays, liquid phase Microtox™ and echinoid fertilization inhibition tests indicate that toxic responses can be anticipated at distances of 0.5 metres, or less from the piling dolphin after 384 days, with marginal toxicity downstream to a distance of 2.0 metres. The PAH compounds, fluoranthene and phenanthrene appeared to be the major contributors to sediment toxicity.

6.3 Mussel *in-situ* Bioassays

- No adverse effects on the survival of mussels (Mytilus edulis edulis) suspended from the pilings were observed in a two year *in-situ* bioassay. Mussels grown in close proximity (15 to 30 cm) to either the Weathered piling or those produced using Best Management Practices, grew more slowly than did mussels grown at greater distances. Total body burden *parental* PAH concentrations in mussels held in close proximity to creosote treated piling increased initially, then returned to normal after 185 days. Higher levels of PAH were observed in gonadal tissue than were observed in whole body tissues. Overall, tissue concentrations were low. Marine growth on the pilings may be inhibiting the dispersion of the chemical constituents from creosote treated wood.

- Mussels held in similar locations all spawned successfully. After 48 hours, the proportion of normal "D" hinge larvae was not significantly different at stations close to creosote treated wood when compared with the Open Control. Mussel condition factors were higher in those cohorts raised downstream from creosote treated piling when compared with mussels raised at the control site.

- A carcinogenic risk assessment associated with the consumption of mussels growing in close proximity to the piling indicates that a person would have to eat greater than 400 grams of mussels per day, every day, in order to exceed the maximum U.S. EPA recommendation for intake of carcinogenic PAH. Although the mussels were held in cages suspended as close to the piling as possible, it should be noted that they were not in direct contact with the treated pilings. These results should not be used to predict carcinogenic risks associated with mussels growing directly on the piling.

6.4 Infaunal Benthic Community Analyses

- Only minimal response to the presence of creosote treated wood was observed in this study. No consistent trends were documented in infauna located downstream from the Mechanical

Control dolphin. No decreases in total taxa richness or abundance were documented as a function of time, sedimented PAH concentration or distance downstream from the BMP treated dolphin. The organic carbon content of the sediments in Sooke Basin appears to be a factor in infaunal community sensitivity. Lower abundance and diversity of infauna were observed on all dates at the Open Control and Weathered Piling site located on the southwestern perimeter of the study area. Specific species sensitive to increased concentrations of TOC were documented in this study.

- The abundance of several taxa was positively correlated (significant at $p = 0.05$) with increasing PAH concentration. Only the bivalve Mysella tumida was significantly negatively correlated with the concentration of PAH. A suite of potentially PAH sensitive species with negative correlation coefficients (< - 0.20) was identified and their abundance found to be effected by PAH concentration. Apparent effects thresholds were defined for a variety of PAH and classes of PAH based on regression analysis. These levels are found to be consistent with U.S. EPA and Washington State Sediment Quality Standards but not with other more conservative criteria reviewed in this document.

- Toxicity threshold values at which no decreases in the abundance of PAH sensitive species downstream from the BP dolphin during the Sooke Basin Creosote Evaluation Study are presented below. Results are based on data collected after 185 and 384 days exposure.

Class of PAH	Toxicity Threshold (dry weight sediment)
Phenanthrene	> 2 µg/g
Low Molecular Weight PAH (LPAH)	> 3 µg/g
Fluoranthene	> 3 µg/g
High Molecular Weight PAH (HPAH)	> 6 µg/g
Total PAH (TPAH)	> 10 µg/g

- Comparison of the concentration of individual PAH compounds having acute toxicity with the Canadian Interim Sediment Quality Guidelines, Long et al. (1995), and the Washington Sediment Quality Criteria suggests that phenanthrene poses the highest level of risk followed by lower risks associated with fluorene and acenaphthene. Fluoranthene and chrysene pose the most significant risks associated with high molecular weight compounds. In general, exceedances of either Long et al. (1995) or Washington States SQS were restricted to the BMP 0.5 metre downstream station. Fluoranthene and acenaphthene, however, exceeded the Washington State criteria at the 1.0 metre downstream station.

6.5 Creosote Transport From Piling to Sediment

- The form in which creosote contamination occurs has an important bearing on the chemical and biological effects. A particulate theory of PAH transport and sedimentation is proposed. Results of this study have suggested that creosote is deposited directly onto the benthic sediments in particulate form rather than PAHs and other chemical constituents first leaching into the water column, adsorbing onto suspended matter and then settling to the bottom. This hypothesis is supported by the following observations:

a) very low concentrations of dissolved PAH were observed in the water column, less than those required to explain the sediment accumulations of PAH observed in this study and less than those predicted by the model of Brooks (1994).

b) the bioconcentration of PAH in mussels grown immediately adjacent to the piling is consistent with the observed water column concentrations.

c) small oily microsheens or droplets were observed on the surface and in the subsurface layers of the sediments. These occurred at core depths of 4.0 cm below the sediment/water interface, the point at which the underlying sediment became coarser and more compact.

d) when sediments are vigorously stirred, these small sheens or droplets rapidly re-appear at the air-slurry interface. This same phenomenon has been observed by Brooks (unpublished data) during evaluation of creosote treated timber bridges for the U.S. Forest Service.

e) the discontinuity observed in sedimented PAH concentrations between 7.5 and 10 metres downstream of the BMP dolphin is difficult to explain by conventional PAH transport mechanisms, such as, adsorption to dissolved organic matter, particulate inorganic matter or particulate organic matter. While the silt adsorption mechanism used by Brooks (1994) appears to provide reasonable estimates of sediment concentrations of PAH, the potential for PAH to adsorb to silt, realistically, is unlikely – particularly in a very poorly flushed environment like this part of Sooke Basin. This model is likely successful because the settling velocity (0.05 cm/sec) is appropriate, but with respect to a different transport mechanism.

f) the distribution of PAHs in the benthic sediments – even on a small spatial scale – was very uneven. These results are consistent with the patchy PAH distribution observed in most other sediment investigations.

g) bench tests to assess the likelihood that PAH are transported in a particulate form have revealed the following:

- small microspheres (10 µL to 1.0 mL) of creosote oil injected onto the surface of water in a graduated cylinder immediately spread out in a sheen that remains intact for at least two years,

- when similar microspheres are injected into the water beneath the surface, they retain their integrity and settle to the bottom in a form resembling mercury droplets. These droplets have also remained intact for two years,

- when the surface sheen on the top of a column of water is agitated, as would occur in the environment, the sheen breaks up into irregularly shaped particles that immediately settle to the bottom and remain intact for at least several months,

- the settling rates of these PAH particles are consistent with Stokes Law (Brooks, 1994). Their vertical velocity is dependent primarily on their size.

Bench tests reveal that when these creosote particles were allowed to interact with coarse sand or ground oyster shell (sieved to <200 µm dia), they remained intact and settled into the material with gentle agitation (such as might occur during bioturbation). These particles remained intact while buried in the sediments for at least several months. When exposed to air by decanting the overlying water, these particles immediately disperse out over the surface of the substrate, creating small sheens similar to those observed during the field studies in Sooke Basin.

It is postulated that the primary mode of contamination from the marine installation of creosote treated pilings occurs as:

a) small sheens or minute droplets forming in the surface water microlayer, largely comprised of the lighter, more acutely toxic PAH fractions. This is most likely to occur during warmer summer periods.

b) creosote migrating from the interior of the piling, forms discrete droplets on the piling surface and are then either washed off the piling as the tide rises or dislodged by their own weight as the creosote accumulates. Larger droplets can actually be seen on the surface of the piling - particularly during warm weather. These creosote droplets pass directly through the water column with little or no biological or chemical impact, then settle onto the bottom sediment. The distance from the pilings at which these droplets reach the seabed depends upon their size (which determines their settling velocity) and current speeds. This phenomena likely occurs primarily on that portion of the piling which is either permanently or temporarily exposed, but may also occur on the underwater portion. Marine growth on the piling likely prevents creosote migrating from the piling through the overlying organic matrix. Over time, the more soluble PAH fractions are lost through physical/chemical and biological degradation and the less soluble, higher molecular weight fractions remain. These high molecular weight compounds degrade in sediments more slowly. Their insolubility decreases their effective bioavailability and acute toxicity. However, their catabolic intermediates, such as arene oxides, are known carcinogens and can have chronic effects, particularly on organisms possessing significant PAH metabolizing enzyme systems – such as fish. The carcinogenic effects associated with creosote treatment were not investigated in the Sooke Basin study.

This particulate PAH transport hypothesis has significant implications in terms of understanding and monitoring the impact of creosote treated wood in the marine environment. The environmental implications and the potential ‘real world’ toxicity of sedimented PAHs originating from creosote may be very different from other more diffuse anthropogenic sources of PAH. On the basis of this hypothesis, it would appear that sediment PAH contamination from creosote treated wood is largely in the form of small particles which remain intact until degraded or buried. The result is a mixture of contaminated sediment surrounded by clean sediment. This hypothesis would explain the following observations:

- the patchy nature of PAH in sediments observed in all studies;

- the lack of benthic community response at concentrations less than ca. 10 μg PAH/g dry sediment weight. Organisms are only exposed to PAH when they encounter one of the PAH particles. The impact on the benthic environment would depend upon the total mass of the creosote treated structure, the abundance of creosote droplets present, their rate of descent and the probability that infauna encounter or avoid discrete areas (particles) of PAH contamination.

- The increased toxicity observed in bioassay systems where PAH are dissolved using an organic solvent when compared with bioassays that do not use a solvent or in mesocosm studies such as those conducted by Tagatz *et al.* (1983).

- Differences between the toxic response predicted by Equilibrium Partitioning Theory and that observed in field studies.

6.6 Managing the Use of Creosote Treated Wood in Marine Environments.

These results suggest that creosote treated wood is a product that can create adverse effects in the near field under worst case conditions. Therefore, this is a commodity that must be managed to minimize these environmental risks. The model of Brooks (1994) was shown to be somewhat conservative from an environmental standpoint in this study. This model provides a basis for identifying projects where biological effects are not anticipated and predicting effects at worst case sites like Sooke Basin. Model predictions can be used to develop generalized results guiding the permitting of creosote treated wood projects (Table 43 below). Different environments, defined by different average annual temperature and salinity, will require different charts. The recommendations given in Table 43 are generally appropriate for temperate marine environments in the Northern U.S. and Canada. The predictions given in the body of the tables are for maximum PAH concentrations (μg TPAH/g dry sediment weight) located within 0.33 meters of any one of four new piling arranged in a row parallel to the currents and spaced six feet apart. It should also be noted that the recommendations made in Table 43 are for areas in which current speeds vary harmonically with the tides. A different model (Brooks, 1995) is available for environments where currents flow in only one direction.

The darkly shaded area in the upper left corner of the tables indicates combinations of current speed and Reduction-Oxidation Potential Discontinuity or RPD, which are probably unsuitable for creosote treated wood projects. The predictions in Table 43 use Washington State Apparent Effects Threshold criteria as a basis for assessing biological suitability. Other criteria can be applied to the PAH concentrations given in the table. The predictions suggest that maximum tidal current speeds should be greater than 0.5 cm/sec. In addition, these predictions suggest that anaerobic sediments (RPD = 0.0) are unsuitable unless current speeds are greater than 7 cm/sec.

The lightly shaded areas represent situations that should require an individual project risk assessment. A more careful analysis is required because the predicted PAH concentrations approach or exceed the Washington State Apparent Effects Threshold of 9.78 μg TPAH/g for the suite of PAH compounds found in creosote at 1.0% TOC. A site specific risk assessment will more accurately predict sediment PAH concentrations and more clearly define the risks associated with using creosote treated wood in these marginal cases. In addition, an individual

risk assessment is recommended for all projects involving greater than 350 piling or in environments where significant other sources of PAH, including numerous other creosote treated wood structures, are present.

The unshaded portion of Table 43 indicates combinations of RPD and current speed where there is minimal risk to aquatic resources and where creosote treated wood projects should be permitted without additional risk assessment. Table 43 was constructed with an allowance of 1.5 µg TPAH/g dry sediment background PAH. Where levels of PAH in sediments may already exceed this 'background' value, such as in industrialized areas, the existing sediment PAH levels should be established by sample analyses. These levels should then be added to the model predictions to ensure a realistic assessment of the expected PAH levels at the site. The bolded line encloses combinations of RPD and current speeds that are typical of open estuaries and bays.

Table 43. Summary of no-risk (unshaded), moderate risk requiring additional risk assessment (lightly shaded), and unsuitable (darkly shaded) environments with respect to the use of creosote treated wood in marine environments. Table values are predicted maximum total sedimented PAH in µg/g (ppm), dry sediment weight. Recommendations are for sediments containing 1.0% total organic carbon.

	Depth of the Reduction-Oxidation Potential Discontinuity (cm)						
Maximum Current Speed, (cm/sec)	**0.0**	**0.5**	**1.0**	**1.5**	**2.0**	**3.0**	**4.0**
0.5	**262.96**	**120.25**	**66.79**	**43.83**	**33.05**	**25.50**	**24.57**
1	**131.48**	**60.13**	**33.4**	**21.91**	**16.52**	**12.75**	**12.29**
2	**65.74**	**30.06**	**16.7**	**10.96**	**8.26**	**6.37**	**6.14**
3	**43.83**	**20.04**	**11.13**	**7.30**	**5.51**	**4.25**	**4.10**
4	**32.87**	**15.03**	**8.35**	**5.48**	**4.13**	**3.19**	**3.07**
5	**26.30**	**12.03**	**6.68**	**4.38**	**3.30**	**2.55**	**2.46**
6	**21.91**	**10.02**	**5.57**	**3.65**	**2.75**	**2.12**	**2.05**
7	**18.78**	**8.59**	**4.77**	**3.13**	**2.36**	**1.82**	**1.76**
8	**16.43**	**7.52**	**4.17**	**2.74**	**2.07**	**1.59**	**1.54**
9	**14.61**	**6.68**	**3.71**	**2.43**	**1.84**	**1.42**	**1.37**
10	**13.15**	**6.01**	**3.34**	**2.19**	**1.65**	**1.27**	**1.23**
11	**11.95**	**5.47**	**3.04**	**1.99**	**1.50**	**1.16**	**1.12**
12	**10.96**	**5.01**	**2.78**	**1.83**	**1.38**	**1.06**	**1.02**
13	**10.11**	**4.63**	**2.57**	**1.69**	**1.27**	**0.98**	**0.95**
14	**9.39**	**4.29**	**2.39**	**1.57**	**1.18**	**0.91**	**0.88**
15	**8.77**	**4.01**	**2.23**	**1.46**	**1.10**	**0.85**	**0.82**
16	**8.22**	**3.76**	**2.09**	**1.37**	**1.03**	**0.80**	**0.77**
17	**7.73**	**3.54**	**1.96**	**1.29**	**0.97**	**0.75**	**0.72**
18	**7.30**	**3.34**	**1.86**	**1.22**	**0.92**	**0.71**	**0.68**
19	**6.92**	**3.16**	**1.76**	**1.15**	**0.87**	**0.67**	**0.65**
20	**6.57**	**3.01**	**1.67**	**1.10**	**0.83**	**0.64**	**0.61**

In general, it is important to emphasize that this study was designed to represent a worst case condition involving a pristine environment with biologically active sediments, moderately low TOC levels and very slow current speeds. The BMP treated pilings used in this study were significantly overtreated to a retention that exceeded the target by 159% - further increasing the worst case approach. No confounding PAH inputs were observed during this study. No

significant differences were observed between the environmental performance of five year old weathered piling and new piling produced using CITW sponsored Best Management Practices.

The most significant concentrations of PAH and toxic biological responses observed during this study occurred within the footprint of the dolphin and downstream to a distance of approximately 0.65 metres. However, it is also important to note that detailed field measurements were only carried out over a 384 day period, followed by limited additional sampling on Day535. Trends in the sediment chemistry after 384 days and model predictions suggest that PAH concentrations have not yet reached their peak. Chronic effects associated with PAH exposure also were not investigated. The Sooke Basin study examined the effects from a specific mass of creosote treated wood (six piling dolphins). Impact on aquatic environments would depend upon the total amount of creosote treated wood present, above and below water.

6.7 Summary.

This study has shown that under worst case conditions, significant PAH contamination was restricted to an area within 7.5 metres from the perimeter of a significant structure. The response of an extensive infaunal community analysis and laboratory bioassays indicates that significant adverse biological effects were found within a distance of approximately 0.65 metres from the perimeter of the structure. Slight adverse effects were observed to a distance of 2.0 metres in laboratory bioassays but not in the infaunal community. Results are summarized in Figure 56.

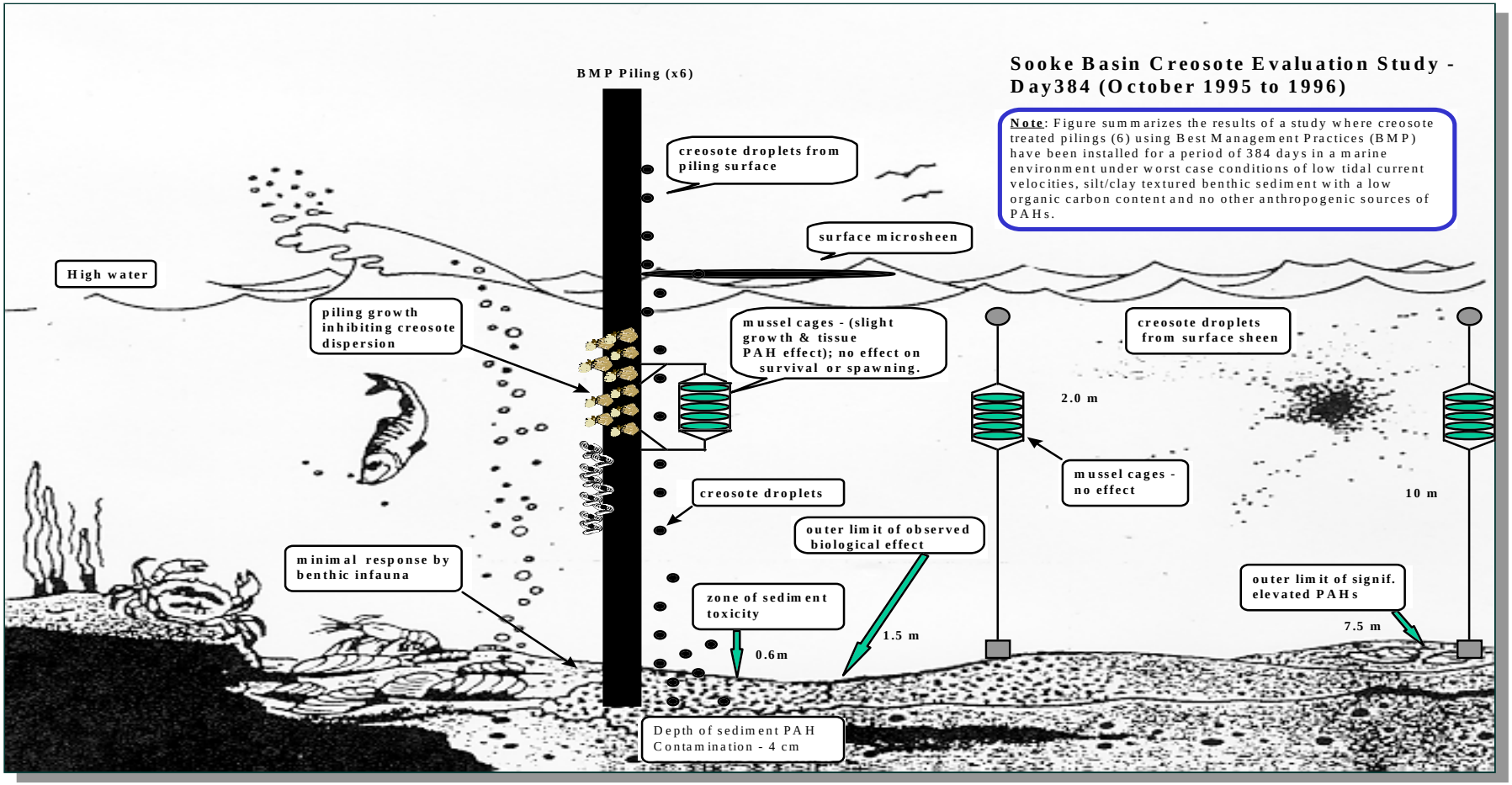


Figure 57. Schematic diagram summarizing the primary sources and impacts from creosote treated pilings in the marine environment after 384 days during the 1995 - 1996 Creosote Evaluation Study in Sooke Basin, British Columbia

7.0 Future Studies

The Particulate Hypothesis of PAH Transport developed in this study has significant implications for the entire field of PAH toxicology. All of the preliminary tests are supportive of the hypothesis– suggesting that future investigations are warranted.

Since the level of sediment PAH contamination at the Sooke Basin Study site has not yet reached it's peak based on model predictions, additional chemical and biological sampling at a number of key locations should be undertaken to determine the total impact and model reliability. Samples should be taken at three years post construction (October, 1998) and again in October 2000.

This long term study also provides a basis for understanding the natural remediation of creosote contaminated sediments. This could be accomplished by removing the Weathered Piling dolphin following an October, 1998 sampling and conducting follow-up PAH sampling in October, 1999 and October, 2000.

The Mechanical Control should be left in place as an appropriate control for any future studies. At the end of the study, piling from Mechanical Control dolphin should be examined and degradation of the untreated wood documented. The exact cause of the sediment toxicity observed at the Mechanical Control site has not been fully resolved and certainly bears further study.

The significance of the offshore sediment PAH concentrations and differences in results from separate laboratory analyses of PAH remain unresolved. At the present time, it appears that these questions can only be resolved through additional study. This could be incorporated in an October, 1998 sampling event.

The database gathered during the Sooke Basin study contains a wealth of information that remains unexplored in this report. The alkylated PAH and dibenzofuran data are unique and certainly bear further analysis and interpretation. Data are also available to assist in evaluating the fate and biological effects of specific alkylated and parental PAH over time - their degradation rates and significance to sediment composition, and toxicity.

The database presented also contains information on the relationship between discrete and composite sampling, and appropriate sampling methods to define the environmental impacts from creosote treated wood. These elements could be incorporated into a study of the PAH transport mechanisms.

This study focused primarily on the chemical and acute toxicity effects of parental PAH associated with creosote treated wood. The Sooke Basin study site offers a unique opportunity to examine the sublethal and genotoxic effects associated with creosote and it's chemical components, taking advantage of an already extensive chemical and biological database.

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Creosote Evaluation: Phase II
Sooke Basin Study - Baseline to 535 Days Post Construction
1995-1996

APPENDICES

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List of Appendices

APPENDIX I

BEST

MANAGEMENT

PRACTICES

FOR THE USE OF

TREATED WOOD

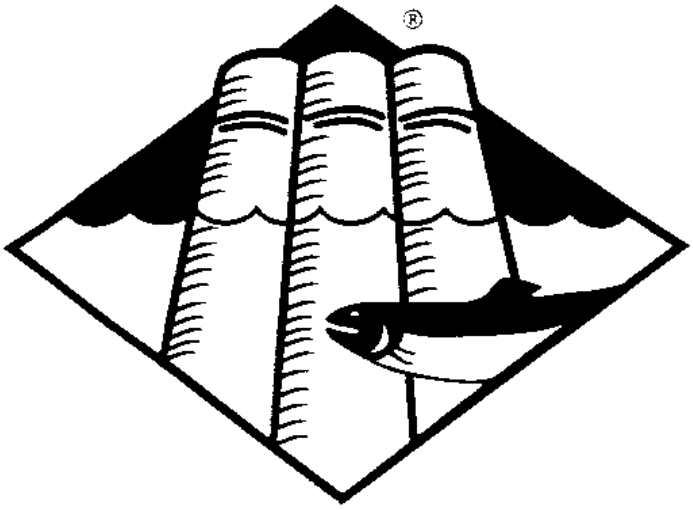
IN AQUATIC

ENVIRONMENTS

(Creosote only)

Appendix I
(Creosote only)

BEST MANAGEMENT PRACTICES FOR THE USE OF TREATED WOOD IN AQUATIC ENVIRONMENTS



CANADIAN VERSION - JANUARY 1997

Developed For Use In Specifying Materials For Use In Aquatic Projects
in Canada and the Western United States by:
Canadian Institute of Treated Wood - Western Wood Preservers Institute

NOTE: CANADIAN AND USA VERSIONS

Both a Canadian and USA version of this document have been prepared. However, the differences are minimal, reflecting, only the slight differences in the appropriate product standards between those of the Canadian Standards Association and the American Wood Preservers Association.

DISCLAIMER

The Canadian Institute of Treated Wood and the Western Wood Preservers Institute believes the information contained herein to be based on up-to-date scientific and economic information and is intended for general informational purposes. In furnishing this information. the Institutes make no warranty or representation. either expressed or implied, as to the reliability or accuracy of such information, nor do the Institutes assume any liability resulting from use of or reliance upon the information by any party. This document should also not be construed as a specific endorsement or warranty, direct or implied. of treated wood products or preservatives, in terms of performance. environmental impact. or safety. The information contained herein should not be construed as a recommendation to violate any federal. provincial. state or municipal law, rule or regulation, and any party using, or producing- pressure treated wood products should review all such laws. rules or regulations prior to using or producing treated wood products.

BEST MANAGEMENT PRACTICES
TABLE OF CONTENTS

Note: At the time of preparation. ACQ and ACZA-treated materials were not available from producers in Canada. Materials treated with copper naphthenate were available on a limited basis. BMPs for the USA have been included for these preservatives as appropriate.

BEST MANAGEMENT PRACTICES FOR THE USE OF TREATED WOOD IN AQUATIC ENVIRONMENTS
INTRODUCTION

PURPOSE

Protection of the quality of the water and diversity of the various life forms found in the lakes, streams. estuaries, bays and wetlands of North America is a goal and responsibility shared by every citizen. An endless list of human activities can impact the aquatic environment: storm waters that run off our streets, exhaust from our boats and cars, municipal and industry discharges, and construction of docks and piers. to name but a few. 'Maintaining the quality of our treasured aquatic resources requires that everyone do their part.

Pressure treated wood is a major material used to construct the piers. docks, buildings, walks and decks used in and above aquatic environments. The pressure treated wood products industry is committed to assuring its products are manufactured and installed in a manner *which minimizes* any potential for adverse impacts to these important environments. To achieve this objective the industry has developed and encourages the use of **BEST MANAGEMENT PRACTICES or BMPs.**

There are a variety of treatments and treated wood products approved for use in or above aquatic environments. Because of inherent differences in the treatment chemicals and the processes there are also a number of BMPs. While the Goal of the **BMPs** are common, i.e., to minimize the migration or leaching of chemicals into the environment. the methods for achieving the goal vary and are discussed in detail. **It is the responsibility of the treating firm to assure that materials leaving the plant destined, and so designated, for use in aquatic environments have been produced in compliance with the BMPs.**

BMPs are in a state of evolution. While this document represents the best available technologies and knowledge. efforts are continuing to develop better methods for risk assessment. to improve the BMPs themselves and to develop a quality assurance process for use by specifiers and regulatory agencies. Research continues in several areas including understanding the environmental impacts of the products, improved treating systems. opportunities to reduce the amount of chemical needed to achieve performance and development of new preservatives. As the knowledge increases the BMPs will be updated and improved.

Please complete and return the form on Page 33 to become a registered BMP recipient. You will then receive all future updates at no charge.

BEST MANAGEMENT PRACTICES

UTILIZING the BMPs

There are four steps to assure products utilized in aquatic environments incorporate BMP produced materials.

1. Specify the appropriate material in terms of performance as defined in the latest edition of the CAN/CSA-080 Series - Wood Preservation.

2. Specify that the material be produced in compliance with these BMPs.

3. Require assurance that the products were produced in conformance with the BMPs.

4. Provide for on-site inspection prior to installation and conformance with any recommended installation practices.

BEST MANAGEMENT PRACTICES
SPECIFYING MATERIALS

A key step in designing a project in an aquatic environment is the specification of the treated wood to be used. There are a variety of available treated wood products approved for use **in and/or above** aquatic environments depending upon the intended use, species, required performance and environmental conditions. The specifier should recognize that, in terms of required retention levels (CSA Standards) as well as potential environmental impacts, materials specified for applications above or over the water are distinctly different than splash zone or in water applications. The industry treats only with preservative chemicals registered for the specific uses by the Pest Management Regulatory Agency of Health Canada. The most common products are those treated with Creosote, ACA (Ammonical Copper Arsenate) and CCA (Chromated Copper Arsenate). **Other preservatives** approved for some uses in or above water are Penta (Pentachlorophenol), **Copper Naphthenate*** and ACQ* (Ammonical Copper Quaternary).

ACZA" (Ammonical Copper Zinc Arsenate) is currently not registered for use in Canada.

PERFORMANCE

The purpose of treating wood products is to provide protection from organisms that can attack or decay the wood. thus extending the useful life and structural performance of the material. The appropriate applications of each product, the required penetration. and the required retention (amount of preservative in the assay zone) are established by the Canadian Standards **Association in their** Commodity Standards which delineate the methods and results of product treatment. A brief description of appropriate applications for each preservative in aquatic environments is included In each specific BMP.

ENVIRONMENTAL AND AESTHETIC CONSIDERATIONS

In designing a project. one needs to consider the characteristics of various treated wood products in relation to the purpose of the project and the environmental characteristics of the site. For example, the environmental risks associated with treated wood placed directly in the water are different from those associated with wood placed over the water. Products used in a heavy industrial application will likely be different from those used in a public boardwalk. Similarly, the use of moderate amount of treated wood in stagnant water may pose significantly greater risks.

Based on the best available science, pressure treated wood poses minimal risk to aquatic environments when used in accordance with the CSA specifications; installed following the guidance provided in the treated wood Material Safety Data Sheets (MSDS): used in conformance with the Consumer Information Sheets; and produced using CITW’s Best Management Practices (BMPs).

See note in the Table of Contents

For further discussion of the environmental aspects of BMPs and specification, see “ENVIRONMENTAL CONSIDERATIONS AND EVALUATIONS FOR USING BMP TREATED WOOD IN AQUATIC PROJECTS" on Page 29.

Note: While provision of Material Safety Data Sheets (MSDS) and Consumer Information Sheets (CIS) is not mandatory in Canada, both types of publications are made available by many treating companies on a voluntary basis, upon request-

BEST MANAGEMENT PRACTICES
for
CREOSOTE

USES AND SPECIFICATIONS

Creosote is specified for a full range of aquatic applications including lumber and timbers (080.2.080.18): bridges (080.2. 080.14); laminated beams in freshwater contact (080.28); and piling in freshwater. and saltwater uses (080.3, 080.18). **Note: Figures in parenthesis are CSA Commodity Specification Standards which should be consulted for appropriate treatment requirements.**

Specifiers and installers should follow the guidance in the Creosote treated wood Material Safety Data Sheets (MSDS) and use the material in conformance with the Consumer Information Sheet for Creosote pressure treated wood. Creosote should not be used in those portions of projects subject to frequent public contact. i.e.. handrails, sunbathing decks, etc.

BEST MANAGEMENT PRACTICES

In order to minimize the amount of Creosote material available to migrate into the environment, the following guidelines shall be used when treating material for use in marine applications:

TREATMENT PROCEDURES

Treat using preservative specified in CSA 080.1, which references AWPA Standard P1/P13. “Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal Water) Use.

Follow good housekeeping practices to minimize sawdust and other surface residues on the wood products prior to treatment.

The “in use” Creosote inventory maintained by the treating, firm at the plant for aquatic applications shall be purchased, managed and/or processed such as to maintain a xylene insoluble (XI) of 0.5% maximum.

Techniques shall be incorporated into the treating process to minimize the amount of residual Creosote which may occur on the surface of the treated product. Techniques may vary depending upon the product type and wood species.

Conditioning- The wood must be conditioned using one of the techniques recommended in Standard 080.2 or 080.3 of CAN/CSA080 Series Wood Preservation.

POST TREATMENT PROCEDURES

Prior to shipment, material for aquatic applications shall be processed under one or the following procedures as determined by the producer:

Expansion Bath - Following the pressure period the Creosote should be heated to 5 to 10^{o}C above press temperatures for a minimum of one hour. Pump Creosote back to Storage and apply a minimum vacuum of 75 kPa for a minimum of 2 hours.

Steaming - Following the pressure period and once the creosote has been pumped back to the storage tank. a vacuum shall be applied for a minimum of two hours at not less than 75 kPa of vacuum to recover excess preservative.

Release vacuum back to atmospheric pressure and steam for a two hour time period for lumber and timbers and three hours for piling. Maximum temperature during this process shall not exceed 115^{o}C. Apply a second vacuum for a minimum of four hours at 75 kPa of vacuum.

MAXIMUM CHEMICAL LOADING

Treating shall be conducted in such a manner as to seek to minimize the amount of chemical placed into the wood while assuming conformance with the CSA retention and penetration requirements.

VISUAL INSPECTION

The Creosote product shall be inspected visually to insure that there are no excessive residual materials or preservative deposits. If the material does not appear clean and dry it shall be rejected. Once on site and prior to installation the materials should be visually inspected in accordance with the above directions. Materials which have developed areas of bleeding," or do not meet the criteria of a clean and dry appearance should be rejected. Good housekeeping is essential to avoid surface deposits and keep the product clean until shipment and installation.

TECHNICAL NOTES

The purpose of the BMPs for Creosote is to minimize the amount of surface residues which are available to migrate to the environment. The purchase of low xylene new Creosote and management processes to **maintain low levels will assure that** there are a minimum of contaminants on the surface of the finished product. The post conditioning requirements (e.g. steaming and/or expansion bath) help to assure that excess Creosote is removed **from the product.** This must be accomplished in a manner which does not reduce the amount of Creosote in the assay zone (retention) below that specified for the particular product and application.

Surface Sheen - When driving Creosote piling, a visible sheen will often develop on the water surface. This sheen represents a trace quantity of Creosote. In almost all instances the sheen will dissipate within 24-48 hours through biodegradation., evaporation or oxidation of the Creosote. Available data indicates that this sheen, which decreases rapidly following installation. will not harm aquatic life nor will it enter the food chain.

Efforts to set precise maximum chemical loading levels have proven technologically unachievable due to the inherent variability found in wood including structure and amount of sap versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the CSA standards consistent with maintaining the needed protection provided by treating.

BEST MANAGEMENT PRACTICES

ENVIRONMENTAL CONSIDERATIONS FOR USING BMP TREATED WOOD IN AQUATIC PROJECTS

Preservatives protect wood by inhibiting, fungal and borer attack. The effectiveness of these treatments is achieved by forcing naturally occurring, metals (copper, chromium, zinc, arsenic) or polycyclic aromatic hydrocarbons (PAH) into the wood under pressure. In properly treated wood, preservatives are stable and minimal amounts are lost. However, the biological risks associated with these releases have caused concern within some governmental regulatory agencies. In response to these concerns, the Institutes have commissioned extensive literature reviews and environmental risk analyses associated with the major preservative treated wood products utilized **in aquatic** environments. Through these ongoing efforts, over 7000 pages of **information regarding these risks** have been reviewed and analyzed. The research effort resulted in the production of detailed risk assessment documents and computer risk assessment models for a creosote, CCA and **ACZA which** discuss and quantitatively predict the environmental levels of preservatives associated with treated wood products. In addition to these currently available tools (see summary discussions below), a similar analysis and model is nearing completion for ACQ. These tools, available through the Institutes, are intended to allow the regulator or specifier to analyze the potential environmental impact of using treated wood products where site specific information justifies such analysis. Such intense review and modeling is not considered appropriate for preservatives normally limited to above water uses such as Penta and Copper Naphthenate.

ENVIRONMENTAL RISKS ASSOCIATED WITH CREOSOTE

The compounds of concern in creosote are called polycyclic aromatic hydrocarbons (PAH). These compounds are naturally produced and have been ubiquitous on earth since carbon was first fixed in organic compounds. Annual inputs of PAH to aquatic environments from all sources is estimated at 227,000 tonnes worldwide. Much of this input is from natural sources. such as forest fires. However, inputs from cities and industry can result in the localized accumulation of PAH in sediments to levels that are toxic to aquatic organisms.

Polycyclic aromatic hydrocarbons are hydrophobic and rarely occur in the water column at levels that are toxic to aquatic organisms. In healthy sediments, with adequate oxygen, naturally occurring microbes metabolize PAH. However, where sediments are devoid of oxygen, these compounds can accumulate to levels that cause acute and chronic toxicity in a variety of fish and invertebrates.

The use of creosote treated piling in fast flowing water with sandy or gravely substrates generally poses no risk. However, the use of large amounts of creosote treated wood in very poorly flushed waterbodies, especially those with muddy sediments that lack oxygen, can result in the accumulation of toxic levels of PAH. To help identify these high risk areas, WWPI has sponsored the creation of computer models which predict the accumulation of PAH in sediments as function of several important parameters. Testing the creosote model under two worst case studies in Canada demonstrated its ability to very accurately predict sediment levels of PAH.

These models suggest that maximum concentrations of PAH occur within a few centimetres of a piling. Further, these models can be used to determine the minimum current speeds required. as a function of the amount of oxygen in the sediments, to help protect our aquatic resources against toxic levels of PAH. Table I can be used to predict conditions where individual site assessments are warranted.

This table is based on a sediment Total Organic Carbon (TOC) content of one percent. Different levels of TOC will result in different requirements. In open marine or freshwater environments, maximum currents are generally greater than 8 to 10 centimetres per second. The RPD is the Reduction Oxidation Potential Discontinuity. This is the depth at which the sediment color turns from gray-green to black. It is measured in centimetres below the sediment surface.

Minimum current speeds required to protect aquatic life are significantly less in constantly flowing water. The use of moderate amounts of creosote treated wood (fewer than five piling in a row parallel with the currents) is not likely to affect aquatic resources where the current speed is greater than 10 cm/sec. Where sediments are well oxygenated (RPD>3 cm), current speeds as slow as 3 cm/sec are adequate to protect aquatic life.

TABLE I

Minimurn current speeds necessary to prevent unacceptable levels of PAH from accumulatin- in marine sediments with varying levels of oxygen (measured by the depth of the Redox Potential Discontinuity in centimetres).

Depth of the RPD	Maximum Currents Required*
0.0 cm	31.0 cm/sec
0.1 cm	14.5 cm/sec
1.0 cm	8.0 cm,/sec
2.0 cm	4.0 cm/sec
> 3.0 cm	3.0 cm/sec

These currents should be measured three hours before or after slack ride on a tidal exchange to mean low water (18.6.year average of all low rides),

For a more detailed examination of these issues, please refer to the Creosote Risk Assessment documents and CREORISK model. Both of these documents are available through the Institutes.

The following briefly summarizes environmental concerns regarding the use of creosote:

1. Water column levels of PAH associated with creosote treated wood do not pose significant risks in open bodies of water.

2. An in-depth analysis of creosote use in association with drinking water fully supports the EPA Consumer Information Sheet which allows the incidental use of creosote treated wood in drinking water supplies.

3. When large creosote projects are contemplated in poorly circulated water bodies where sediments contain low oxygen levels, a site specific risk assessment should be undertaken.

If you have questions. need additional copies of this document, or guidance on specifying treated wood in aquatic environments, please contact:

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APPENDIX II

CREOSOTE EVALUATION STUDY - Phase II

Field Procedures and Analytical Protocols

CREOSOTE EVALUATION STUDY - Phase II

Field Procedures and Analytical Protocols

Objective: The objective of this study is to determine the spatial and temporal effects of creosote treated wood on living resources. The study will involve the installation of creosote treated piling in a clean marine environment meeting specific physical, chemical and biological requirements. These site selection requirements were developed in order to optimize the potential for observing biological and chemical effects associated with creosote treated wood. The study is a BACT design (before-after-control-treatment) and will continue for a 1 to 2 year period. A brief outline of the study is attached.

Site selection (Figure 1). Site selection was accomplished during the winter of 1995. The southern shore of Sooke Basin was chosen because it most closely meets a list of screening criteria developed by the study participants. Underwater surveys are to be carried out at each treatment site within Sooke Basin before the pilings are driven. This will ensure that sediment characteristics and other test conditions are uniform at each treatment site and similar between sites. Sample sites will be located in approximately 7 metres of water (MLLW).

Treatment sites. Treatment sites consist of: a) BMP treated pilings, b) 5 year land-weathered pilings, c) untreated pilings used for a mechanical control and, d) an open control with no pilings installed. Spacing between each set of dolphins must be at least 100 ft., with the land-weathered pilings at the western end of the test area, the untreated mechanical control pilings in the centre and the BMP pilings at the easternmost end. The open control site should be located within the same general area and at the same depth.

a) **BMP Treated Piling**.** A small dolphin, consisting of six creosote treated piling, averaging approximately 30 cm in diameter, will be constructed. The dolphins will have a base of approximately 2.5 to 3.0 metres and the piling will be tied together at the top. These piling will be treated with creosote preservative to a retention of 20 pcf by Stella Jones in accordance with *Best Management Practices* published by the Canadian Institute of Treated Wood (CITW).

b) **Aged Piling**.** A second, identical dolphin will be constructed of conventionally treated creosote piling that has been land-weathered for five years.

c) **Control Piling.** A third dolphin will be constructed of six, 30 cm diameter, untreated Douglas fir piles. This dolphin serves as a mechanical control to assess the effects associated with the installation and presence of the dolphin structure.

d) **Control.** A fourth site will be selected as an undisturbed control. This will allow the study to determine the effects associated with the structure and to compare those effects with similar, creosote treated structures.

** NOTE: Core samples are to be taken from the outer 1.0 cm. of the land-weathered

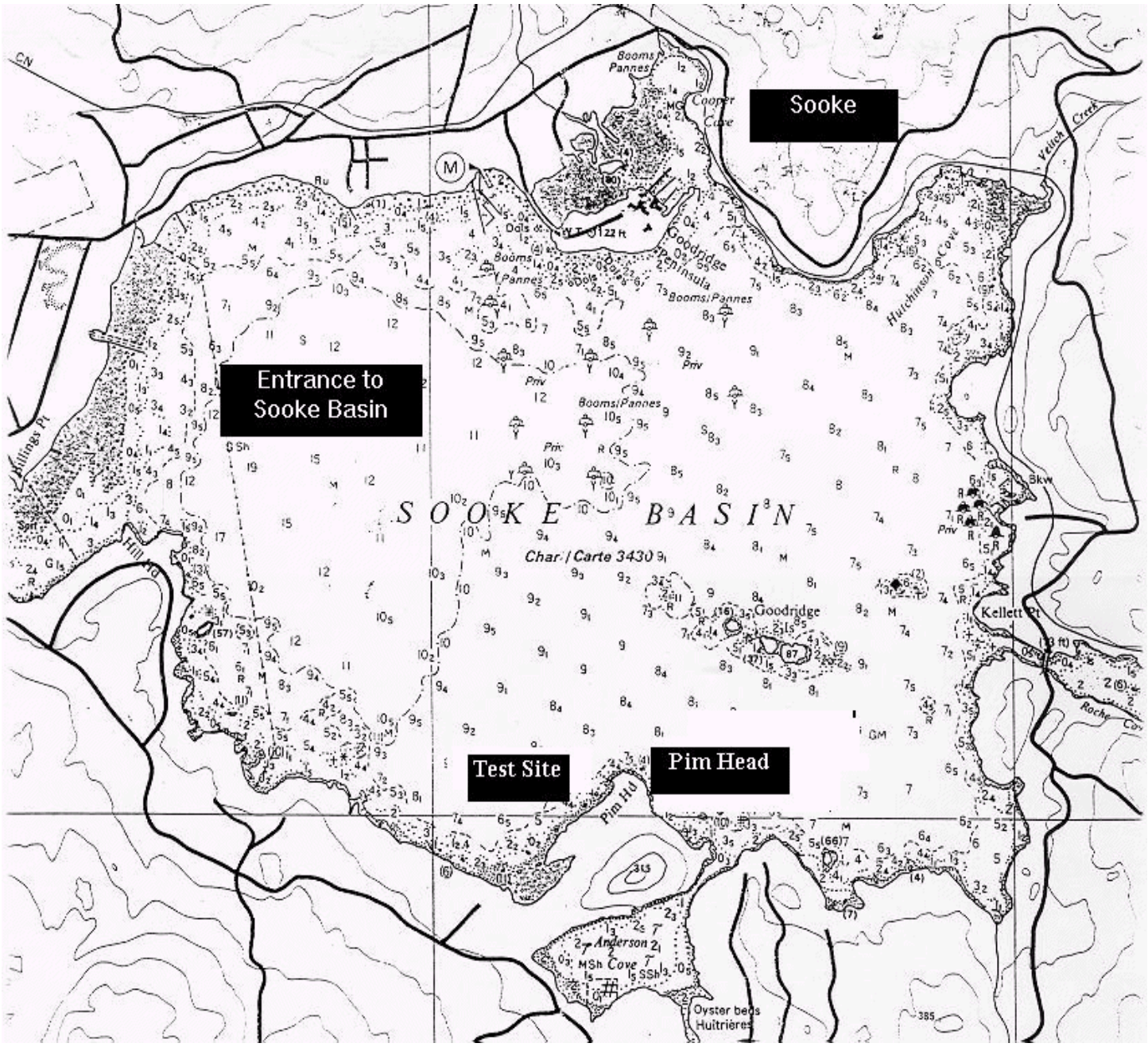


Figure 1. Proposed Sooke Basin Test Site

pilings and BMP pilings just prior to installation, frozen and submitted for PAH analysis.

Sampling design (Figure 2). Sampling is to take place periodically over the next 1 to 2 years, before and after piling installation. Sampling intensity varies between sites with the primary focus on the BMP and the untreated mechanical control pilings. Prior to piling installation, baseline sampling is to take place along a single transect at each treatment site located immediately adjacent to, but not within, the area selected for post-installation sampling. Post-installation sampling in Year 1 will take place along four additional sediment sampling 'downstream' and opposing 'upstream' transects. Two additional transects will be reserved for mussel cages and Year 2 sampling, if funding is available. All transects will be selected at random according to the particular sampling period, but, sampled only once during the study.

Sampling will be a combination of **replicate sampling** (generally triplicates) at discrete distances along each transect for some parameters and treatment sites and **single samples** taken at closer intervals supported by **duplicate** samples collected at specified intervals, totalling 3/station.

Samples from the 'upstream' stations are to be taken at 2.0, 5.0 and 10 metres. Only the 2m sample will be submitted for analysis. The remaining samples are to be appropriately preserved and archived in case further analysis is required. The degree of 'upstream' sampling will depend upon the level of confidence in establishing the predominant current direction based on existing information and results collected from the anticipated 'downstream' stations during the early stages of the study. Samples intended for chemical and bioassay tests are to be taken along each transect at "Position A", as shown in Figure 2. Samples for infaunal analysis are to be collected from the opposing side (i.e. Position B). The type of analysis (chemistry/bioassays vs. infauna) applied to each set of samples will be determined randomly after collection.

Sampling distances, number of replicates, etc., for each treatment site are shown in Table 1. Samples shown in brackets are to be collected but not analyzed. These are to be kept cool, away from light and given to Environment Canada for storage (-40 °C).

Note: At the BMP and mechanical control site, post-installation samples collected at the 'downstream' stations for sediment chemistry and infauna are single samples taken at closer intervals (i.e. 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 5, 7.5, 10, 20 and 30 metres). In addition, duplicate samples are to be collected at the 0.5, 5 and 10 metre stations. The latter are to provide a measure of sample variability and matching data for other parameters collected at discrete locations.

Sampling transects (Figure 2). Five parallel transects, spaced 0.67 metres apart, will be permanently marked immediately after piling installation at each treatment site. The beginning and end of each transect will be marked with a white PVC pipe. In addition, the centreline of each transect will be marked at distances of 0.5, 1.0, 1.5, 2.0, 2.5 3.0, 3.5, 7.5, 10, 20, and 30 metres from the edge of the piling. Each white PVC marker shall have its distance permanently marked on each side. This will minimize disturbance of the sediments during subsequent sampling.

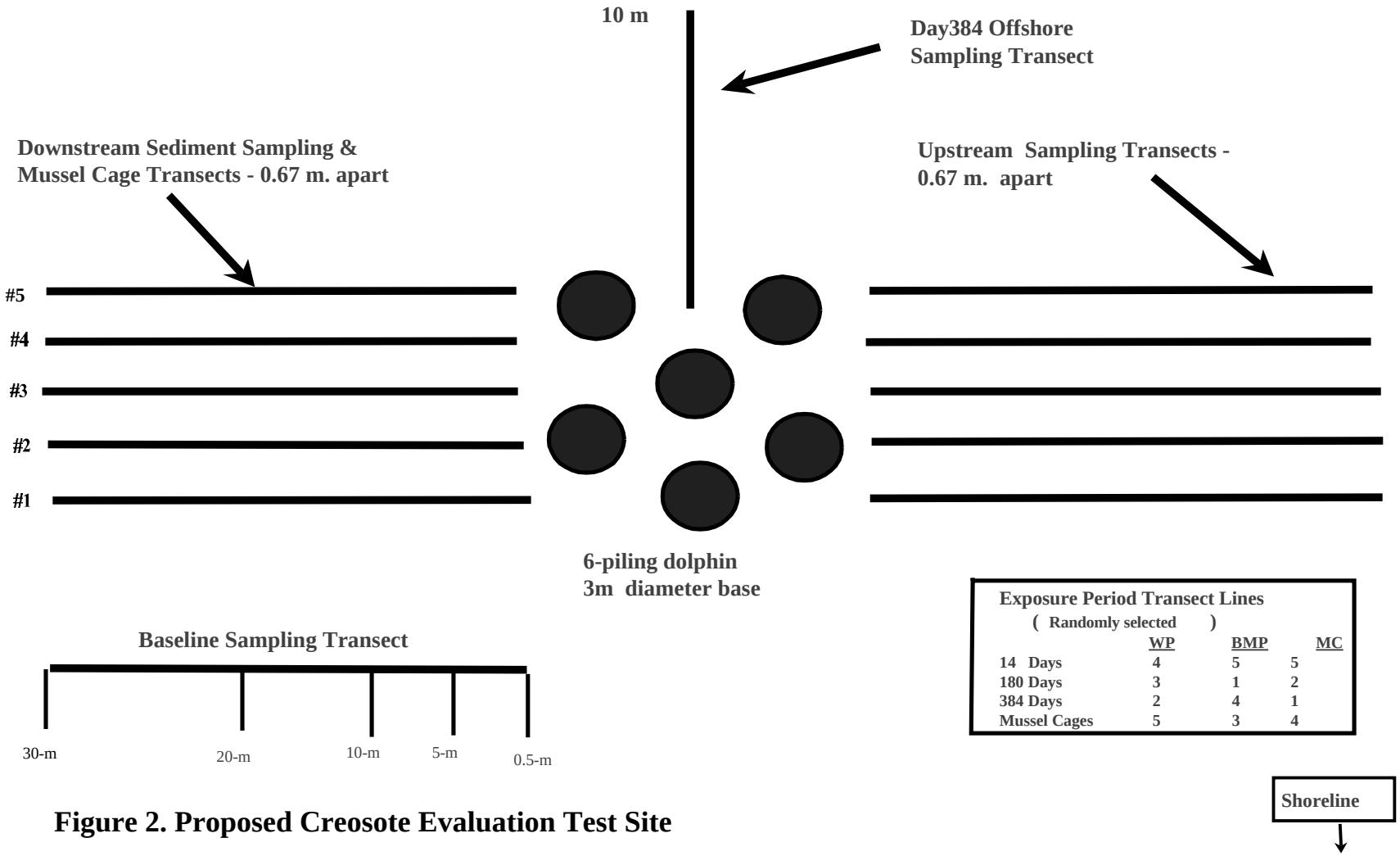


Figure 2. Proposed Creosote Evaluation Test Site

Table 1. List of Samples: Sooke Basin Creosote Evaluation Study - Phase II (1995-96)

Site	Sampling	Parameters	Current Direction	Sampling Stations	Sample Volume (min.)	No. Replicates/Stn.	N0. Samples/Sampling Period	No. Sampling Periods	Total No. Samples Collected	Total Analyzed	By Parameter
BMP	Chemistry	PAH,TOC, Redox, Part. Size	Baseline	0.5, 2.0, 5.0, 10, 30m	50mL	2	15	1	15	5	
			Downstream	0.5, 1, 1.5, 2, 2.5, 3, 3.5, 5, 7.5, 10, 30, 30m	50mL	1	12	3	36	36	
			Downstream	0.5, 5, 10m (duplicates)	50mL	2	6	3	18	18	
			Upstream	2, (5, 10)m	50mL	3	9	3	27	9	68
	Infauna	Taxa	Baseline	0.5, 1, 1.5, 2, 2.5, 3, 3.5, 5, 7.5, 10, 30, 30m	0.030 sq. m.	1	1 2	1	12	12	
			Baseline	0.5, 5, 10m (duplicates)	0.030 sq. m.	2	6	1	6	6	
			Downstream	0.5, 1, 1.5, 2, 2.5, 3, 3.5, 5, 7.5, 10, 30, 30m	0.030 sq. m.	1	12	3	36	36	
			Downstream	0.5, 5, 10m (duplicates)	0.030 sq. m.	2	6	3	18	18	
			Upstream	2, (5, 10)m	0.030 sq. m.	3	9	3	27	9	81
	Bioassay	Amphipod, Microtox, Mutatox	Baseline	0.5, 2, 5, 10, 30m	1 L	1	5	1	5	5	
			Downstream	0.5, 2, 5, 10, 30m	1 L	1	5	3	15	15	
			Upstream	2m	1 L	1	1	3	3	3	23
	Mussels	Growth & Mortality	Baseline	Initial Stock	50 indiv.	50 indiv.	50 indiv.	1	50 indiv.	50 indiv.	
			Downstream	0.5, 2, 10m	50 indiv.	50 indiv.	150 indiv.	3	450 indiv.	450 indiv.	
		Tissue PAH	Baseline	Initial Stock	Composite (n=10)	3	3	1	3		
			Downstream	0.5, 2, 10m	Composite (n=10)	3	9	3	27		
		Tissue PAH (gametogenesis)	Downstream	0.5	Composite (n=10)	3	3	1	3	3	33
Weathered	Chemistry	PAH, TOC, Phenols, Redox, Part. size	Baseline	0.5, 2m	50 mL	3	3	1	3	3	
			Downstream	0.5, 2m	50 mL	3	6	3	18	18	
			Upstream	2m	50 mL	3	3	3	9	9	30
	Infauna	Taxa	Baseline	0.5, 2m	0.03 sq. m	3	3	1	3	3	
			Downstream	0.5, 2m	0.03 sq. m	3	6	3	18	18	
			Upstream	2m	0.03 sq. m	3	3	3	9	9	30
	Bioassay	Amphipod, Microtox, Mutatox	Baseline	0.5, 2m	1 L	1	2	1	2	2	
			Downstream	0.5, 2m	1 L	1	2	3	6	6	
			Upstream	2m	1 L	1	1	3	3	3	11
	Mussels	Growth & Mortality	Downstream	0.5m	Composite (n=10)	3	3	3	9	9	9

Table 1. List of Samples: Sooke Basin Creosote Evaluation Study - Phase II (1995-96)

Site	Sampling	Parameters	Current Direction	Sampling Stations	Sample Volume (min.)	No. Replicates/Stn.	N0. Samples/Sampling Period	No. Sampling Periods	Total No. Samples Collected	Total Analyzed	By Parameter
Mechanical Control	Chemistry	PAH, TOC, Redox, Part. size	Baseline	0.5m	50 mL	3	3	1	3	3	
			Downstream	0.5, (2, 5)m	50 mL	3	9	3	27	9	12
	Infauna	Taxa	Baseline	0.5, 1, 1.5, 2, 2.5, 3, 3.5, 5, 7.5, 10, 30, 30m	0.030 sq. m.	1	12	1	12	12	
			Baseline	0.5, 5, 10m (duplicates)	0.030 sq. m.	2	6	1	6	6	
			Downstream	0.5, 1, 1.5, 2, 2.5, 3, 3.5, 5, 7.5, 10, 30, 30m	0.030 sq. m.	1	12	3	36	36	
			Downstream	0.5, 5, 10m (duplicates)	0.030 sq. m.	2	6	3	18	18	72
	Bioassay	Amphipod, Microtox, Mutatox	Baseline	0.5m	1L	1	1	1	1	1	
			Downstream	0.5m	1L	1	1	3	3	3	4
Open Control	Chemistry	PAH, TOC, Redox, Part. size	Baseline	0m	50 mL	3	3	1	3	3	
			Study	0m	50 mL	3	3	3	9	9	12
	Infauna	Taxa	Baseline	0m	0.030 sq. m.	3	3	1	3	3	
			Study	0m	0.030 sq. m.	3	3	3	9	9	12
	Bioassay	Amphipod, Microtox, Mutatox	Baseline	0m	1L	3	3	1	3	3	
			Study	0m	1L	3	3	9	9	9	12
	Mussels	Growth & Mortality	Study	0m	50 indiv.	50	50	3	150	150	
		Tissue PAH	Study	0m	Composite (n=10)	3	3	3	9	9	
		Tissue PAH (gametogenesis)	Study	0m	Composite (n=10)	3	3	1	9	9	18

Sampling frequency. Baseline sampling is to take place at each site at least 14 days prior to piling installation to allow for any re-sampling, if necessary. Following piling installation, samples will be collected on day +14, +90, and +300, or as close to 365 days as other considerations will allow. There will be a total of four sets of samples collected in Year 1.

Transects to be surveyed on a particular day have been chosen randomly. The following schedule is applicable. Transect numbers read from left to right from the 30 metre station and facing the pilings. The **baseline transect** will be displaced two to three metres shoreward from the treatment site. Transects are assigned sampling dates using a random number table in the following table. Sample days are referred to the date of piling installation (day 0).

Table 2. Randomly assigned transects for each treatment site and sample day.

Sample Date	Aged, Creosote Treated Dolphin	BMP, Creosote Treated Dolphin	Control, Untreated Dolphin
+14	4	5	5
+90	3	1	2
+300	2	4	1
Mussel cages	5	3	4
Year 2	1	2	3

For example, on the first sampling day, post installation (Day +14), samples will be collected along transect number 4 at the aged, creosote treated dolphin. Transect number 4 is the fourth transect from the left when facing the dolphin.

Sampling Techniques and Analyses. To insure accuracy in sampling location and minimal disturbance of the sediments, **ALL** sampling will be accomplished by SCUBA using properly cleaned, stainless steel utensils. Sampling shall be accomplished in the following order:

1. Water samples: Water samples will be collected before any possible disturbance of bottom sediments. If water samples are to be analyzed for PAH, then stainless steel samplers with Teflon seals, properly cleaned followed by a rinse in pesticide grade acetone shall be used. Alternatively, heat treated glass jars with foil liners may be provided by Environment Canada for this purpose. The following measurements shall be made during each sampling period.

a) The current direction shall be measured using an appropriate current meter at mid-depth (-3.5 metres). If currents are too slow (<1.5 cm sec^{-1}) to measure with a current meter, then a drogue shall be used. In either case, three replicate measurements of current speed shall be made three hours before and after the predicted high or low slack tide. The predicted height of the low or high tide (with respect to MLLW) shall be noted on the data

sheet together with any meteorological conditions (wind, weather conditions, etc.) that might effect the validity of the prediction. One set of these measurements shall be made at each of the treatment sites on each sampling day.

During the baseline study, an appropriate drogue will be used to measure tidal currents through one complete tidal exchange (12 hours). The position of the drogue shall be determined, with respect to a fixed marker buoy at hourly intervals. This can be accomplished most easily by placing transits, separated by a distance of 300 metres on the shore and triangulating positions each hour. The direction of net movement (position of the drogue after the 12 hour period relative to the marker buoy) will define the direction in which sampling transects are laid out following installation of the dolphins.

b) Turbidity, total suspended solids, total volatile solids and temperature and salinity will be measured in the middle of the study site at two metre depth intervals during each sampling day. This information will be useful in assessing the fate of released PAH and in evaluating the growth of caged mussels.

2. Sediment samples: Sediment samples will be collected using 0.35 m^2 stainless steel samplers provided by Aquatic Environmental Sciences or similar alternative sampler. These samplers are 10 cm deep and the sampler must be full (within 2 cm of the top cover), but not overfull, to be acceptable.

Sampling shall begin at the most distant (i.e. least likely to be contaminated) sampling station and proceed toward the piling. Within a given treatment site, samplers and all equipment coming in contact with the sediments, will be thoroughly rinsed and cleaned with distilled water between samples. Between treatment sites, all sampling equipment should will be washed in detergent, rinsed in distilled water and receive a final rinse in pesticide grade acetone. As an alternative, four samplers can be taken, precleaned, into the field, one for each treatment site and the control. Sediment samples should be visually characterized upon retrieval. Characteristics include texture, colour, biological structures (e.g. shell debris, tubes or casings, macrophytes); presence of debris (wood chips, fibres); presence of an oily sheen; odour (e.g. hydrogen sulphide, oil, creosote). The depth of sediment in the sampler should be measured and the presence and depth of the RPD measured (if visible).

Samples taken along each transect for sediment chemistry and bioassays are to be collected on the side directly opposite to samples intended for infaunal analysis (e.g. (e.g. Position "A" - and Position "B" - Figure 1). The type of analysis applied to each will be determined randomly, after collection.

3. Sediment Chemistry: Samples for sediment chemistry (PAH, phenols), total volatile solids (TVR) and sediment grain size analyses shall be taken from the **"top 2 cm"** of the substrate. Sediment samples for chemical analysis shall be taken on site either directly from each sampling station or as subsamples from those samples intended for sediment bioassay tests. Heat treated 125ml. sample jars will be provided by Environment Canada for PAH and TVR analysis plus additional sample containers for particle size analysis. Cap and jar labels are to show date,

area (Sooke Basin), treatment site, distance interval, and transect "Position". **A prepared standard made up of two NRC Standard Reference Materials will be provided by Environment Canada for each sample batch submitted for PAH analysis as a 'blind' measure of QA/QC.** These blind Reference Standards are to be submitted at the same time as the field samples are submitted and given artificial field identifications. Analysis of laboratory duplicates, additional Standard Reference Materials and procedural blanks will be conducted independently by the contract lab for each sample batch as additional QA/QC. All results will be reported to Environment Canada for tabulation, QA/QC analysis and initial reporting. Unused portion of each sample and the digested material shall be retained in case additional analysis is required.

a) PAH analysis. PAH analysis will be in accordance with procedures outlined in "Determination of Polycyclic Aromatic Hydrocarbons (PAHs) in Tissues and Sediment" provided by Axys Analytical Ltd.

b) Total Volatile Solids (Sediment). Analysis shall be done using standard protocols with drying at 103 to 105 °C until no further reductions in weight are observed and ashing at 550 °C until no additional weight loss occurs. Total volatile solids shall be reported as a percent of the dry sediment weight.

c) Total Suspended Solids and Total Volatile Solids (Water). Standard protocols shall be followed. No less than 350 mls of thoroughly mixed sample shall be filtered on 0.4 to 0.45µm glass filters. These shall be dried to 103±2 °C. Ashing will be accomplished at 550 °C.

d) Sediment grain size. Grain size analysis shall be done using the sieve and pipette method. Grain size shall be reported as gravel, sand 1 (>1 mm), sand 2 (>250 µm), sand 3 (>63µm), Total sand, silt (>3.9 µm) and clay (<3.9µm).

Sediment Bioassays: Protocols for sediment bioassays will be in accordance with:

Amphipod - **"Biological Test Method: Acute Test for Sediment Toxicity Using Marine or Estuarine Amphipods"**. Report EPS 1/RM/26. December 1992. Tests will consist of a 10-day static test using five replicates, 20 individuals each, for every station sample. The test species will be *Rhepoxynius abronius*.

Microtox - **"Biological Test Method: Toxicity Test Using Luminescent Bacteria (*Photobacterium phosphoreum*)**. Report EPS 1/RM/24. November 1992.

Mutatox - **"Mutatox Protocol for One (1) Sample"**. Procedures provided by Microbics Corporation, Carlsbad, Calif.

Sediment bioassay samples are to consist of a single 1 litre sample from each station. These samples will subsequently be divided into 5 replicate samples by Environment Canada's

Aquatic Toxicity Lab. at the Pacific Environmental Science Centre (PESC), North Vancouver. Subsamples will also be taken for solid and liquid phase Microtox and Mutatox testing by provincial government laboratory staff at PESC. Samples are to be kept cool and in the dark until delivery to the lab. Tests are to be conducted as soon as possible after collection and no longer than 6 weeks.

Mussel cages (Figures 3 & 4): A total of 20 mussel cages, containing mussels (*Mytilus edulis edulis*), will be constructed from heavy duty ADPI™ clam or oyster cages and installed in tiers of five each at the 0.5, 2.0, and 10 metre stations at the BMP treated dolphin site and at the undisturbed control site. End closure will be accomplished with a split, ¾" PVC pipe that is secured in two places with either cable ties or heavy, synthetic twine. The cages shall be installed as depicted in Figure 3 & 4.

The top three cages will each contain 50 premeasured mussels. All measurements will be made to 0.1 mm. The fourth cage will contain 120 premeasured mussels for tissue PAH analysis. This is to allow for collecting triplicate composite samples (10 mussels each) during each of the four sampling periods. The bottom cage will contain 100 large mussels (>4 cm valve length) for the gametogenesis study.

These cages will have ¼" mesh openings and be anchored with a 50 pound concrete weight and a subsurface buoy (approx. -2m @MLLW)(Figure 2).

The initial valve length of the mussels in the top four cages should be between 2.0 and 4.0 cm, purchased from Blue Frontier. A random sample should be selected from their mussel stock without regard to initial lengths. No effort should be made to select mussels of similar length.

Two sets of mussel cages will be initially provided (40 cages). All mussels will be removed from each of the top three cages on each sampling days (+14, +90 and +300), measured, replaced in a clean cage and returned to the site from which they came. Both inside and outside identification tags will be provided for each sample. These tags will indicate the cage location and its replicate number. Only the first three replicates (number 1, 2, & 3) will be measured. However, all five replicates will be removed to clean cages on each sampling day. Additional surveys should also be made on days 160 and 230 to measure mussels in the top three tiers and to change the cages for all mussels.

Three composite samples of 10 mussels each shall be removed from the fourth cage in each tier on days +14, +90 and +300 for tissue PAH analysis. In addition, when ready to spawn in late winter (likely February) or early spring of 1996, mussels from the bottom of each tier should be removed and half of the mussels shipped, on ice, by 24 hour delivery to Aquatic Environmental Sciences for analysis of gametogenesis, spawning and examination of development through the straight hinge stage. Three additional composite samples of 10 mussels each shall be removed from Cage #5 and submitted for PAH analysis of gonadal tissue (primarily mantle tissue). **All work at Aquatic Environmental Sciences is conducted at a site 3 miles from salt water and there is no potential for the introduction of *Mytilus edulis edulis* into the waters of Washington State.**

Figure 3. Mussel Cage Layout

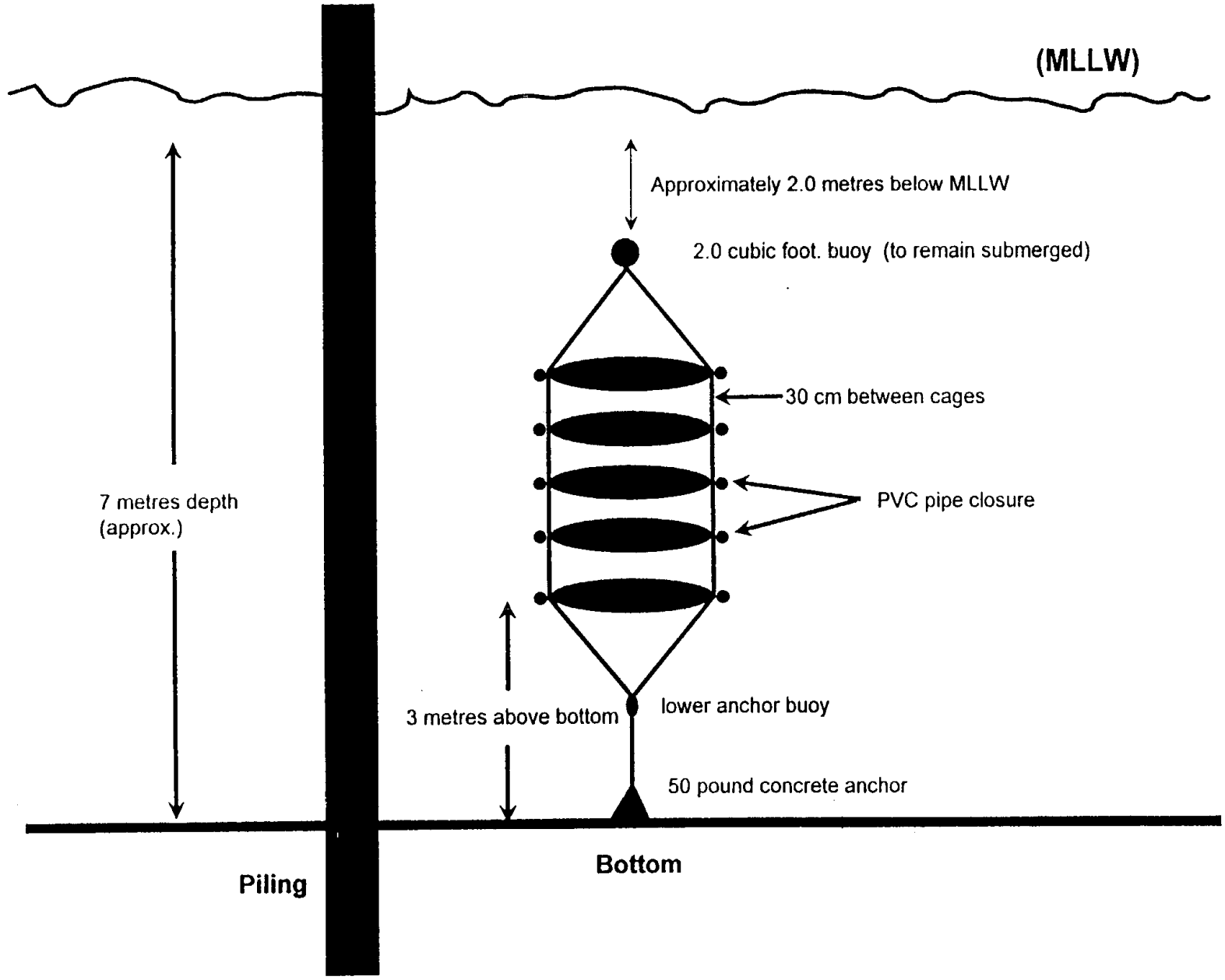
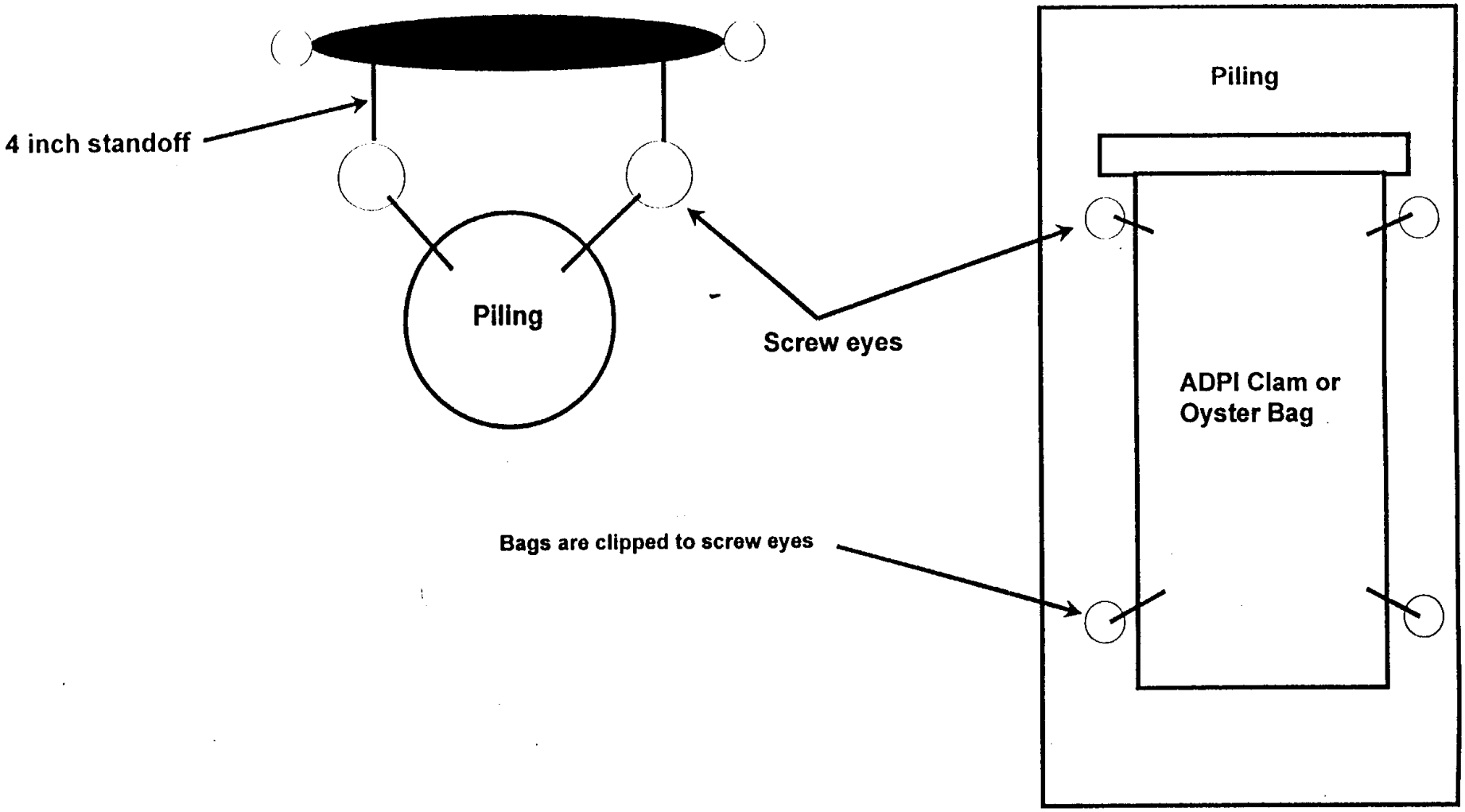


Figure 4. Mussel Cage Attachment (outside of five of the six piling at the BMP site)



Mussel cages installed at the 0.5m distance will be attached directly to the piling as described in Figure 3. Large diameter screw-eyes will be installed before or after (as appropriate) the piles are driven. One mussel cage will be attached to the outside of five of the six pilings.

Care and Handling of Mussels. Mussels should be handled carefully. Do not pull mussels apart. Individuals should be separated by cutting the byssal threads with sharp, stainless scissors. Samples should be washed gently in seawater, kept moist and out of the sun while measuring and transferring them. Do not hold them in stagnant seawater for longer than ten minutes. All mussels removed from the site should be stored on ice, wrapped in non-toxic paper towels that have been soaked in seawater collected away from the test sites. Information describing any mussels that are accidently injured or lost during sampling must be recorded.

Infauna samples: After the collative characteristics of the sample have been recorded, the entire infaunal sample will be sieved in stacked sieves with mean openings of 1.0mm and 0.5mm. All water entering the sieves shall be filtered to a minimum of 50µ. Any overlying water in the sampler must be retained and sieved with the sample. Sediments adhering to the outside of the sampler should not be mixed with the sample.

Material retained on the 1.0mm and 0.5mm sieves will remain segregated in separate sample bottles. Both samples shall be fixed in a buffered (pH>8.2) solution of 15% formalin in 50µm filtered seawater of the same salinity as the sample site. Sample bottles will not contain more than 50% sample. If the sieved sample exceeds 50% of the sample bottle volume, then the sample shall be split into an appropriate number of bottles, or a larger bottle shall be used.

All sample containers shall have inside, outside and cap labels. The inside labels shall follow the samples throughout the field and laboratory processing. Following fixation for 48 to a maximum of 96 hours, the samples can be transferred to 70% alcohol (ethanol or isopropyl). Samples may be stained with Rose Bengal, if desired. All fauna in the 1mm sieved samples will be identified to species and enumerated. The 500µm sieve fraction will be preserved and archived for possible future analysis.

Sample sorting. Each sample shall be sorted by a single person. A minimum of ten percent of the samples must be completely resorted by a second person. Inside labels from the field shall follow all samples through the process and shall be archived with the field sample at the end of processing.

Twenty (20) percent of each sample shall be resorted for QA/QC purposes. **If resorting reveals a greater than five percent increase in the number of organisms, then the entire sample shall be resorted.** All waste material retained on the respective sieves shall be archived in 70% alcohol (ethyl or isopropyl).

Sample processing. All identifications shall be to species, where possible. When all identification and internal QA/QC procedures are completed, the jars containing all organisms from a single samples shall be topped off with 5% glycerin/70% alcohol. The lids shall either be of polyseal construction, or they shall be tightly sealed with black electrical tape

to prevent evaporation.

Data entry. Data shall be recorded in spreadsheet form in Microsoft™ Excel for Windows. Data entry shall be phylum, class, order, genus and species. All original data sheets and the data base shall be provided to the study team.

Quality Assurance. All samples will be archived by the study team. Five percent (6) of the samples in this study will be examined by Aquatic Environmental Sciences and/or Environment Canada as a quality control check. Discrepancies will be verified with the subcontractor and appropriate changes made prior to acceptance of the database.

Quality control checks to verify data entry shall be accomplished by a member of the study team. All proposed corrections shall be verified with the consulting taxonomist prior to changing the database.

Piling Removal: Pilings will be removed upon termination of the study after 1 to 2 years. Representative core samples from the outer 1.0 cm. of the land-weathered pilings and BMP pilings are to be taken shortly after their removal and frozen for PAH analysis.

APPENDIX III

Analytical Methods for Hydrocarbons,

Total Organic Carbon and Particle Size

(taken from Axys Analytical Ltd. report - December 1996)

CREOSOTE EVALUATION STUDY: RESULTS FOR HYDROCARBONS, TOTAL ORGANIC CARBON AND PARTICLE SIZE

Standing Offer KA601-2-0625/02-XSB

Final Report

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December 1996

1. INTRODUCTION

Axys Analytical Services Ltd. was contracted by Environment Canada, North Vancouver, BC, to conduct analyses of sediment and tissue samples as part of the Creosote Evaluation Study. One hundred and seventeen samples were analyzed for one or more of the following analyses:

- parent and alkylated polycyclic aromatic hydrocarbons (PAHs);
- dibenzofurans;
- gravimetric lipids;
- phenols;
- Total Organic Carbon (TOC); and
- particle size.

The sample handling protocols, sample workup procedures and instrumental analyses are documented in this final report. Complete data reports for all samples are presented. Results for QA/QC samples (procedural blanks, analysis duplicates, and internal reference materials) are presented and discussed.

2. SAMPLE PREPARATION AND ANALYTICAL METHODS

2.1 Sample Handling

Samples were delivered to Axys' laboratory from January 1995 through to February 1996, and then stored at -20°C until analyzed. Samples consisted of 91 sediments, 4 sediment reference material samples, 18 mussel tissue samples, one water sample, one wet paper towel and two creosote-soaked wood samples. A list of Axys sample numbers and corresponding sample identification is given in Table 1.

Sediment samples were homogenized by stirring with a solvent-rinsed spatula. Large rocks and seashells were removed. Mussel samples consisted of composites of 10 to 11 individual mussels which were shucked at Axys using solvent-rinsed tools, and homogenized in a Virtis blender. Water, wet paper towel and wood samples were analyzed in their entirety. Wood samples were cut up into small pieces with solvent-rinsed scissors.

Immediately prior to analysis, homogenized samples were thawed, stirred thoroughly and subsampled for analysis. Samples were analyzed wet (except wood core samples) and a separate subsample was taken for moisture determination. Wood core samples were analyzed dry and were not subsampled for moisture. The sediment and wood core data are presented on a dry-weight basis. All other data are on a wet-weight basis. Moisture content is also reported. Lipid content is reported for mussel samples only.

2.2 Polycyclic Aromatic Hydrocarbon (PAH) Analysis

All samples submitted were analyzed for parent PAH and some samples were also analyzed for alkylated PAH.

The PAH method is described in detail in Appendix I.

In brief, each sediment and mussel sample was first spiked with an aliquot of surrogate standard solution containing nine perdeuterated PAHs and one perdeuterated alkylated PAH. Each sample was digested in ethanolic KOH and extracted with pentane, followed by clean-up by column chromatography on silica gel. Prior to instrumental analysis, an aliquot of recovery standard containing three perdeuterated PAHs was added. Extracts were analyzed by high resolution gas chromatography with low resolution mass spectrometric detection (HRGC/LRMS) using a Finnigan INCOS 50 mass spectrometer equipped with a Varian 3400 GC, a CTC autosampler and a DG10 data system.

An additional non-routine clean-up step was performed on one sample extract, 2891-53, to confirm the level of benzo[a]pyrene. This clean-up step consisted of washing the extract with a dilute sodium hydroxide solution. The extract was then re-analyzed by GC/MS.

2.3 Dibenzofuran (DBF) Analysis

DBF analysis was performed in conjunction with the PAH analysis described in full in Appendix I. Samples analyzed for dibenzofuran are designated in Table 1.

Each sample analyzed for DBF was spiked with an aliquot of surrogate standard containing perdeuterated dibenzofuran. Samples were extracted as described in Section 2.4 and analyzed by GC/MS along with the PAHs.

2.4 Gravimetric Lipid Determination

Lipid content was determined on each mussel sample submitted for analysis.

A subsample of tissue was ground with sodium sulphate, packed in a glass column and eluted with solvent. The extract was concentrated, transferred to a petri dish and dried to a constant weight. Lipid content was determined gravimetrically using a four-place analytical balance.

2.5 Phenol Analysis

Five samples (2891-58, 2891-64 to 2891-66, and 2891-70) were subsampled and sent to Analytical Service Laboratories Ltd. (ASL), Vancouver, B.C., for phenol analyses. Phenol analysis was carried out according to USEPA Methods 3540/8270. The procedure involved a soxhlet extraction followed by analysis by GC/MS.

2.6 Total Organic Carbon (TOC) Analysis

Each sediment sample was subsampled and sent to Cantest Ltd., Vancouver, B.C., for the TOC analysis. The procedure consisted of first air drying a subsample of sediment at room temperature. The dried sample was digested with concentrated hydrochloric acid to remove inorganic carbon. The acid-treated sample was dried at 60°C. Iron tin fines were added to the sample prior to combustion in a Leco Induction Furnace. Carbon was determined volumetrically as CO_2.

2.7 Particle Size Determination

Forty-six sediment samples were analyzed for particle size distribution. These analyses were carried out by Pacific Soil Analysis Inc. (PSAI), Burnaby BC.

Particle size distribution was determined by the pipette method.

3. ANALYTICAL RESULTS

Results were reported to the Scientific Authority as analyses were completed. Reports for all of the samples are included in Appendix II, arranged by Axys sample numbers. The percent moisture is reported for all samples and percent lipid is reported for all mussel tissue samples. Both are included on PAH analysis reports in Appendix II. Results for procedural blanks and reference samples are found in Appendix III and Appendix IV, respectively.

4. QUALITY ASSURANCE / QUALITY CONTROL

The basis of Axys' QA/QC plan is the batch method. All samples analyzed at Axys were worked up in batches with accompanying QC samples. Each batch went from sample workup through instrumentation as a unit, and on to data interpretation and final reports. The sample results were reviewed and evaluated in relation to the QA/QC samples worked up at the same time.

4.1 Batch Composition

The composition of each batch of samples analyzed for PAH and DBF is detailed in the Batch Summary Sheets presented in Appendix V.

PAH analyses were carried out in 18 batches. DFB analyses were carried out in six of these batches, and alkylated PAH analyses were carried out in seven. Each batch included a maximum of nine samples in addition to one known sample (a certified reference sample or a spiked matrix sample), one analysis duplicate and a procedural blank. Two batches (PH-0696 and PH-0845) did not include analysis duplicates but additional duplicates were analyzed in other batches.

4.2 Procedural Blanks

The data for the blanks are presented in Appendix III. Overall, the procedural blanks demonstrated low or not detectable background levels of the target compounds.

4.3 Duplicates

Results for duplicates are reported along with the analysis results in Appendix II. Twenty samples were analyzed in duplicate for PAH, five for DBF and six for alkylated PAH. Axys' criterion for acceptance duplicates is ±(20% + Method Detection Limit). In some cases, agreement between duplicates did not meet specifications as a result of sample heterogeneity. (For example, in some instances fibrous particulate matter which appeared to be coated with a black substance was noted in samples. If this were creosote-coated wood particles unevenly distributed in the sediment, it could account for the variation.) Additional duplicate analyses were performed in order to provide additional information on precision.

4.4 Surrogate Standard Recoveries

The recovery of each surrogate standard is monitored by comparing its response to that of the recovery standard added just prior to instrumental analysis. The calculation of percent recovery is explained in Section 5 below. Axys' quality control protocols require that in order for the results to be quantifiable, surrogate standard recoveries must be within an acceptable range. In cases where this standard was not achieved, analyses of the samples were repeated.

Some sample extracts (2891-77 and 2891-78) contained large concentrations of PAH and required dilution and addition of more surrogate standard in order for data to be reported. Surrogate recoveries were not reportable in these cases and data are reported as minimum levels.

4.5 Reference Samples

A "known" sample was worked up with each batch of analyses and used to demonstrate the accuracy of the data.

Each batch of samples analyzed for PAHs included either a certified reference sediment or a spiked matrix sample. The marine sediment certified reference material, HS-6, was analyzed with most sediment batches. The data for the 15 certified reference samples are presented in Appendix IV. Results generally fall within ±20% of the certified value range which meets Axys' criteria for acceptability.

Two spiked tissue samples and a spiked blank were analyzed along with the mussel tissue samples. The data for the three spiked samples presented in Appendix IV were generally within the acceptable percent recovery range of 70-130%. The spiked tissue samples were prepared at Axys by spiking a solution of authentic PAHs and dibenzofuran into a weighed amount of in-house reference tissue (well homogenized and analyzed unspiked in-house). The spiked blank sample was prepared by spiking a solution of authentic dibenzofuran into a procedural blank sample.

4.6 Detection Limits

Detection limits were calculated on a sample-specific basis and are reported with each sample.

The detection limit was calculated as the concentration corresponding to the area reject. The area reject, determined from the ion chromatogram of each compound, is the area of a peak with height three times the maximum height of the noise. Only peaks with responses greater than three times the background noise level are quantified. The calculation of detection limits is described in Section 5.

5. CALCULATIONS

The internal standard method was used to quantify components in the samples. $Conc_i$, the concentration of a component in a sample, was calculated using the following equations:

$$Conc_i = \frac{A_i}{A_{si}} \times \frac{W_{si}}{W_i} \times \frac{1}{RRF_{i,si}}$$

where A_i = area of the analyte peak of interest to quantify

A_{si} = area of labelled surrogate used to quantify i

W_i = weight of sample taken for analysis

W_{si} = weight of labelled surrogate added to sample

$RRF_{i,si}$ = relative response factor of i to si as determined by daily runs of the calibration standard solution and defined as

$$\frac{A_i}{A_{si}} \times \frac{W_{si}}{W_i}$$

Detection limits were also calculated using the above equations with the minimum detectable peak area used for A_i. The minimum detectable peak area was calculated as three times the maximum noise in the GC/MS channel of interest (height of noise x area / height ratio of a typical peak x 3).

Recoveries of internal standards were calculated using the following equation.

$$\%Recovery = \frac{A_{si}}{A_{rs}} \times \frac{W_{rs}}{W_{si}} \times \frac{100}{RRF_{si,rs}}$$

where A_{si} and A_{rs} are the areas of the labelled surrogate and the recovery standard in the sample run and W_{rs}, W_{si} are the weights of recovery standard and labelled surrogate added to the sample. $RRF_{si,rs}$ is the relative response factor of the labelled surrogate to the recovery standard as determined by daily runs of the quantification solution and defined by

$$\frac{A_{si}}{A_{rs}} \times \frac{W_{rs}}{W_{si}}$$

All concentration, detection limits and surrogate standard recovery calculations are carried out on an in-house software program.

DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH), AND DIBENZOFURAN IN SEDIMENT AND TISSUE SAMPLES

All samples were spiked with an aliquot of surrogate standard solution containing perdeuterated analogues of acenaphthene, chrysene, naphthalene, perylene, phenanthrene, pyrene, dibenz[ah]anthracene, benzo[ghi]perylene, benzo[a]pyrene and 2-methylnaphthalene for analysis of PAHs. An additional surrogate standard containing perdeuterated dibenzofuran was added to those samples requiring dibenzofuran analysis. Sediment and tissue samples were base digested, and extracted with pentane. Each extract was fractionated on silica gel into polar and non-polar fractions. The polar fraction was analyzed for parent and alkylated PAHs and dibenzofuran by high resolution gas chromatography with low resolution (quadrupole) mass spectrometric detection (HRGC/LRMS).

1. Extraction Methods

Base Digestion

A subsample of homogenized sediment or tissue was dried overnight at 105°C for moisture determination.

A wet sample was accurately weighed into a 500 mL round bottom flask and spiked with an aliquot of surrogate standard solution. Methanol and a potassium hydroxide solution were then added and the mixture was heated under reflux for 1 hour, cooled, and extracted water was then added through the condenser. Refluxing was resumed for an additional hour.

The digest was transferred to a separatory funnel with methanol rinses and extracted with pentane (3 x 100 mL). The pentane layers were combined, washed with extracted water 3 times, and dried over anhydrous sodium sulphate. The pentane extract was then concentrated in a Kuderna-Danish flask prior to column cleanup.

2. Column Chromatography

The extract was loaded onto a silica gel column and eluted with pentane (F1) followed by dichloromethane (F2). F2 contains parent and alkylated PAHs and dibenzofuran.

The F2 extract was concentrated to a small volume, transferred to an autosampler vial and an aliquot of recovery standard containing deuterated benzo[b]fluoranthene, fluoranthene, and acenaphthylene was added prior to GC/MS analysis.

3. Instrumental Analysis

Analysis of the extract was carried out using a Varian 3400 gas chromatograph with a Finnigan Incos 50 mass spectrometer, a CTC autosampler and a DG 10 Data system. A 30 metre DB-5 (0.25 mm i.d. x 0.25 μm film thickness) chromatography column, used for GC separation, was coupled to the MS source.

The mass spectrometer was operated in the EI mode (70 Ev) selected ions acquired using Multiple Ion Detection (MID) to enhance sensitivity, acquiring at least two characteristic ions for each target analyte and surrogate standard. A split/splitless injection sequence was used.

APPENDIX IV

Biological Assessment of Sediments from a

Creosote Study Site, Sooke B.C.

Summary Report on Baseline, Day14, Day180, Day270 and Day384 Results

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Biological Assessment of Sediments from a Creosote Study Site, Sooke, B.C.
Summary Report on Baseline, Day-14, Day-180, Day-270 and Day-384 Results

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1.0 Introduction

In support of a study undertaken by Environment Canada's Chemical Evaluation Section on the impact of creosote pilings in the marine environment, the Aquatic Toxicology Section of Environment Canada performed various biological assays throughout a one year sediment monitoring period. Sediments from the study site at Sooke, B.C. were routinely tested for acute lethality to amphipods, metabolic inhibition of a bioluminescent bacterium, and mutagenicity in a dark strain of the bacterium for the determination of sediment toxicity. From September 1995 until October 1996, five collections of two to nine sediment samples were delivered to the Pacific Environmental Science Centre's Aquatic Toxicology laboratory, and stored in the dark at $4 \pm 2^{\circ}C$ until test preparation for each set of sediments. All testing was complete by mid-November 1996. A suite of single-species aquatic toxicity tests using organisms representing different taxonomic and trophic levels is commonly performed to measure different toxic effects of environmental pollutants. Four sediment bioassays were performed: a 10-day amphipod survival test using two species, Microtox® liquid- and solid-phase metabolic-inhibition tests, and Mutatox® liquid-phase testing for genotoxicity.

2.0 Materials and Methods

2.1 Acute Test for Sediment Toxicity Using Marine Amphipods

Amphipod sediment testing was performed using two species of infaunal amphipods, *Eohaustorius washingtonianus* and *Rhepoxynius abronius*. The *E. washingtonianus* were field collected at Esquimalt Lagoon, Victoria, B.C. by Biologica Environmental Services. The *R. abronius* were field collected from Whidbey Island, Washington by Environment Resolution Services. Both species were collected and delivered to the laboratory within five days of test initiation. Amphipods were acclimated upto $15 \pm 1^{\circ}C$ in control sediment (*i.e.* collection site sediment) under continuous light and aeration at a rate of $\leq 3^{\circ}C$/day , and held under these conditions for about two days prior to test initiation.

These amphipod species are two of the four species recommended for use in amphipod sediment testing for the Pacific Coast (Environment Canada 1992a), and are both commonly used at the laboratory. The sensitivity of these species has been found to differ with respect to response in contaminated sediments, chemical-toxicant solutions, and in response to non-contaminant effects such as particle size, salinity, and photoperiod. The Aquatic Toxicology Section has been addressing these issues in various studies, and since this creosote study provided an appropriate opportunity to further investigate the difference in responses observed with the two species, it was recommended that both be used in this study.

Static 10-day acute lethality tests were performed according to the procedures outlined in Environment Canada (1992a). The control sediment used in these tests was homogenized and wet sieved through a 0.5 mm stainless steel sieve to remove native organisms. Large rocks and other debris were removed from each test sediment and the remaining sample homogenized by hand. Three to six acid-washed, one litre jars (depending on volume of test sediment available) were prepared for each control and test sediment. Approximately 175 to 200 g of sediment (to a height of 2 cm) was added to each jar. Each container was then carefully filled with a fresh laboratory supply of sand-filtered seawater from Burrard Inlet, being careful not to disturb the sediment layer. The test containers were aerated and allowed to settle overnight. Twenty (ten for Day-384 *E. washingtonianus*: 05-15 November) randomly selected amphipods were added to each of the replicate jars per sediment. The bioassays were conducted in an environmental chamber at 15 ± 1°C under continuous light. Water quality (temperature, pH, salinity and dissolved oxygen) was measured periodically throughout the tests. At the conclusion of the bioassays, the total number of emergent (dead and alive) amphipods on the sediment surface (or swimming in the water column) of each test container was recorded. The sediments were wet-sieved through a 0.5 mm stainless steel screen, and total surviving, dead and missing amphipods were recorded.

Baseline assays for the study site took place from 19 to 29 September 1995, Day 14 (14 days following piling placement) assays were performed from 24 October to 3 November 1995, Day 180 assays were performed from 09 April to 19 April 1996, Day 270 assays took place from 25 June to 5 July 1996, and finally Day 384 amphipod assays ran from 5 to 15 November 1996.

In addition, 96 hour LC50 positive control tests were run concurrently with each set, using various concentrations of the reference toxicant cadmium chloride in seawater, to assess the acceptability of test conditions and amphipod sensitivity in reference to historical performance under the same conditions (including absence of substrate and darkness).

2.2 Acute Toxicity Test Using a Photoluminescent Bacterium

A marine bioluminescent bacterium, *Vibrio fischeri*, was used to assess the toxicity of the test sediments using the Microtox® test system. Vials of freeze-dried *V. fischeri* stored at -20 ± 2°C were reconstituted in 1.0 mL of distilled water and incubated at 5.5 ± 1°C for no less than 20 minutes prior to use in liquid- and solid-phase tests. Test results were based on measured light output in the presence of various levels of test substance in aqueous solutions, which were compared with light output of a control blank (*i.e.* bacterial cell suspension in diluent only). Light output is a product of the electron transport system and relates directly to the metabolic state of the bacteria (Schiewe *et al.* 1985). The degree of light loss (degree of metabolic inhibition in the bacteria) indicates then the degree of toxicity of the sample.

Each of the full 50 mL polystyrene tubes collected per test sediment was centrifuged for 30 min at 4000 r.p.m. and 4°C to extract the pore water from the sediment. This interstitial water of the sediments was immediately decanted and tested within 24 h for toxicity using liquid-phase testing procedures for screening and IC50- determination outlined by Microbics Corporation (1992a) and Environment Canada (1992b). A 50-100% effect during the screening test using a 100% concentration only, would indicate further testing using serial dilutions of the pore water might allow

determination of an IC50 value. Natural seawater, adjusted with natural brine salts to match the salinity of the pore water samples, was used as control and diluent water during liquid-phase testing. Light emission readings were recorded after 5 and 15 minutes (also after 30 minutes for baseline and Day 14 samples) of incubation at 15.0 ± 0.5°C in controls and test solutions.

The sediment remaining in one of the tubes per test sediment following centrifugation was homogenized prior to solid-phase testing, which was carried out according to methods outlined by Microbics Corporation (1992b). Bacteria were incubated for 20 min at ambient room temperature in a series of aqueous solutions of various concentrations made up of the sediment sample and a 3.5% solution of Reagent Grade NaCl crystals dissolved in deionized water. Following this incubation period of direct bacterium-particle interaction, the solutions were filtered and 500 μL of each filtrate was transferred to a corresponding glass cuvette within the incubation unit. After a further five minute incubation period at 15.0 ± 0.5°C, light emission from each concentration was measured.

A Microtox® model 500 Toxicity Analyzer (Microbics Corporation) controlled by the appropriate Microtox® software (versions 7.03 and 7.81) was used for all procedures.

2.3 Mutatox Genotoxicity Test Using Luminescent Bacteria

The Mutatox test system is designed to determine the presence of genotoxic agents in various sample types using a dark mutant of the photoluminescent bacterium *Vibrio fischeri* (Strain M169). Vials of freeze-dried *V. fischeri* (Strain M169) stored at -20 ± 2°C were reconstituted in 1.1 mL of reconstition solution (ultra pure water) in preparation for addition to reconstituted growth media and serial dilutions of pore water samples, which was all subsequently incubated at 27 ± 1°C. A genotoxic response was indicated when the luminescent state in bacteria was restored. After 12 to 24 hours of exposure to sublethal concentrations of genotoxic chemicals, this dark variant produces light (Microbics Corporation 1993b).

Each of the full 50 mL polystyrene tubes collected per test sediment was centrifuged for 30 min at 4000 r.p.m. and 4°C to extract the pore water from the sediment. This interstitial water of the sediments was immediately decanted and tested within 24 h for genotoxicity using testing procedures outlined in Microbics Corporation (1995) and Environment Canada (1995).

Each pore water sample is run in two types of assay media; direct Mutatox medium to detect environmental substances which damage DNA in their present form, and indirect Mutatox medium which contains rat-liver microsomal preparation (S9 protein plus co-factors) for exogenous metabolic activation of progenotoxins (which must first be biotransformed to a genotoxic form). Positive controls run concurrently with the pore water samples were the direct acting compound phenol, and benzo(a)pyrene, a compound which requires metabolic activation by hepatic enzymes. Besides media controls, solvent controls for dimethyl sulfoxide (DMSO) were also included for testing, as b(a)p is not readily soluble in water and DMSO was used in b(a)p stock preparation. Also, natural and laboratory prepared solutions of 30 p.p.t. salt water were tested as controls for these marine samples to determine any confounding effects of salinity.

Light levels were determined by a Microtox® model 500 Luminometer (Microbics Corporation) after 16, 21 and 25 hours incubation.

2.4 Data Analysis and Toxicity Test Criteria

2.4.1 Acute Test for Sediment Toxicity Using Marine Amphipods

All data were tested for normality using the Shapiro-Wilk test and homogeneity of variance was tested using Bartlett's test in the TOXSTAT statistical program (Gulley *et al.* 1989). If any of the treatments showed zero variance (*i.e.* identical survival rate in all replicates), the treatment was removed from the analysis since treatments with zero variance will always result in a rejection of tests for normality and homogeneity of variance (US EPA 1994). If the data passed the tests for normality and homogeneity of variance, a two-sample one-tailed *t*-test with equal variance ($\alpha = 0.05$) was used to determine whether survival in each test and reference sediment was significantly lower from that in the control (Excel 7.0 1995). If data failed tests for normality or homogeneity of variance, the data were transformed using an arcsine - square root transformation developed by Anscombe and described in Zar (1984) before being retested for both. If the transformed data passed tests for normality and homogeneity of variance, the two-sample one-tailed *t*-test with equal variance was performed on the transformed data. If the transformed data still failed tests for homogeneity of variance but passed the test for normality, a two-sample one-tailed *t*-test with unequal variance was used on the transformed data to determine whether survival in each test and reference sediment was significantly lower from that in the control.

It should be noted that statistical significance does not necessarily reflect biological significance, and that it is up to the researcher evaluating the study site to determine what is to be considered a toxic response. Provided in Table 1 below for guidance, are the criteria employed most recently for the Pacific and Yukon Region's Ocean Disposal Program to determine toxic responses in amphipod sediment assays.

Table 1: Interim pass/fail criteria for amphipod testing (Lee *et al.*, 1995)

A/ Reference sediment available	1/ control survival ≥ 90 % 2/ reference survival ≥ 80 % or abandon reference comparison (see B/) 3/ if % control survival - % reference survival ≥ 20 % & statistically lower, abandon reference comparison (see B/) 4/ test sediment toxic if: % reference survival - % test survival ≥ 20 % & is statistically lower
B/ Reference sediment unavailable or abandoned	1/ control survival ≥ 90 % 2/ test sediment toxic if: % control survival - % test survival ≥ 30 % & is statistically lower

In order for a test to be considered valid, amphipod survival in the control sediment must be 90 % or greater (Environment Canada 1992a).

The LC50 values (and associated 95% confidence limits) for the positive reference toxicant tests were determined using the Environment Canada computer program based on Stephan (1977).

2.4.2 Acute Toxicity Test Using a Photoluminescent Bacterium

A 50-100% inhibition of light production during the screening test (using a 100% concentration only)

would indicate further testing using serial dilutions of the pore water might allow determination of an IC50 value. The degree of light loss (*i.e.* degree of metabolic inhibition in the bacteria) indicated the degree of toxicity of the sample. A dose-response curve was determined by Microbics software (version 7.81 for liquid-phase; version 7.03 for solid-phase), on which the IC50 was located. A 95% confidence range was also reported. The IC50 is the inhibiting concentration of a sample causing a 50% decrease in the bacterial light output under defined conditions of exposure time and test temperature. Interpretation guidelines for these tests are as follows:

	Solid-Phase 5 min. IC50	Liquid-phase 15 min. IC50
Practically nontoxic:	≥ 1.0%	>100%
Moderately toxic:	0.1 - 1.0%	50 - 100%
Toxic:	≤ 0.1%	<50%

2.4.3 Mutatox Genotoxicity Test Using Luminescent Bacteria

Light output of the bacteria after exposure to a specified dilution series of a sample are compared to the light output of control blanks and positive controls (known mutagenic substances phenol and benzo(a)pyrene). No statistical calculations are made on the results; the test endpoint is a positive or negative response. Positive samples containing suspected genotoxic agents are defined as those which induce increased light levels of at least two times the average control blank reading in at least two consecutive test dilutions in the series.

3.0 Results and Discussion

3.1 Acute Test for Sediment Toxicity Using Marine Amphipods

3.1.1 96-hour Positive Control Reference Toxicant Tests

LC50 values derived from the reference toxicant 96-h mortality data are listed in Table 2.

Table 2: Results of 96-h LC50 tests with cadmium chloride (as mg Cd^{++}/L)

	LC50 (95 % C.I.)	
Date	*Eohaustorius washingtonianus*	*Rhepoxynius abronius*
September 1995	0.672 (0.32 - 1.80)	1.430 (1.00 - 1.80)
October 1995	0.691 (0.32 - 1.00)	0.818 (0.32 - 1.80)
April 1996	0.642 (0.52 - 0.81)	0.376 (0.29 - 0.47)
June 1996	0.438 (0.35 - 0.54)	0.525 (0.41 - 0.66)
November 1996	1.000 (0.32 - 1.80)	0.702 (0.32 - 1.00)
Historical Control Chart Data	n = 28	n = 14
Mean LC50 (95 % C.I.)	0.555 (0.383 - 0.860)	0.728 (0.512 - 1.181)

Results are generally comparable to historical control chart data (95 % confidence intervals overlap), therefore confirming the acceptability of test conditions and amphipod sensitivity. The one exception is the low *R. abronius* April 1996 result, however the control survival in the concurrent 10-day lethality tests was acceptable.

3.1.2 Acute Lethality 10-day Sediment Bioassays

Tables 3a & 3b below list the results of the amphipod bioassays and presents results of hypothesis inference testing. In the absence of a reference sediment each test sediment was compared to the control performance for an indication of toxicity. Note that for tests to discern a statistically and biologically significant decrease in amphipod survival in each sediment sample, the criteria of Environment Canada's Ocean Disposal Group have been applied (flagged by "° "). In addition, a statistically significant decrease in survival from the control has also been flagged (by "*"), should the criteria for this creosote impact evaluation change from that outlined above. Again, those flagged by "° " would be considered acutely lethal by the criteria outlined above, while those flagged by "* " indicate statistically lower values only.

Table 3a: Results of Sediment Bioassays Using *Eohaustorius washingtonianus* (Survival ± sd (%))

Site	Baseline	BP0.5 Redo	Day-14	Day-180	Day-270	Day-384
Control	99 ± 2.2	85 ± 5.0	85 ± 5.0	94 ± 5.5	94 ± 4.2	86 ± 20.7
BP 0.0						30 ± 10°*
BP 0.5	86 ± 8.2^*	90 ± 10.0	86 ± 10.8	91 ± 8.9	19 ± 12.9°*	36 ± 22°*
BP 2.0			85 ± 7.1	92 ± 2.7		46 ± 24°*
BP 5.0			86 ± 9.6	76 ± 23.3*		83 ± 15
BP 10			87.5 ± 10.4			
BP 30	95 ± 5.0					
MC 0.5	90 ± 7.1*		86.3 ± 8.5	84 ± 10.8		56 ± 18°*
OC 0.0	97.5 ± 2.9		81 ± 21.6	84 ± 8.9*	92 ± 5.7	90 ± 0.0
WP 0.5	98 ± 2.7		89 ± 10.8	88 ± 4.5*		86 ± 11.4
WP 2.0			86 ± 10.3	89 ± 5.5		78 ± 4.5

Rhepoxynius abronius data follow in Table 3b.

Table 3b: Results of Sediment Bioassays Using *Rhepoxynius abronius* (Survival ± sd (%))

Site	Baseline	BP0.5 Redo	Day-14	Day-180	Day-270	Day-384
Control	99 ± 2.2	99 ± 2.2	99 ± 2.2	89 ± 4.2	100 ± 0.0	100 ± 0.0
BP 0.0						72 ± 16*
BP 0.5	65 ± 26.7^^	94 ± 4.2*	86 ± 2.2*	90 ± 8.7	69 ± 12.9°*	69 ± 22°*
BP 2.0			92 ± 4.5*	86.3 ± 11.8		58 ± 47°*

BP 5.0		92 ± 9.1	87 ± 5.7		91 ± 7.4*
BP 10		92 ± 4.5*			
BP 30	98 ± 2.7				
MC 0.5	93 ± 9.8	95 ± 3.5*	91 ± 4.2		89 ± 8.9*
OC 0.0	95 ± 3.5*	94 ± 4.2*	81 ± 8.2*	85 ± 7.9*	92 ± 4.5*
WP 0.5	96 ± 4.2	90 ± 10.0*	92 ± 10.4		90 ± 9.4*
WP 2.0		94 ± 4.2*	86 ± 4.2		89 ± 9.6*

^ Retested at Day 14. ^^ Retested at Day 14, and no t-test comparison with control performed.

° Statisticallyand biologically significant acutely lethal response according to Lee et al. (1995).

* Statistically significant decrease in survival as compared to that in the control sediment, without further criteria applied.

It is important to note that survival in each run with control sediment did not always meet the 90 % survival criterion. However, the results of these bioassays are included in this report since a new sediment collection was not possible, and results obtained are still useful (species performance was acceptable during the positive control tests).

Daily water quality measurements fell within the specified parameters set by Environment Canada (1992a). The appendix contains summary tables of amphipod response data together with Student's *t*-test tables.

3.2 Acute Toxicity Test Using a Photoluminescent Bacterium

The results of Microtox® solid-phase testing are presented in Table 4 below.

Table 4: Results of Microtox® Solid-Phase Testing (IC50 in % (95 % confidence range))

Site	Baseline	BP0.5 Redo	Day-14	Day-180	Day-270	Day-384
BP 0.0						.72 (.7-.74)
BP 0.5	.91 (.78-1.1)	.49 (.45-.52)	.79 (.69-.90)	1.6 (.96-2.7)	4.1 (1.6-10)	1 (.92-1.2)
BP 2.0			.49 (.39-.63)	.99 (.74-1.3)		.77 (.7-.82)
BP 5.0			.53 (.52-.55)	.79 (.68-.92)		.98 (.97-.99)
BP 10			.75 (.70-.81)			
BP 30	.67 (.53-.85)					
MC 0.5	.80 (.75-.85)		.57 (.47-.70)	1.0 (.94-1.1)		1.2 (1-1.4)
OC 0.0	.79 (.65-.97)		.94 (.80-1.12)	1.6 (1.4-1.8)	3.1 (1.5-6.5)	1.8 (1.5-2)
WP 0.5	1.37 (1.22-1.53)		.71 (.64-.80)	2.9 (2.2-3.8)		1.3 (1.1-1.5)
WP 2.0			.98 (.78-1.22)	1.6 (1.1-2.2)		1.1 (1-1.3)

Performance criteria for solid-phase testing should be considered with care, as sediment particle size in addition to pollutants, affects light output, with a coarser grain resulting in a higher output. Generally coarse sediments exhibit higher IC50 values than fine particle-size sediments, because larger grain size makes it more difficult to serial dilute accurately, and also less surface area is available for toxicant binding. Upon visual inspection it was noted that in general, all the sediment

samples received had fine and homogenous particle size characteristics. Interpretation of IC50 values, therefore, is dependent on local sediment characteristics and conditions. Microtox® testing, even without well-established criteria to define toxicity levels, is useful for repeated monitoring of the same site or comparing a suite of sediments from the same area (assuming similar physical characteristics). Differences in IC50 values might then be related back to differences in levels of environmental pollutants, such as heavy metals or polyaromatic hydrocarbon levels, without the confusing factor of any additional toxicity differences due to varied particle-size profiles.

Solid-phase microtox results suggest that in general there was no significant light inhibition from any of the sediment samples from any of the collections made. The levels of toxicity range from moderately toxic to practically nontoxic, with often higher IC50s (ie/ less toxic responses) from identical sample sites which received longer exposure at the study location.

Liquid-phase testing on the porewater samples obtained from the sediments indicates that all samples were not acutely toxic to the bacteria for the baseline, Day-14, Day-180, and Day-270 samples. The highest, although "practically nontoxic" response, came from Day-180 MC 0.5 which caused a 25% and 20% decrease in light production after 5 and 15 minutes of exposure, respectively.

During the 100 %-concentration screening test, the Day-384 porewater samples all showed a greater than 50 % decrease in light production with respect to the controls, and so all were further tested in an attempt to determine an IC50 value. IC50 values derived after 5 and 15 minutes of exposure are listed in Table 5 below.

Table 5: Results of 5- and 15-min IC50 Tests with Day-384 Porewater samples

	IC50 (95 % confidence interval)	
Treatment	5 minute exposure	15 minute exposure
BP 0.0	27.77 (23.87-32.31)	25.06 (21.62-29.05)
BP 0.5	> 50	67.25 (40.96-110.42)
BP 2.0	> 50	47.22 (26.12-85.36)
BP 5.0	> 50	> 50
MC 0.5	43.00 (27.41-67.45)	35.66 (24.36-52.19)
OC 0.0	> 50	> 50
WP 0.5	33.67 (29.26-38.73)	29.23 (25.50-33.52)
WP 2.0	> 50	> 50

Pore water samples of BP 0.0, BP 2.0, MC 0.5 and WP 0.5 are considered toxic; and those from BP 0.5, BP 5.0, OC 0.0 and WP 2.0 are considered marginally toxic.

3.3 Genotoxicity Test Using Bacteria

There was no genotoxicity noted for any of the samples in either the baseline or the Day-14 samples. Within the brief November 1995 summary of baseline/Day-14 mutatox data it was noted that complex samples, such as marine sediments, may have positive mutagenic responses inhibited or masked (Microbics Corporation 1993a). The marine samples may contain toxic constituents or exhibit

physico-chemical properties, such as the high salt concentrations (or pH, colour etc.), which prevent the expression of light at the genetic or metabolic level. At the time of preparing this report, James Kochi (ph#: 1-800-642-7629 ext. 229) of Azur Environmental (formerly Microbics Corporation) was assessing this phenomenon by adding control chemicals with known genotoxic properties to environmental samples (spiked samples) and comparing test results with the unspiked environmental sample and positive control data from the same chemical. To date some masking has been observed using direct acting media. Day-180 testing, however, did reveal some suspect samples which suggests they contain genotoxic agents. Table 6 below presents these results.

Table 6: Results of Mutatox Testing on Day-180 Porewater Samples and Reference Toxicants.

	Direct Acting Media			*Indirect Acting Media*		
Treatment	16 h	21 h	25 h	16 h	21 h	25 h
Phenol ref.*	+ (12.5-100)	+ (25-100)	+ (25-100)			
B(a)P ref.*				+ (0.6-10)	+ (0.6-10)	+ (0.6-10)
BP 0.5	+ (12.5-25)	+ (0.6-25)	+ (0.64-25)	+ (3.1-25)	+ (3.1-25)	+ (3.1-25)
BP 2.0	--	--	+ (3.1-6.3)	+ (12.5-25)	+ (12.5-25)	+(12.5-25)
BP 5.0	+ (12.5-25)	+ (0.6-12.5)	+ (0.6-6.3)	+ (0.6-25)	+ (0.6-25)	+ (0.6-25)
MC 0.5	--	+ (12.5-25)	+ (1.6-25)	+ (12.5-25)	+ (6.3-25)	+ (6.3-25)
OC 0.0	--	+ (1.6-12.5)	+ (1.3-12.5)	+ (12.5-25)	+ (12.5-25)	--
WP 0.5	--	+ (1.6-25)	+ (1.3-25)	+ (6.3-25)	+ (3.1-25)	+ (3.1-25)
WP 2.0	--	--	--	--	--	--

+ = genotoxic response, with concentration range of response (%); -- = no response

*Concentration of reference toxicant range of response expressed in µg/mL

Cytotoxicity from a test sample can interfere with microbial genotoxicity test systems like Mutatox. If the test sample concentration is highly toxic, the cells will not be able to grow and express any genotoxic effects from the sample (Microbics Corporation 1993a). Toxicity can be determined by comparing the cell growth (visible turbidity) in the control vials with cell growth in the sample dilution cuvettes, however, observations on turbidity were not recorded for these data. For the Day-180 data then, WP 2.0 porewater could be cytotoxic at all concentrations tested thereby preventing a positive genotoxic response, or WP 2.0 is simply neither cytotoxic nor genotoxic. Comparisons with other bioassay results should clarify the toxicity of WP 2.0. Similarly, for all the samples where an upper value of genotoxic response is reported, the sample is likely cytotoxic above this value.

Differences between samples can be evaluated using two criteria (Microbics Corporation 1993a). One may compare the lowest concentration of sample which gives a positive Mutatox response and the potency of response from the highest test concentration. Different samples may give a positive response at similar test concentrations, whereas the strength of these responses may be quite different. The appendix contains the Mutatox light readings. After comparing the potency of light readings between the porewater samples which resulted in a positive genotoxic response, it is concluded that this criterion does not show significant differences between samples. The concentration range of the response was considered the more revealing criterion for any differences between porewater samples.

3.4 Overall Biological Assessment

The results of the biological testing component of the creosote piling study should be considered in

conjunction with any other analyses performed on samples from these sites, such as particle size analysis, organic and inorganic chemical characterization, and benthic community analysis.

See Table 7 below for a summary of toxicity test results.

Table 7: Conclusions of Bioassays with Study Sediments after 384 Days (or latest data possible)

	10d Amphipod Survival		Metabolic Inhibition		Genotoxicity
Treatment	*R.abronius*	*E.washingtonianus*	Solid-phase	Liquid-phase	Day 180 results
BMP 0.5 (270)	toxic	toxic	nontoxic	nontoxic	not performed
BP 0.0	nontoxic	toxic	moderate	toxic	not performed
BP 0.5	toxic	toxic	nontoxic	moderate	genotoxic
BP 2.0	toxic	toxic	moderate	toxic	genotoxic
BP 5.0	nontoxic	nontoxic	moderate	moderate	genotoxic
BP 10 (14)	nontoxic	nontoxic	moderate	nontoxic	not performed
BP 30 (baseline)	nontoxic	nontoxic	moderate	nontoxic	not performed
MC 0.5	nontoxic	toxic	nontoxic	toxic	genotoxic
OC 0.0	nontoxic	nontoxic	nontoxic	moderate	genotoxic
WP 0.5	nontoxic	nontoxic	nontoxic	toxic	genotoxic
WP 2.0	nontoxic	nontoxic	nontoxic	moderate	not genotoxic

If there are any questions regarding this report, please do not hesitate to call either Michelle Fennell (924-2516) or Graham van Aggelen (924-2513) at the Pacific Environmental Science Centre.

Acknowledgements

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*Results of Day-535 Microtox Testing (Screen Test, Liquid-phase on pore water, & Solid-phase)

	Screen Test (% effect at [100%])		Liquid-phase (IC50 in % (95% C.I.)		Solid-phase (IC50 in % (95% C.I.)
Site	5 min. exposure	15 min. exposure	5 min. exposure	15 min. exposure	25 min. exposure total
BP 0.0	81.13%	82.04%	34.60 (29.14-41.07)	38.93 (30.07-50.41)	0.541 (0.496-0.591)
BP 0.5	87.77%	91.44%	24.73 (21.93-27.90)	23.21 (20.20-26.68)	0.341 (0.306-0.379)
BP 0.5 offshore	72.93%	78.88%	>50	>50	0.351 (0.321-0.383)
BP 2.0	3.00%	0.00%	not performed (n/p)	n/p	0.400 (0.369-0.434)
BP 2.0 offshore	38.06%	31.15%	n/p	n/p	0.601 (0.525-0.688)
BP 5.0	72.04%	78.79%	>50	>50	0.833 (0.825-0.842)
BP 5.0 offshore	23.12%	25.48%	n/p	n/p	0.574 (0.514-0.642)
MC 0.5	98.85%	99.56%	16.41 (12.65-21.29)	12.79 (9.35-17.48)	0.529 (0.484-0.578)
WP 0.0	98.15%	99.26%	15.61 (12.48-19.53)	11.39 (8.48-15.30)	0.280 (0.270-0.290)

*Please append these results to the report entitled : *Biological Assessment of Sediments from a Creosote Study Site, Sooke, B.C. - Summary Report on Baseline, Day-14, Day-180, Day-270 and Day-384 Results*
Methods, Data Analysis and Criteria can be found in the above mentioned report.
All pore water samples were determined to be 28 ppt, except BP 0.0 which was 27 ppt.
Natural seawater was adjusted from 25 to 28 ppt using natural brine (Screen and Liquid-phase testing).
Reagent lot# ACV008-6 for all testing.

Solid-phase results indicate moderate toxicity for all sediment samples.
Porewater testing results indicate BP2.0; 2.0 offshore; and BP5.0 offshore are practically nontoxic
BP0.5 offshore and BP5.0 are moderately toxic, and
BP0.0; BP0.5; MC0.5; and WP0.0 are toxic.

Direct any inqiries to Michelle Fennell (924-2516) or Graham van Aggelen (924-2513) at PESC.

Echinoid Fertilization Inhibition Test using the Eccentric Sand Dollar					Test Date: June 18/97		
Site	% Fertilization in Replicates			Mean	% Fertilization after Abbott's Correction	SD	Significant Difference
	A	B	C				
CONTROL	84	90	86	87	100	3.06	___
WP0.0	0	0	0	0	0	0.00	yes *
535BP0.0	7	10	4	7	8	3.00	yes *
MC0.5	37	20	14	24	27	11.93	yes *
BP0.5 OFFSHORE	72	76	76	75	86	2.31	no
BP2.0 OFFSHORE	88	92	90	90	100	2.00	no
BP5.0 OFFSHORE	88	79	89	85	98	5.51	no
BP0.5	0	0	0	0	0	0.00	yes *
BP2.0	79	80	76	78	90	2.08	no
BP5.0	72	83	90	82	94	9.07	no

***** Treatment significantly different from the control and a 25% or greater decrease in mean fertilization observed between test solution and the control. (ie/ statistically and biologically significant difference from the control)

Reference Toxicant Test with Copper Sulphate (as ug/L Cu^{++})			
	FID50	95% LCL	95% UCL
June 18/97	28.4	25.3	31.7
	MEAN FID50	LWL	UWL
95/97 (n = 11)	30.3	14.1	46.5

SD = standard deviation between replicates
FID50 = inhibition dose causing 50% fertilization
LCL = lower confindence limit
UCL = upper confidence limit
LWL = lower warning limit
UWL = upper warning limit

APPENDIX V

Laboratory Quality Assurance/Quality Control

A. Sediment Procedural Blanks

B. N.R.C. Standard Reference Material (HS6)

C. Blind N.R.C. Standard Reference Material

D. Sample Detection Limits

APPENDIX V(A)

Laboratory Quality Assurance/Quality Control

Sediment Procedural Blanks

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period	Site Selection					Baseline						
Batch I.D.	Port Graves	Port Graves	Storm Bay	Sooke Basin, Ellen Bay, Pat Bay, Genoa Bay	Pt.Browning, Centre Bay	PH-0814	PH-0825	PH-0827	Baseline Samples			
Lab No.	2891	2891	2891	2891	2891	2891	2891	2891				
Sample No.	01-04	09-12	06-08	13-16,17-19	20-23	26-31,34-36	24,25,32,33,49	42,43,44	Min	Max	Mean (n=3)	Std. Dev.
Naphthalene	2.2	NDR(0.97)	NDR(0.86)	2.1	2.2	1.6	NDR(1.4)	NDR(0.86)	NDR(0.86)	1.6	1.6	---
Acenaphthylene	ND	ND	ND	NDR(0.17)	0.1	ND	ND	0.33	ND	0.33	0.33	---
Acenaphthene	ND	ND	ND	ND	0.36	NDR(1.1)	NDR(0.33)	ND	ND	NDR(1.1)	NDR(1.1)	---
Fluorene	0.38	ND	NDR(0.08)	NDR(0.21)	0.35	NDR(0.86)	NDR(0.17)	ND	ND	NDR(0.86)	NDR(0.86)	---
Phenanthrene	1.3	NDR(0.76)	NDR(0.25)	0.42	0.56	1.0	0.24	0.38	0.24	1.0	0.54	0.4
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
LPAH	3.9	0.0	0.0	2.5	3.6	2.6	0.24	0.71	0.24	2.6	1.2	1.2
Fluoranthene	0.35	NDR(0.45)	NDR(0.12)	0.35	0.32	ND	NDR(0.19)	NDR(0.2)	ND	NDR(0.2)	NDR(0.2)	---
Pyrene	NDR(0.27)	NDR(0.35)	NDR(0.15	0.38	0.27	ND	NDR(0.18)	NDR(0.22)	ND	NDR(0.2)	NDR(0.2)	---
Benz(a)anthracene	ND	ND	ND	NDR(0.26)	ND	ND	ND	ND	ND	NDR(0.2)	NDR(0.2)	---
Chrysene	NDR(0.23)	ND	ND	NDR(0.89)	0.48	ND	NDR(0.27)	0.38	ND	0.38	0.38	---
Benzofluoranthenes	ND	ND	ND	NDR(0.82)	0.44	ND	ND	0.32	ND	0.32	0.32	---
Benzo(e)pyrene	ND	ND	ND	NDR(0.85)	0.26	ND	ND	1.3	ND	1.3	1.3	---
Benzo(a)pyrene	ND	ND	ND	NDR(0.99)	ND	ND	ND	0.74	ND	0.74	0.74	---
Perylene	ND	ND	ND	NDR(1.1)	ND	ND	NDR(0.2)	0.81	ND	0.81	0.81	---
Dibenz(ah)anthracene	NDR(0.46)	1.0	ND	2.6	ND	ND	NDR(0.56)	NDR(2.7)	ND	NDR(2.7)	NDR(2.7)	---
Indeno(1,2,3-cd)pyrene	NDR(0.57)	0.81	ND	NDR(1.3)	0.41	ND	NDR(0.58)	NDR(1.9)	ND	NDR(1.9)	NDR(1.9)	---
Benzo(ghi)perylene	NDR(0.32)	ND	ND	NDR(1.8)	0.49	ND	NDR(0.78)	NDR(2.3)	ND	NDR(2.3)	NDR(2.3)	---
HPAH	0.4	1.8	0.0	3.3	2.7	0.0	0.0	3.6	0.0	3.6	1.2	2.0
TPAH	4.2	1.8	0.0	5.9	6.2	2.6	0.2	4.3	0.2	4.3	2.4	2.0
TPAH (µg/g)	0.004	0.002	0.0	0.006	0.006	0.003	0.0002	0.004	0.0002	0.004	0.002	0.002

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period	Day14										
Batch I.D.	PH-0815	PH-0816	PH-0819	PH-0825	PH-0827	PH-0837	PH-0845	PH-0852	PH-0854	PH-0860	PH-0861
Lab No.	2891	2891	2891	2891	2891	2891	2891	2891	2891	2891	2891
Sample No.	37,38,48,50-52,54	55,56A,59,60-63	68,69,71,75,76	57,58,64,65	66,67,70,73	47,53,59,72	45,46,77,78	74	94-101	102-109	110-117
Naphthalene	NDR(1.3)	ND	NDR(1.1)	NDR(1.4)	NDR(0.86)	1.4	8.3	NDR(0.6)	NDR(0.89)	----	1.4
Acenaphthylene	NDR(0.27)	ND	NDR(0.36)	ND	0.33	0.23	2.6	ND	NDR(0.59)	0.36	0.16
Acenaphthene	ND	ND	0.14	NDR(0.33)	ND	0.12	NDR(1.8)	ND	0.32	ND	0.22
Fluorene	NDR(0.2)	ND	ND(0.07)	NDR(0.17)	ND	ND(0.05)	NDR(1.1)	0.2	0.31	0.45	ND
Phenanthrene	NDR(0.6)	ND	NDR(0.49)	0.24	0.38	0.27	NDR(5.8)	0.34	0.5	5.1	0.5
Anthracene	ND	ND	ND	ND	ND	ND	3.6	ND	0.25	ND	ND
LPAH	0.0	0.0	0.14	0.24	0.71	2.0	14.5	0.5	1.4	5.9	2.3
Fluoranthene	NDR(0.21)	ND	NDR(0.4)	NDR(0.19)	NDR(0.2)	NDR(0.16)	4.9	NDR(0.14)	NDR(0.21)	3.7	0.28
Pyrene	0.06	ND	ND	NDR(0.18)	NDR(0.22)	0.15	4.0	NDR(0.12)	NDR(0.22)	2.1	0.16
Benz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.11	0.18
Chrysene	NDR(0.3)	ND	ND	NDR(0.27)	0.38	NDR(0.2)	NDR(3.0)	ND	ND	0.4	0.29
Benzofluoranthenes	ND	ND	NDR(0.84)	ND	0.32	ND	ND	ND	ND	ND	ND
Benzo(e)pyrene	0.67	ND	NDR(0.8)	ND	1.3	NDR(0.87)	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	0.74	ND	ND	ND	ND	ND	ND
Perylene	ND	ND	ND	NDR(0.2)	0.81	NDR(0.35)	ND	ND	ND	0.26	ND
Dibenz(ah)anthracene	ND	ND	ND	NDR(0.56)	NDR(2.7)	ND	ND	ND	NDR(0.59)	ND	0.31
Indeno(1,2,3-cd)pyrene	ND	ND	NDR(3.3)	NDR(0.58)	NDR(1.9)	ND	ND	ND	ND	0.24	0.3
Benzo(ghi)perylene	NDR(.092)	ND	ND	NDR(0.78)	NDR(2.3)	NDR(1.6)	ND	ND	ND	ND	0.15
HPAH	0.7	0.0	0.0	0.0	3.6	0.2	8.9	0.0	0.0	6.8	1.7
TPAH	0.7	0.0	0.1	0.2	4.3	2.2	23.4	0.5	1.4	12.7	4.0
TPAH (µg/g)	0.001	0.00	0.0001	0.0002	0.004	0.002	0.023	0.001	0.001	0.013	0.004

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period					Day180								
Batch I.D.	Day14 Samples				PH-0891	PH-0896	PH-0897	PH-0899	PH-0900	PH-0902	PH-0914	PH-0947	PH-0961
Lab No.					9611	9611	9611	9611	9611	9611	9611	9611	9611
Sample No.	Min	Max	Mean (n=11)	Std. Dev.	01-06	08-16	07, 17-24	25-33	34-42	43-51	52-53	77	74-78
Naphthalene	ND	8.3	3.7	4.0	2.8	6.9	2.3	0.58	NDR(0.59)	NDR(0.47)	NDR(0.46)	NDR(1.8)	NDR(1.8)
Acenaphthylene	ND	2.6	0.7	1.0	NDR(0.33)	ND	ND	ND	ND	NDR(0.17)	NDR(0.34)	NDR(1.1)	ND
Acenaphthene	ND	0.32	0.2	0.1	NDR(0.26)	0.34	ND	0.38	NDR(0.24)	NDR(0.32)	0.43	ND	ND
Fluorene	ND	0.45	0.32	0.1	0.22	0.17	0.29	0.29	0.17	0.29	0.32	0.9	0.32
Phenanthrene	ND	5.1	1.1	1.8	0.4	0.3	0.4	NDR(0.82)	0.43	NDR(0.87)	0.54	3.6	0.52
Anthracene	ND	3.6	1.9	2.4	NDR(0.16)	ND	NDR(0.13)	0.11	NDR(0.14)	NDR(0.14)	0.3	NDR(0.44)	ND
LPAH	0.0	14.5	2.5	4.3	3.5	7.7	3.0	1.4	0.6	0.3	1.6	4.5	0.8
Fluoranthene	ND	4.9	3.0	2.4	0.11	0.17	NDR(0.18)	NDR(0.2)	0.33	0.76	0.24	0.55	ND
Pyrene	ND	4.0	1.3	1.7	0.1	NDR(0.19)	NDR(0.14)	ND	NDR(0.24)	0.37	ND	0.41	ND
Benz(a)anthracene	ND	0.18	0.15	0.05	ND	ND	ND	NDR(0.15)	NDR(0.22)	NDR(0.16)	ND	ND	ND
Chrysene	ND	0.4	0.36	0.1	NDR(0.2)	NDR(0.14)	NDR(0.07)	ND	0.3	NDR(0.3)	ND	ND	ND
Benzofluoranthenes	ND	0.32	0.32	---	ND	ND	ND	ND	NDR(0.15)	ND	ND	ND	ND
Benzo(e)pyrene	ND	1.3	0.99	0.4	ND	ND	ND	ND	NDR(0.19)	ND	ND	ND	ND
Benzo(a)pyrene	ND	0.74	0.74	---	ND	ND	ND	ND	NDR(0.22)	ND	ND	ND	ND
Perylene	ND	0.81	0.54	0.4	ND	ND	ND	ND	NDR(0.22)	ND	ND	ND	ND
Dibenz(ah)anthracene	ND	0.31	0.31	---	ND	ND	ND	ND	NDR(0.77)	NDR(0.32)	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	0.3	0.27	0.04	NDR(0.26)	NDR(0.47)	NDR(0.2)	ND	NDR(0.46)	NDR(0.25)	ND	ND	ND
Benzo(ghi)perylene	ND	0.15	0.15	---	NDR(0.2)	ND	NDR(0.46)	ND	NDR(0.38)	NDR(0.14)	ND	ND	ND
HPAH	0.0	8.9	2.0	3.1	0.2	0.2	0.0	0.0	0.6	1.1	0.2	1.0	0.0
TPAH	0.0	23.4	4.5	7.3	3.7	7.8	3.0	1.4	1.2	1.4	1.8	5.5	0.8
TPAH (µg/g)	0.00	0.023	0.005	0.007	0.004	0.008	0.003	0.001	0.001	0.001	0.002	0.005	0.001

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period					Day384							
Batch I.D.	Day180 Samples				PH-0974	PH-0976	PH-0980	PH-0981	PH-0982	PH-0983	PH-0984	PH-0986
Lab No.					9611	9611	9611	9611	9611	9611	9611	9611
Sample No.	Min	Max	Mean (n=9)	Std. Dev.	81 - 88	89-100	102,104,106-110,113	79,80,87,92,94,99,101	115-117,119,123-126	103,105,112,114,118, 120, 122.	127-132	134-139,143-145
Naphthalene	NDR(0.46)	6.9	3.9	2.7	3.9	11	12	9.9	7.3	9.0	8.3	8.1
Acenaphthylene	ND	NDR(1.1)	NDR	---	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	0.43	0.4	0.0	ND	0.4	ND	NDR(0.39)	ND	ND	ND	ND
Fluorene	0.17	0.9	0.4	0.2	ND	0.83	1.4	NDR(0.75)	0.81	0.98	0.7	0.95
Phenanthrene	NDR(0.82)	3.6	1.2	1.2	0.36	2.5	2.7	2.2	2.4	2.4	2.1	2.4
Anthracene	ND	0.3	0.2	0.1	ND	ND	ND	ND	ND	ND	ND	ND
LPAH	0.3	7.7	2.8	2.4	4.3	14.7	16.1	12.1	10.5	12.4	11.1	11.5
Fluoranthene	NDR(0.18)	0.76	0.4	0.2	NDR(0.12)	0.48	0.45	0.6	0.46	0.75	0.5	0.46
Pyrene	ND	0.41	0.3	0.2	NDR)0.13)	0.42	0.25	0.37	0.34	0.54	0.3	0.41
Benz(a)anthracene	ND	NDR(0.22)	NDR	---	ND	NDR(0.1)	ND	ND	ND	ND	ND	ND
Chrysene	ND	0.3	0.3	---	ND	NDR(0.25)	ND	ND	ND	ND	ND	ND
Benzofluoranthenes	ND	NDR(0.15)	NDR	---	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(e)pyrene	ND	NDR(0.19)	NDR	---	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	NDR(0.22)	NDR	---	ND	ND	ND	ND	ND	ND	ND	ND
Perylene	ND	NDR(0.22)	NDR	---	ND	ND	ND	ND	ND	ND	ND	ND
Dibenz(ah)anthracene	ND	NDR(0.77)	NDR	---	ND	NDR(0.15)	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	NDR(0.47)	NDR	---	ND	NDR(0.27)	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	ND	NDR(0.46)	NDR	---	ND	ND	ND	ND	ND	ND	ND	ND
HPAH	0.0	1.1	0.4	0.4	0.0	0.9	0.7	1.0	0.8	1.3	0.8	0.9
TPAH	0.8	7.8	3.2	2.4	4.3	15.6	16.8	13.1	11.3	13.7	11.9	12.3
TPAH (µg/g)	0.001	0.008	0.003	0.002	0.004	0.02	0.02	0.01	0.01	0.01	0.01	0.01

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period

Batch I.D.	PH-0987	PH-0988	PH-0990	PH-0991	PH-0993	Day384 Samples				Day0 to Day384
Lab No.	9611	9611	9611	9611	9611					
Sample No.	147-149,152-156	157-160,162-166	140-142,167-170	171-175,176-179	121,133,146,150,151,161, 175	Min	Max	Mean (n=13)	Std. Dev.	Overall Mean (n=36)
Naphthalene	13	0.7	NDR(1.5)	NDR(0.93)	2.4	NDR(0.93)	13	7.9	4.0	5.8
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	---	0.7
Acenaphthene	NDR(0.43)	ND	ND	ND	ND	ND	0.4	0.4	---	0.3
Fluorene	0.82	ND	NDR(0.1)	ND	0.13	ND	1.4	0.8	0.4	0.5
Phenanthrene	2.1	0.37	0.33	NDR(0.24)	0.4	NDR(0.24)	2.7	1.7	1.0	1.2
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	---	1.1
LPAH	15.9	1.1	0.3	0.0	2.9	0.0	16.1	8.5	6.1	4.7
Fluoranthene	0.44	0.26	0.26	0.32	0.31	NDR(0.12)	0.75	0.4	0.1	0.8
Pyrene	0.22	0.17	0.11	ND	0.14	NDR)0.13)	0.54	0.3	0.1	0.6
Benz(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	---	0.1
Chrysene	NDR(0.16)	0.24	ND	ND	0.11	ND	0.24	0.2	0.1	0.3
Benzofluoranthenes	ND	ND	ND	ND	ND	ND	ND	ND	---	0.3
Benzo(e)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	---	1.1
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	---	0.7
Perylene	ND	ND	ND	ND	ND	ND	ND	ND	---	0.6
Dibenz(ah)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	---	0.3
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	---	0.3
Benzo(ghi)perylene	ND	ND	ND	ND	ND	ND	ND	ND	---	0.2
HPAH	0.7	0.7	0.4	0.3	0.6	0.0	1.3	0.7	0.3	1.0
TPAH	16.6	1.7	0.7	0.3	3.5	0.3	16.8	9.3	6.3	5.7
TPAH (µg/g)	0.02	0.002	0.001	0.0003	0.003	0.0003	0.017	0.009	0.006	0.006

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period	Site Selection					Baseline						
Batch I.D.	Port Graves	Port Graves	Storm Bay	Sooke Basin, Ellen Bay, Pat Bay, Genoa Bay	Pt.Browning, Centre Bay	PH-0814	PH-0825	PH-0827	Baseline Samples			
Lab No.	2891	2891	2891	2891	2891	2891	2891	2891				
Sample No.	01-04	09-12	06-08	13-16,17-19	20-23	26-31,34-36	24,25,32,33,49	42,43,44	Min	Max	Mean (n=3)	Std. Dev.
C1 naphthalenes						na	0.72	0.39	0.39	0.72	0.56	0.2
C2 naphthalenes						na	0.37	0.27	0.27	0.37	0.32	0.1
C3 naphthalenes						na	ND	0.8	ND	0.8	0.8	---
C4 naphthalenes						na	ND	ND	ND	ND	ND	---
C5 naphthalenes						na	ND	ND	ND	ND	ND	---
C1 phen,anth						na	ND	ND	ND	ND	ND	---
C2 phen,anth						na	ND	ND	ND	ND	ND	---
C3 phen,anth						na	ND	ND	ND	ND	ND	---
C4 phen,anth						na	ND	ND	ND	ND	ND	---
Retene						na	ND	ND	ND	ND	ND	---
C5 phen,anth						na	ND	ND	ND	ND	ND	---
C1 fluor,pyrenes						na	ND	ND	ND	ND	ND	---
C2 fluor,pyrenes						na	ND	ND	ND	ND	ND	---
C3 fluor,pyrenes						na	ND	ND	ND	ND	ND	---
C4 fluor,pyrenes						na	ND	ND	ND	ND	ND	---
C5 fluor,pyrenes						na	ND	ND	ND	ND	ND	---
Dibenzothiophene						na	ND	ND	ND	ND	ND	---
C1 dibenzothiophene						na	ND	ND	ND	ND	ND	---
C2 dibenzothiophene						na	ND	ND	ND	ND	ND	---
Dibenzofuran						na	ND	0.09	ND	0.09	0.09	---

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period	Day14										
Batch I.D.	PH-0815	PH-0816	PH-0819	PH-0825	PH-0827	PH-0837	PH-0845	PH-0852	PH-0854	PH-0860	PH-0861
Lab No.	2891	2891	2891	2891	2891	2891	2891	2891	2891	2891	2891
Sample No.	37,38,48,50-52,54	55,56A,59,60-63	68,69,71,75,76	57,58,64,65	66,67,70,73	47,53,59,72	45,46,77,78	74	94-101	102-109	110-117
C1 naphthalenes	na	na	na	0.72	0.39	na	ND	na	0.62	ND	0.44
C2 naphthalenes	na	na	na	0.37	0.27	na	ND	na	0.39	ND	ND
C3 naphthalenes	na	na	na	ND	0.8	na	ND	na	0.41	2.5	ND
C4 naphthalenes	na	na	na	ND	ND	na	ND	na	ND	ND	ND
C5 naphthalenes	na	na	na	ND	ND	na	ND	na	ND	ND	ND
C1 phen,anth	na	na	na	ND	ND	na	ND	na	ND	1.6	ND
C2 phen,anth	na	na	na	ND	ND	na	ND	na	ND	ND	ND
C3 phen,anth	na	na	na	ND	ND	na	ND	na	ND	ND	ND
C4 phen,anth	na	na	na	ND	ND	na	ND	na	ND	ND	ND
Retene	na	na	na	ND	ND	na	ND	na	ND	ND	ND
C5 phen,anth	na	na	na	ND	ND	na	ND	na	ND	ND	na
C1 fluor,pyrenes	na	na	na	ND	ND	na	ND	na	ND	ND	na
C2 fluor,pyrenes	na	na	na	ND	ND	na	ND	na	ND	ND	na
C3 fluor,pyrenes	na	na	na	ND	ND	na	ND	na	ND	ND	na
C4 fluor,pyrenes	na	na	na	ND	ND	na	ND	na	ND	ND	na
C5 fluor,pyrenes	na	na	na	ND	ND	na	ND	na	ND	ND	na
Dibenzothiophene	na	na	na	ND	ND	na	NDR(1.1)	na	NDR(0.3)	ND	ND
C1 dibenzothiophene	na	na	na	ND	ND	na	ND	na	ND	ND	ND
C2 dibenzothiophene	na	na	na	ND	ND	na	ND	na	ND	ND	ND
Dibenzofuran	na	na	na	ND	0.09	na	1.4	na	ND	ND	na

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period					Day180								
Batch I.D.	Day14 Samples				PH-0891	PH-0896	PH-0897	PH-0899	PH-0900	PH-0902	PH-0914	PH-0947	PH-0961
Lab No.					9611	9611	9611	9611	9611	9611	9611	9611	9611
Sample No.	Min	Max	Mean (n=11)	Std. Dev.	01-06	08-16	07, 17-24	25-33	34-42	43-51	52-53	77	74-78
C1 naphthalenes	ND	0.7	0.5	0.2	na	1.8	0.54	na	0.41	0.54	na	na	na
C2 naphthalenes	ND	0.4	0.3	0.1	na	ND	ND	na	ND	0.48	na	na	na
C3 naphthalenes	ND	2.5	1.2	1.1	na	ND	ND	na	ND	0.64	na	na	na
C4 naphthalenes	ND	ND	ND	---	na	ND	ND	na	ND	ND	na	na	na
C5 naphthalenes	ND	ND	ND	---									
C1 phen,anth	ND	1.6	1.6	---	na	ND	ND	na	ND	0.42	na	na	na
C2 phen,anth	ND	ND	ND	---	na	ND	ND	na	ND	ND	na	na	na
C3 phen,anth	ND	ND	ND	---	na	ND	ND	na	ND	ND	na	na	na
C4 phen,anth	ND	ND	ND	---	na	ND	ND	na	ND	ND	na	na	na
Retene	ND	ND	ND	---									
C5 phen,anth	ND	ND	ND	---									
C1 fluor,pyrenes	ND	ND	ND	---									
C2 fluor,pyrenes	ND	ND	ND	---									
C3 fluor,pyrenes	ND	ND	ND	---									
C4 fluor,pyrenes	ND	ND	ND	---									
C5 fluor,pyrenes	ND	ND	ND	---									
Dibenzothiophene	ND	ND	ND	---	na	NDR(0.09)	ND	na	NDR(0.29)	NDR(0.16)	na	na	na
C1 dibenzothiophene	ND	ND	ND	---	na	ND	ND	na	ND	ND	na	na	na
C2 dibenzothiophene	ND	ND	ND	---	na	ND	ND	na	ND	ND	na	na	na
Dibenzofuran	ND	1.4	0.75	0.9	na	ND	ND	0.29	ND	ND	na	na	na

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period					Day384							
Batch I.D.	Day180 Samples				PH-0974	PH-0976	PH-0980	PH-0981	PH-0982	PH-0983	PH-0984	PH-0986
Lab No.					9611	9611	9611	9611	9611	9611	9611	9611
Sample No.	Min	Max	Mean (n=9)	Std. Dev.	81 - 88	89-100	102,104,106-110,113	79,80,87,92,94,99,101	115-117,119,123-126	103,105,112,114,118, 120, 122.	127-132	134-139,143-145
C1 naphthalenes	0.41	1.8	0.9	0.7	na	na	na	7.1	na	7.1	na	na
C2 naphthalenes	ND	0.48	0.5	---	na	na	na	4.6	na	3.8	na	na
C3 naphthalenes	ND	0.64	0.6	---	na	na	na	2.4	na	ND	na	na
C4 naphthalenes	ND	ND	ND	---	na	na	na	ND	na	ND	na	na
C5 naphthalenes												
C1 phen,anth	ND	0.42	0.4	---	na	na	na	1.8	na	ND	na	na
C2 phen,anth	ND	ND	ND	---	na	na	na	ND	na	ND	na	na
C3 phen,anth	ND	ND	ND	---	na	na	na	ND	na	ND	na	na
C4 phen,anth	ND	ND	ND	---	na	na	na	ND	na	ND	na	na
Retene												
C5 phen,anth												
C1 fluor,pyrenes												
C2 fluor,pyrenes												
C3 fluor,pyrenes												
C4 fluor,pyrenes												
C5 fluor,pyrenes												
Dibenzothiophene	ND	NDR0.29)	NDR0.29)	---	na	na	na	ND	na	ND	na	na
C1 dibenzothiophene	ND	ND	ND	---	na	na	na	ND	na	ND	na	na
C2 dibenzothiophene	ND	ND	ND	---	na	na	na	ND	na	ND	na	na
Dibenzofuran	ND	0.29	0.3	---	na	na	na	NDR(1.4)	na	NDR(1.2)	na	na

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

Appendix V (A). Laboratory Results(ng/g, dry wt.) for Sediment Sample Batch Procedural Blanks: Sooke Basin - Site Selection and Day0 to Day384.

Exposure Period

Batch I.D.	PH-0987	PH-0988	PH-0990	PH-0991	PH-0993	Day384 Samples				Day0 to Day384
Lab No.	9611	9611	9611	9611	9611					
Sample No.	147-149,152-156	157-160,162-166	140-142,167-170	171-175,176-179	121,133,146,150,151,161, 175	Min	Max	Mean (n=13)	Std. Dev.	Overall Mean (n=36)
C1 naphthalenes	na	na	na	na	0.83	0.8	7.1	5.0	3.6	1.7
C2 naphthalenes	na	na	na	na	1.6	1.6	4.6	3.3	1.6	1.4
C3 naphthalenes	na	na	na	na	0.7	0.7	2.4	1.6	1.2	1.2
C4 naphthalenes	na	na	na	na	ND	ND	ND	ND	---	ND
C5 naphthalenes										ND
C1 phen,anth	na	na	na	na	ND	1.8	1.8	1.8	---	1.3
C2 phen,anth	na	na	na	na	ND	ND	ND	ND	---	ND
C3 phen,anth	na	na	na	na	ND	ND	ND	ND	---	ND
C4 phen,anth	na	na	na	na	ND	ND	ND	ND	---	ND
Retene										ND
C5 phen,anth										ND
C1 fluor,pyrenes										ND
C2 fluor,pyrenes										ND
C3 fluor,pyrenes										ND
C4 fluor,pyrenes										ND
C5 fluor,pyrenes										
Dibenzothiophene	na	na	na	na	NDR(0.14)	ND	NDR(0.14)	NDR(0.14)	---	NDR
C1 dibenzothiophene	na	na	na	na	ND	ND	ND	ND	---	ND
C2 dibenzothiophene	na	na	na	na	ND	ND	ND	ND	---	ND
Dibenzofuran	na	na	na	na	0.23	NDR(1.2)	NDR(1.4)	NDR(1.4)	---	0.5

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Mean = based on positive values except if all values are ND or NDR.

APPENDIX V (B)

Laboratory Quality Assurance/Quality Control

N.R.C. Standard Reference Material (HS6)

Appendix V (B). Laboratory Results (ng/g, dry wt.) for N.R.C. Marine Sediment Standard Reference Material (HS6): Sooke Basin Study - Day0 to Day14.

Batch ID.	HS6 N.R.C.	PH-0814	PH-0815	PH-0816	PH-0819	PH-0825	PH-0827
Sample ID.		2891	2891	2891	2891	2891	2891
Sample Nos.		26-36A	37,38,48,50,51,52,54	55,56A,59,60-63	68,69,71,75A,76	24,25,32,33,49,57A,58,64,65	42,43,44,66,67A,70,73
Reporting Date		20-Nov-95	19-Jan-96	17-Nov-95	23-Jan-96	18-Jan-96	19-Jan-96
	Certified	Determined	Determined	Determined	Determined	Determined	Determined
Naphthalene	4100±1100	4400	4600	4800	4600	4600	4700
Acenaphthylene	190±50	230	190	230	240	180	170
Acenaphthene	230±70	170	130	160	130	140	140
Fluorene	470±120	370	320	380	300	270	290
Phenanthrene	3000±600	3300	3800	3500	3700	3600	3300
Anthracene	1100±400	910	1000	860	950	900	870
Fluoranthene	3540±650	3300	3600	3800	4000	3700	3500
Pyrene	3000±600	2700	3000	3100	3200	2900	2900
Benz(a)anthracene	1800±300	1600	1900	1600	2000	1600	1600
Chrysene	2000±300	2100	2800	2200	2700	2400	2500
Benzofluoranthenes	4230±750	5100	4600	5000	4900	4300	5800
Benzo(e)pyrene	---	1800	1600	1900	1700	1600	2000
Benzo(a)pyrene	2200±400	1900	1400	1900	1700	1500	1600
Perylene	---	400	380	410	560	520	400
Dibenz(ah)anthracene	490±160	400	360	380	440	410	400
Indeno(1,2,3-cd)pyrene	1950±580	2500	1900	2000	2500	2200	2100
Benzo(ghi)perylene	1780±720	1600	1500	1600	1800	1600	1600
Dibenzofuran	1100±300						
Surrogate Stds. (% recovery)							
Naph d-8		63	63	61	100	69	62
Acen d-10		65	64	60	100	81	65
Phen d-10		80	68	73	79	91	77
Pyr d-10		92	78	77	87	84	78
Cry d-12		88	75	73	76	83	73
B(a)P d-12		83	76	72	85	94	68
Perylene d-12		79	76	71	100	92	67
DiB(ah)A d-14		97	91	69	32	91	51
B(ghi)P d-12		76	69	66	72	81	54
2-Methylnaph. d-10							
Dibenzofuran d-8							

Appendix V (B). Laboratory Results (ng/g, dry wt.) for N.R.C. Marine Sediment Standard Reference Material (HS6): Sooke Basin Study - Day0 to Day14.

Batch ID.	PH-0837	PH-0845	PH-0852	PH-0854	PH-0860	PH-0861
Sample ID.	2891	2891	2891	2891	2891	2891
Sample Nos.	47,53,59,72	45,46,77,78	77	94-101	102-109	110-117
Reporting Date	23-Jan-96	05-Feb-96	27-Feb-96	04-Apr-96	04-Apr-96	04-Apr-96
	Determined	Determined	Determined	Determined	Determined	Determined
Naphthalene	4800	4300	4900	4200	4800	4600
Acenaphthylene	190	220	240	220	280	280
Acenaphthene	140	110	160	160	160	170
Fluorene	320	230	350	350	420	370
Phenanthrene	3400	3300	3700	3100	3400	3500
Anthracene	890	900	850	700	950	950
Fluoranthene	3800	3600	3900	3600	3300	3600
Pyrene	3200	2800	3200	2900	2800	3000
Benz(a)anthracene	1700	1800	1600	1400	1900	2100
Chrysene	2500	2400	2500	2200	2500	2600
Benzofluoranthenes	5100	5400	4500	4200	4700	5000
Benzo(e)pyrene	1900	1900	1700		1600	1700
Benzo(a)pyrene	1700	1600	1800	1800	2000	1600
Perylene	410	440	450		430	460
Dibenz(ah)anthracene	390	410	400	330	410	420
Indeno(1,2,3-cd)pyrene	1900	2100	2200	1800	2400	2600
Benzo(ghi)perylene	1600	1700	1800	1500	1800	1800
Dibenzofuran				1000	1300	
Surrogate Stds. (% recovery)						
Naph d-8	64	77	---	48	28	63
Acen d-10	67	73	---	50	34	50
Phen d-10	76	82	---	60	65	66
Pyr d-10	73	89	---	57	80	65
Cry d-12	73	85	---	50	80	61
B(a)P d-12	54	83	---	56	80	56
Perylene d-12	50	84	---	48	68	49
DiB(ah)A d-14	54	81	---	55	69	65
B(ghi)P d-12	54	78	---	45	50	45
2-Methylnaph. d-10				44	---	
Dibenzofuran d-8				52	40	

Appendix V (B). Laboratory Results (ng/g, dry wt.) for N.R.C. Marine Sediment Standard Reference Material (HS6): Sooke Basin Study - Day180.

Batch ID.		PH-0891	PH-0896	PH-0897	PH-0899	PH-0900	PH-0902	PH-0914
Sample ID.	HS6 N.R.C.	9611	9611	9611	9611	9611	9611	9611
Sample Nos.		1A-6	8-16	7,17-24	25-33	34-42	43-51	52-53
Reporting Date		24-May-96	17-Jun-96	09-Jul-96	17-Jun-96	11-Jun-96	14-Jun-96	24-Jul-96
	Certified	Determined	Determined	Determined	Determined	Determined	Determined	Determined
Naphthalene	4100±1100	4900	4600	4800	5100	4500	4900	4600
Acenaphthylene	190±50	340	280	250	320	260	260	230
Acenaphthene	230±70	180	170	200	200	180	180	180
Fluorene	470±120	430	390	470	460	350	420	380
Phenanthrene	3000±600	3500	3200	3500	3500	3000	3400	3400
Anthracene	1100±400	950	900	910	1000	920	950	930
Fluoranthene	3540±650	3600	3300	3300	3300	3100	3300	3400
Pyrene	3000±600	2900	2600	2800	2800	2600	2700	2700
Benz(a)anthracene	1800±300	1800	1800	1800	2000	1600	1700	1700
Chrysene	2000±300	2500	2500	2400	2600	2400	2400	2300
Benzofluoranthenes	4230±750	4800	4700	4400	4700	4200	4300	4400
Benzo(e)pyrene	---	1800	1700	1700	1800	1500	1700	1700
Benzo(a)pyrene	2200±400	1900	2000	2000	2100	1800	1800	2000
Perylene	---	460	460	460	490	410	440	450
Dibenz(ah)anthracene	490±160	380	400	400	440	390	430	430
Indeno(1,2,3-cd)pyrene	1950±580	2200	2400	2300	2500	2300	2100	1900
Benzo(ghi)perylene	1780±720	1700	1700	1700	1800	1600	1600	1700
Dibenzofuran	1100±300			1300			1300	
Surrogate Stds. (% recovery)								
Naph d-8		26	49	35	40	48	32	64
Acen d-10		38	62	60	58	58	40	72
Phen d-10		63	80	84	82	71	56	78
Pyr d-10		69	88	96	89	77	67	82
Cry d-12		73	87	110	89	80	70	82
B(a)P d-12		71	88	93	92	69	61	87
Perylene d-12		64	77	84	83	61	54	79
DiB(ah)A d-14		83	93	120	120	73	61	100
B(ghi)P d-12		62	63	80	83	51	49	82
2-Methylnaph. d-10								
Dibenzofuran d-8								

Appendix V (B). Laboratory Results (ng/g, dry wt.) for N.R.C. Marine Sediment Standard Reference Material (HS6): Sooke Basin Study - Day270 and Day384.

Batch ID. Sample ID. Sample Nos. Reporting Date	HS6 N.R.C.	PH-0947 270 77	PH-0974 384 81- 88	PH-0976 384 89-100	PH-0980 384 102-113	PH-0981 384 79,80,87A,92,94,99,101	PH-0982 384 115-117, 119, 123-126	PH-0983 384 103-122	PH0986 384 134-139;143-145
	Certified	Determined	Determined	Determined	Determined	Determined	Determined	Determined	Determined
Naphthalene	4100±1100	4200	4200	4200	4400	4800	4700	4900	4500
Acenaphthylene	190±50	170	170	200	180	190	190	190	200
Acenaphthene	230±70	170	180	180	170	180	160	180	180
Fluorene	470±120	300	400	390	320	330	390	360	360
Phenanthrene	3000±600	3000	2900	3400	3300	3500	3400	3900	3900
Anthracene	1100±400	8200	810	880	880	900	910	900	1000
Fluoranthene	3540±650	3100	3200	3600	3400	3700	3400	3600	3800
Pyrene	3000±600	2600	2600	2700	2800	2900	2900	2900	2900
Benz(a)anthracene	1800±300	1500	1500	1700	1600	1700	1600	1700	1700
Chrysene	2000±300	2400	2200	2500	2500	2300	2100	2000	2400
Benzofluoranthenes	4230±750	4000	4300	4600	4800	4700	4900	4700	4900
Benzo(e)pyrene	---	1500	1600	---	1800	1700	1800	1800	1800
Benzo(a)pyrene	2200±400	1700	1700	2000	2000	2000	1800	2000	2000
Perylene	---	390	400	---	450	440	440	440	430
Dibenz(ah)anthracene	490±160	350	380	390	410	39	410	430	390
Indeno(1,2,3-cd)pyrene	1950±580	2000	1900	2100	2100	2100	2100	2100	2100
Benzo(ghi)perylene	1780±720	1600	1600	1600	1800	1700	1700	1700	1800
Dibenzofuran	1100±300					1200		1200	
Surrogate Stds. (% recovery)			.						
Naph d-8		72	79	90	72	83	59	66	73
Acen d-10		80	81	87	70	86	63	71	77
Phen d-10		77	89	87	78	92	74	78	82
Pyr d-10		79	83	91	76	87	78	80	79
Cry d-12		70	67	100	83	67	67	66	60
B(a)P d-12		72	85	86	74	92	78	86	83
Perylene d-12		64	78	88	66	85	69	79	75
DiB(ah)A d-14		62	74	120	69	100	67	84	87
B(ghi)P d-12		57	62	88	56	78	53	73	75
2-Methylnaph. d-10									
Dibenzofuran d-8						88		72	

Concentrations are recovery corrected

Appendix V (B). Laboratory Results (ng/g, dry wt.) for N.R.C. Marine Sediment Standard Reference Material (HS6): Sooke Basin Study - Day270 and Day384.

Batch ID. / Sample ID. / Sample Nos. / Reporting Date	HS6 N.R.C.	PH-0987 384 147-149,152-156	PH-0988 384 157-166	PH-0990 384 140-142;167-170	PH0991 384 171-179	PH-0993 384 121,133,146,150-151,161,175
	Certified	Determined	Determined	Determined	Determined	Determined
Naphthalene	4100±1100	4700	4900	4600	4800	5000
Acenaphthylene	190±50	220	220	240	260	260
Acenaphthene	230±70	180	200	210	160	180
Fluorene	470±120	360	450	460	210	400
Phenanthrene	3000±600	3500	3400	3100	3800	3600
Anthracene	1100±400	890	960	910	1000	990
Fluoranthene	3540±650	3700	3500	3500	3700	3800
Pyrene	3000±600	2800	3000	2800	3000	2000
Benz(a)anthracene	1800±300	1700	1700	1600	1700	1700
Chrysene	2000±300	2200	2600	2100	2500	2300
Benzofluoranthenes	4230±750	4700	4600	4500	4500	4600
Benzo(e)pyrene	---	1800	1800	1800	1800	1800
Benzo(a)pyrene	2200±400	2000	2100	2000	1900	2000
Perylene	---	460	470	460	440	470
Dibenz(ah)anthracene	490±160	450	460	460	450	420
Indeno(1,2,3-cd)pyrene	1950±580	2100	2100	1800	2000	2100
Benzo(ghi)perylene	1780±720	1700	1900	1500	1800	1800
Dibenzofuran	1100±300					
Surrogate Stds. (% recovery)						
Naph d-8		92	93	110	80	88
Acen d-10		95	93	110	89	89
Phen d-10		92	84	110	88	93
Pyr d-10		85	78	95	83	89
Cry d-12		87	66	94	88	78
B(a)P d-12		94	72	100	92	100
Perylene d-12		85	65	97	89	90
DiB(ah)A d-14		90	64	110	120	97
B(ghi)P d-12		84	62	120	110	84
2-Methylnaph. d-10						
Dibenzofuran d-8						

Concentrations are recovery corrected

APPENDIX V (C)

Laboratory Quality Assurance/Quality Control

Blind N.R.C. Standard Reference Material

Appendix V (C). Laboratory Results (ng/g, dry wt.) for Blind N.R.C. Marine Sediment Standard Reference Material (SRM) - Sooke Basin Study.

Sample ID (Axys) / Reporting Date	Baseline Samples 2891-38 19-Jan-96			Day14 Samples 2891-76 23-Jan-96			Day14 Samples 2891-113 04-Feb-96		
	Measured	Expected	+/-	Measured	Expected	+/-	Measured	Expected	+/-
Naphthalene	1900	1730	170	2000	2170	-170	620	570	50
Acenaphthylene	120	170	-50	170	190	-20	83	150	-67
Acenaphthene	630	950	-320	800	1170	-370	38	150	-112
Fluorene	1400	2630	-1230	1700	3290	-1590	58	180	-122
Phenanthrene	18000	18720	-720	24000	22680	1320	960	930	30
Anthracene	1700	2590	-890	1500	3240	-1740	190	240	-50
LPAH	23750	26790	-3040	30170	32740	-2570	1949	2220	-271
Fluoranthene	18000	17140	860	23000	19710	3290	1400	1490	-90
Pyrene	11000	11430	-430	13000	13070	-70	1200	1160	40
Benz(a)anthracene	2600	4880	-2280	4900	5460	-560	720	660	60
Chrysene	4400	4720	-320	5900	5280	620	930	800	130
Benzofluoranthenes	6800	4260	2540	5400	4640	760	1600	1390	210
Benzo(a)pyrene	1700	2660	-960	1800	2950	-1150	610	820	-210
Dibenz(ah)anthracene	520	390	130	380	440	-60	130	160	-30
Indeno(1,2,3-cd)pyrene	1700	1990	-290	1800	2200	-400	830	660	170
Benzo(ghi)perylene	1400	1930	-530	1300	2120	-820	600	710	-110
HPAH	48120	49400	-1280	57480	55870	1610	8020	7850	170
TPAH	71870	76190	-4320	87650	88610	-960	9969	10070	-101
TPAH (µg/g)	71.9	76.2	-4.3	87.7	88.6	-1.0	10.0	10.1	-0.1
Benzo(e)pyrene	2400			1800			570		
Perylene	490			640			210		
Surrogate Stds.(% recovery)									
Naph d-8	53			74			48		
Acen d-10	64			81			39		
Phen d-10	79			91			58		
Pyr d-10	82			80			70		
Cry d-12	72			52			67		
B(a)P d-12	63			89			57		
Perylene d-12	64			87			50		
DiB(ah)A d-14	35			110			53		
B(ghi)P d-12	45			99			42		

Appendix V (C). Laboratory Results (ng/g, dry wt.) for Blind N.R.C. Marine Sediment Standard Reference Material (SRM) - Sooke Basin Study.

Sample ID (Axys)	Day180 Samples 9611-53A	9611-53B	9611-53			Day384 Samples 9611-129		
Reporting Date	01-Jul-96							
	Measured	Measured	mean	Expected	+/-	Measured	Expected	+/-
Naphthalene	260	250	255	220	35	2800	3040	-240
Acenaphthylene	96	88	92	150	-58	140	200	-60
Acenaphthene	69	62	66	210	-145	1400	1600	-200
Fluorene	200	200	200	340	-140	3000	4610	-1610
Phenanthrene	3300	3000	3150	4190	-1040	24000	30660	-6660
Anthracene	260	280	270	330	-60	2100	4540	-2440
LPAH	4185	3880	4033	5440	-1408	33440	44650	-11210
Fluoranthene	6100	6700	6400	6810	-410	21000	24870	-3870
Pyrene	3600	3300	3450	4720	-1270	12000	16390	-4390
Benz(a)anthracene	1500	1500	1500	2370	-870	4800	6630	-1830
Chrysene	2200	2000	2100	2330	-230	6200	6410	-210
Benzofluoranthenes	2700	2400	2550	2570	-20	6500	5390	1110
Benzo(a)pyrene	1000	900	950	1470	-520	2700	3520	-820
Dibenz(ah)anthracene	170	180	175	190	-15	480	550	-70
Indeno(1,2,3-cd)pyrene	730	1100	915	1120	-205	2000	2610	-610
Benzo(ghi)perylene	640	590	615	1140	-525	1600	2490	-890
HPAH	18640	18670	18655	22720	-4065	57280	68860	-11580
TPAH	22825	22550	22688	28160	-5473	90720	113510	-22790
TPAH (µg/g)	22.8	22.6	22.7	28.2	-5.5	90.7	113.5	-22.8
Benzo(e)pyrene	950	750	850			2200		
Perylene	260	240	250			630		
Surrogate Stds.(% recovery)								
Naph d-8	50	65	58			99		
Acen d-10	55	67	61			100		
Phen d-10	66	73	70			92		
Pyr d-10	75	77	76			91		
Cry d-12	86	75	81			100		
B(a)P d-12	94	88	91			100		
Perylene d-12	82	81	82			93		
DiB(ah)A d-14	110	100	105			110		
B(ghi)P d-12	99	95	97			96		

APPENDIX V (D)

Laboratory Quality Assurance/Quality Control

Sample Detection Limits

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.) - Summary Statistics.

Exposure Period Sample I.D. Lab Sample No.	Site Selection/Baseline				Day14			
	Min	Max	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev
Naphthalene	0.04	0.17	0.09	0.04	0.06	2.0	0.08	0.41
Acenaphthylene	0.05	0.46	0.23	0.13	0.05	3.8	0.25	0.71
Acenaphthene	0.089	0.34	0.18	0.08	0.01	1.7	0.18	0.35
Fluorene	0.04	0.47	0.13	0.10	0.03	1.1	0.13	0.24
Phenanthrene	0.05	0.15	0.08	0.03	0.04	1.5	0.07	0.29
Anthracene	0.05	0.2	0.10	0.05	0.04	2.1	0.09	0.38
Fluoranthene	0.05	0.1	0.07	0.01	0.05	3.5	0.07	0.85
Pyrene	0.05	0.1	0.07	0.01	0.05	4.0	0.07	1.03
Benz(a)anthracene	0.1	0.24	0.15	0.04	0.04	6.6	0.16	1.08
Chrysene	0.1	0.31	0.14	0.05	0.04	6.3	0.15	1.04
Benzofluoranthenes	0.09	0.52	0.25	0.13	0.10	2.5	0.26	0.46
Benzo(e)pyrene	0.088	0.5	0.25	0.12	0.10	2.3	0.25	0.45
Benzo(a)pyrene	0.11	0.77	0.36	0.20	0.13	2.9	0.38	0.57
Perylene	0.098	0.56	0.29	0.14	0.11	2.7	0.30	0.52
Dibenz(ah)anthracene	0.24	3.0	1.07	0.74	0.27	15.0	1.17	2.9
Indeno(1,2,3-cd)pyrene	0.22	1.2	0.69	0.27	0.26	13.0	0.70	2.4
Benzo(ghi)perylene	0.16	0.75	0.47	0.17	0.19	11.0	0.47	2.0
C1 naphthalenes	0.1	0.32	0.18	0.09	0.11	1.8	0.20	0.48
C2 naphthalenes	0.12	0.23	0.16	0.04	0.12	1.7	0.17	0.46
C3 naphthalenes	0.072	0.19	0.11	0.05	0.06	1.0	0.13	0.27
C4 naphthalenes	0.1	0.19	0.13	0.04	0.08	1.4	0.14	0.38
C5 naphthalenes	0.13	0.22	0.16	0.03	0.13	1.8	0.17	0.49
C1 phen,anth	0.066	0.15	0.10	0.04	0.07	1.0	0.11	0.27
C2 phen,anth	0.1	0.16	0.13	0.02	0.12	2.0	0.13	0.56
C3 phen,anth	0.15	0.37	0.28	0.09	0.17	5.1	0.25	1.5
C4 phen,anth	0.16	0.27	0.20	0.04	0.18	2.6	0.20	0.72
Retene	0.16	0.27	0.20	0.04	0.18	2.6	0.20	0.72
C5 phen,anth	0.11	0.3	0.17	0.08	0.12	1.8	0.19	0.48
C1 fluor,pyrenes	0.06	0.09	0.08	0.01	0.07	1.3	0.08	0.37
C2 fluor,pyrenes	0.15	0.27	0.23	0.05	0.18	4.0	0.22	1.1
C3 fluor,pyrenes	0.26	0.97	0.47	0.29	0.33	5.1	0.50	1.4
C4 fluor,pyrenes	0.26	1.1	0.50	0.35	0.33	4.8	0.54	1.3
C5 fluor,pyrenes	0.38	1.4	0.68	0.42	0.47	7.0	0.73	1.9
Dibenzothiophene	0.054	0.11	0.08	0.02	0.06	0.85	0.08	0.23
C1 dibenzothiophene	0.061	0.14	0.09	0.03	0.07	0.96	0.10	0.26
C2 dibenzothiophene	0.053	0.1	0.08	0.02	0.05	0.64	0.08	0.17
Dibenzofuran	0.06	0.13	0.09	0.03	0.06	0.56	0.09	0.14

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.) - Summary Statistics.

Exposure Period Sample I.D. Lab Sample No.	Day180 Min.	 Max.	 Mean	 Std. Dev	Day384 Min	 Max	 Mean	 Std. Dev.
Naphthalene	0.05	6.9	0.21	0.9	0.03	1.4	0.17	0.19
Acenaphthylene	0.06	0.3	0.13	0.05	0.07	3.4	0.52	0.65
Acenaphthene	0.06	0.3	0.14	0.1	0.11	3.1	0.53	0.50
Fluorene	0.04	0.2	0.09	0.03	0.04	11	0.36	1.1
Phenanthrene	0.02	0.3	0.06	0.04	0.04	9.1	0.53	1.1
Anthracene	0.02	0.3	0.06	0.05	0.04	9.6	0.44	0.98
Fluoranthene	0.01	0.3	0.07	0.1	0.03	3.7	0.28	0.45
Pyrene	0.02	0.3	0.07	0.1	0.03	3.7	0.28	0.45
Benz(a)anthracene	0.03	0.3	0.08	0.1	0.03	9.9	0.56	1.1
Chrysene	0.03	0.5	0.09	0.1	0.03	22	0.82	2.4
Benzofluoranthenes	0.04	0.4	0.14	0.1	0.08	16	0.74	1.6
Benzo(e)pyrene	0.04	0.4	0.13	0.1	0.09	2.9	0.54	0.52
Benzo(a)pyrene	0.05	0.5	0.17	0.1	0.13	4.7	0.77	0.74
Perylene	0.05	0.5	0.16	0.1	0.14	4.4	0.73	0.76
Dibenz(ah)anthracene	0.01	1.1	0.30	0.3	0.14	3.5	0.84	0.65
Indeno(1,2,3-cd)pyrene	0.05	0.5	0.17	0.1	0.17	4.0	0.81	0.87
Benzo(ghi)perylene	0.04	0.4	0.13	0.1	0.14	3.4	0.69	0.75
C1 naphthalenes	0.04	0.1	0.06	0.01	0.072	0.27	0.16	0.07
C2 naphthalenes	0.05	0.1	0.09	0.02	0.08	1.3	0.50	0.41
C3 naphthalenes	0.06	0.1	0.10	0.02	0.12	0.83	0.33	0.23
C4 naphthalenes	0.07	0.1	0.10	0.02	0.09	0.5	0.27	0.15
C5 naphthalenes	---	---	---	---	---	---	---	---
C1 phen,anth	0.04	0.1	0.05	0.01	0.1	0.61	0.27	0.18
C2 phen,anth	0.06	0.1	0.08	0.01	0.084	2.4	0.68	0.81
C3 phen,anth	0.10	0.2	0.12	0.03	0.15	2.4	0.79	0.86
C4 phen,anth	0.10	0.2	0.13	0.02	0.095	0.8	0.41	0.24
Retene	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---
Dibenzothiophene	0.03	0.1	0.04	0.01	0.047	0.28	0.15	0.08
C1 dibenzothiophene	0.03	0.1	0.05	0.01	0.08	0.68	0.23	0.16
C2 dibenzothiophene	0.03	0.1	0.05	0.01	0.046	0.43	0.16	0.12
Dibenzofuran	0.02	0.1	0.06	0.03	0.34	0.46	0.40	0.04

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.) - Site Selection and Sooke Basin Test Site Baseline Samples.

	Site Selection				BMP							
Sample I.D.	5A	5B	5C	5D	BBP0.5 (1)	BBP30	BBP10	BBP5.0(1)	BBP2.0(1)	BBP0.5(1)	BBP0.5(2)	BBP0.5(3)
Lab Sample No. (2891)	13	14	15	16	24	28	27	26	25	42	43	44
Naphthalene	0.11	0.1	0.11	0.15	0.12	0.05	0.04	0.07	0.17	0.12	0.13	0.11
Acenaphthylene	0.06	0.05	0.06	0.08	0.12	0.32	0.3	0.46	0.16	0.19	0.2	0.17
Acenaphthene	0.1	0.09	0.09	0.13	0.13	0.22	0.23	0.34	0.2	0.098	0.1	0.089
Fluorene	0.05	0.05	0.05	0.07	0.06	0.16	0.17	0.47	0.08	0.061	0.064	0.054
Phenanthrene	0.1	0.1	0.1	0.2	0.1	0.06	0.06	0.08	0.12	0.055	0.084	0.072
Anthracene	0.11	0.12	0.12	0.17	0.09	0.06	0.06	0.1	0.12	0.09	0.09	0.077
Fluoranthene	0.1	0.1	0.1	0.1	0.05	0.07	0.05	0.1	0.09	0.084	0.082	0.069
Pyrene	0.1	0.1	0.1	0.1	0.06	0.07	0.07	0.1	0.06	0.086	0.085	0.069
Benz(a)anthracene	0.1	0.1	0.1	0.15	0.14	0.16	0.15	0.24	0.23	0.13	0.13	0.1
Chrysene	0.1	0.1	0.1	0.15	0.14	0.13	0.13	0.2	0.31	0.14	0.13	0.11
Benzofluoranthenes	0.13	0.14	0.13	0.23	0.09	0.33	0.36	0.52	0.23	0.13	0.11	0.091
Benzo(e)pyrene	0.13	0.14	0.13	0.22	0.09	0.33	0.35	0.5	0.23	0.13	0.1	0.088
Benzo(a)pyrene	0.17	0.17	0.17	0.28	0.12	0.49	0.54	0.77	0.31	0.17	0.14	0.11
Perylene	0.16	0.17	0.16	0.28	0.13	0.37	0.39	0.56	0.34	0.14	0.12	0.098
Dibenz(ah)anthracene	0.26	0.26	0.24	0.41	0.32	1.2	0.98	2.5	1.1	3.0	1.0	0.53
Indeno(1,2,3-cd)pyrene	0.34	0.34	0.31	0.59	0.22	0.77	0.94	1.2	0.68	0.72	0.69	0.55
Benzo(ghi)perylene	0.25	0.26	0.23	0.44	0.16	0.49	0.6	0.75	0.5	0.6	0.55	0.44
C1 naphthalenes	---	---	---	---	0.23	---	---	---	0.32	0.12	0.12	0.1
C2 naphthalenes	---	---	---	---	0.16	---	---	---	0.23	0.13	0.14	0.12
C3 naphthalenes	---	---	---	---	0.14	---	---	---	0.19	0.08	0.086	0.072
C4 naphthalenes	---	---	---	---	0.14	---	---	---	0.19	0.11	0.11	0.1
C5 naphthalenes	---	---	---	---	0.16	---	---	---	0.22	0.14	0.16	0.13
C1 phen,anth	---	---	---	---	0.13	---	---	---	0.15	0.075	0.076	0.066
C2 phen,anth	---	---	---	---	0.1	---	---	---	0.16	0.14	0.13	0.11
C3 phen,anth	---	---	---	---	0.15	---	---	---	0.23	0.37	0.35	0.3
C4 phen,anth	---	---	---	---	0.17	---	---	---	0.27	0.2	0.19	0.16
Retene	---	---	---	---	0.17	---	---	---	0.27	0.2	0.19	0.16
C5 phen,anth	---	---	---	---	0.19	---	---	---	0.3	0.14	0.13	0.11
C1 fluor,pyrenes	---	---	---	---	0.06	---	---	---	0.09	0.089	0.09	0.072
C2 fluor,pyrenes	---	---	---	---	0.15	---	---	---	0.25	0.26	0.27	0.21
C3 fluor,pyrenes	---	---	---	---	0.44	---	---	---	0.97	0.34	0.32	0.26
C4 fluor,pyrenes	---	---	---	---	0.46	---	---	---	1.1	0.34	0.32	0.26
C5 fluor,pyrenes	---	---	---	---	0.64	---	---	---	1.4	0.49	0.47	0.38
Dibenzothiophene	---	---	---	---	0.09	---	---	---	0.11	0.06	0.063	0.054
C1 dibenzothiophene	---	---	---	---	0.11	---	---	---	0.14	0.07	0.071	0.061
C2 dibenzothiophene	---	---	---	---	0.08	---	---	---	0.1	0.06	0.083	0.053
Dibenzofuran	---	---	---	---	0.1	---	---	---	0.13	0.07	0.07	0.06

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.) - Site Selection and Sooke Basin Test Site Baseline Samples.

Sample I.D. Lab Sample No. (2891)	Mechanical Control BMC0.5 (1) 35	 BMC0.5(2) 36A	 36B	 BMC0.5(3) 37	 BOC0.0 (1) 29	Open Control BOC0.0 (2) 30	 BOC0.0 (3) 31	Min	Max	Mean	Std. Dev.
Naphthalene	0.04	0.05	0.04	0.15	0.04	0.1	0.06	0.04	0.17	0.09	0.04
Acenaphthylene	0.31	0.3	0.3	0.07	0.33	0.33	0.41	0.05	0.46	0.23	0.13
Acenaphthene	0.22	0.24	0.22	0.13	0.24	0.24	0.28	0.089	0.34	0.18	0.08
Fluorene	0.16	0.17	0.14	0.04	0.17	0.2	0.2	0.04	0.47	0.13	0.10
Phenanthrene	0.05	0.05	0.05	0.11	0.06	0.06	0.07	0.05	0.15	0.08	0.03
Anthracene	0.05	0.2	0.2	0.12	0.06	0.06	0.07	0.05	0.2	0.10	0.05
Fluoranthene	0.06	0.06	0.06	0.07	0.08	0.07	0.09	0.05	0.1	0.07	0.01
Pyrene	0.07	0.06	0.07	0.07	0.07	0.07	0.09	0.05	0.1	0.07	0.01
Benz(a)anthracene	0.14	0.12	0.14	0.21	0.17	0.2	0.21	0.1	0.24	0.15	0.04
Chrysene	0.12	0.1	0.12	0.2	0.15	0.14	0.17	0.1	0.31	0.14	0.05
Benzofluoranthenes	0.28	0.32	0.27	0.26	0.42	0.33	0.43	0.09	0.52	0.25	0.13
Benzo(e)pyrene	0.28	0.3	0.27	0.25	0.41	0.33	0.43	0.088	0.5	0.25	0.12
Benzo(a)pyrene	0.43	0.5	0.41	0.32	0.62	0.52	0.65	0.11	0.77	0.36	0.20
Perylene	0.32	0.34	0.3	0.28	0.44	0.39	0.49	0.098	0.56	0.29	0.14
Dibenz(ah)anthracene	0.96	1.2	1.0	1.2	1.5	0.96	1.8	0.24	3.0	1.07	0.74
Indeno(1,2,3-cd)pyrene	0.77	0.86	0.74	0.42	0.97	0.9	1.1	0.22	1.2	0.69	0.27
Benzo(ghi)perylene	0.49	0.55	0.47	0.29	0.62	0.6	0.71	0.16	0.75	0.47	0.17
C1 naphthalenes	---	---	---	---	---	---	---	0.1	0.32	0.18	0.09
C2 naphthalenes	---	---	---	---	---	---	---	0.12	0.23	0.16	0.04
C3 naphthalenes	---	---	---	---	---	---	---	0.072	0.19	0.11	0.05
C4 naphthalenes	---	---	---	---	---	---	---	0.1	0.19	0.13	0.04
C5 naphthalenes	---	---	---	---	---	---	---	0.13	0.22	0.16	0.03
C1 phen,anth	---	---	---	---	---	---	---	0.066	0.15	0.10	0.04
C2 phen,anth	---	---	---	---	---	---	---	0.1	0.16	0.13	0.02
C3 phen,anth	---	---	---	---	---	---	---	0.15	0.37	0.28	0.09
C4 phen,anth	---	---	---	---	---	---	---	0.16	0.27	0.20	0.04
Retene	---	---	---	---	---	---	---	0.16	0.27	0.20	0.04
C5 phen,anth	---	---	---	---	---	---	---	0.11	0.3	0.17	0.08
C1 fluor,pyrenes	---	---	---	---	---	---	---	0.06	0.09	0.08	0.01
C2 fluor,pyrenes	---	---	---	---	---	---	---	0.15	0.27	0.23	0.05
C3 fluor,pyrenes	---	---	---	---	---	---	---	0.26	0.97	0.47	0.29
C4 fluor,pyrenes	---	---	---	---	---	---	---	0.26	1.1	0.50	0.35
C5 fluor,pyrenes	---	---	---	---	---	---	---	0.38	1.4	0.68	0.42
Dibenzothiophene	---	---	---	---	---	---	---	0.054	0.11	0.08	0.02
C1 dibenzothiophene	---	---	---	---	---	---	---	0.061	0.14	0.09	0.03
C2 dibenzothiophene	---	---	---	---	---	---	---	0.053	0.1	0.08	0.02
Dibenzofuran	---	---	---	---	---	---	---	0.06	0.13	0.09	0.03

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin- Day14.

Sample I.D.	WP Site 14WP2.0(1)		14WP2.0(2)		14WP2.0(3)		14WP0.5(1)	14WP0.5(2)	14WP0.5(3)	14WP2.0(1)	14WP2.0(2)
Lab Sample No. (2891)	67A	67B	68A	68B	69A	69B	70	71	72	73	74
Naphthalene	0.13	0.13	0.08	0.12	0.09	0.08	2.0	0.08	1.9	0.12	0.1
Acenaphthylene	0.21	0.2	0.09	0.12	0.09	0.08	2.6	0.08	3.8	0.16	0.1
Acenaphthene	0.11	0.11	0.05	0.13	0.05	0.09	1.4	0.91	1.7	0.092	0.06
Fluorene	0.065	0.065	0.06	0.07	0.06	0.05	0.82	1.1	0.89	0.058	0.07
Phenanthrene	0.094	0.088	0.09	0.07	0.1	0.05	1.1	1.5	0.86	0.082	0.1
Anthracene	0.1	0.096	0.11	0.08	0.11	0.05	1.2	2.1	0.96	0.089	0.11
Fluoranthene	0.099	0.095	0.16	0.08	0.17	0.06	1.2	3.5	1.2	0.088	0.16
Pyrene	0.1	0.097	0.16	0.09	0.18	0.06	1.3	3.6	1.1	0.092	0.17
Benz(a)anthracene	0.17	0.17	0.25	0.08	0.28	0.05	2.1	6.6	1.2	0.14	0.25
Chrysene	0.18	0.18	0.25	0.09	0.27	0.05	2.2	6.3	1.2	0.15	0.24
Benzofluoranthenes	0.22	0.25	0.33	0.43	0.3	0.2	2.5	0.43	1.8	0.13	0.29
Benzo(e)pyrene	0.22	0.25	0.31	0.4	0.3	0.18	2.3	0.44	1.8	0.12	0.28
Benzo(a)pyrene	0.27	0.31	0.43	0.5	0.4	0.23	2.9	0.58	2.1	0.15	0.41
Perylene	0.24	0.26	0.49	0.45	0.46	0.21	2.7	0.73	2.2	0.13	0.43
Dibenz(ah)anthracene	2.6	2.4	2.2	8.0	2.3	3.6	15	0.89	9.6	2.5	1.5
Indeno(1,2,3-cd)pyrene	1.9	2.2	1.2	2.0	1.0	0.88	13	1.5	10	0.72	1.0
Benzo(ghi)perylene	1.6	1.8	0.79	1.6	0.71	0.74	11	1.0	8.1	0.68	0.72
C1 naphthalenes	0.13	0.13	---	---	---	---	1.8	---	---	0.11	---
C2 naphthalenes	0.14	0.14	---	---	---	---	1.7	---	---	0.12	---
C3 naphthalenes	0.086	0.064	---	---	---	---	1.0	---	---	0.076	---
C4 naphthalenes	0.12	0.11	---	---	---	---	1.4	---	---	0.1	---
C5 naphthalenes	0.15	0.15	---	---	---	---	1.8	---	---	0.13	---
C1 phen,anth	0.083	0.078	---	---	---	---	1.0	---	---	0.072	---
C2 phen,anth	0.16	0.15	---	---	---	---	2.0	---	---	0.14	---
C3 phen,anth	0.43	0.41	---	---	---	---	5.1	---	---	0.39	---
C4 phen,anth	0.23	0.22	---	---	---	---	2.6	---	---	0.21	---
Retene	0.23	0.22	---	---	---	---	2.6	---	---	0.21	---
C5 phen,anth	0.16	0.15	---	---	---	---	1.8	---	---	0.14	---
C1 fluor,pyrenes	0.11	0.1	---	---	---	---	1.3	---	---	0.093	---
C2 fluor,pyrenes	0.32	0.3	---	---	---	---	4.0	---	---	0.29	---
C3 fluor,pyrenes	0.44	0.44	---	---	---	---	5.1	---	---	0.36	---
C4 fluor,pyrenes	0.44	0.44	---	---	---	---	4.8	---	---	0.36	---
C5 fluor,pyrenes	0.64	0.63	---	---	---	---	7.0	---	---	0.52	---
Dibenzothiophene	0.071	0.065	---	---	---	---	0.85	---	---	0.061	---
C1 dibenzothiophene	0.075	0.073	---	---	---	---	0.96	---	---	0.069	---
C2 dibenzothiophene	0.071	0.065	---	---	---	---	0.64	---	---	0.062	---
Dibenzofuran	0.06	0.06	---	---	---	---	0.56	---	---	0.07	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin- Day14.

Sample I.D.	14WP2.0(3)		BMP Site 14BP30(1)		14BP20(1)	14BP10(1)	14BP7.5(1)	14BP5.0(1)	14BP3.5(1)	14BP3.0(1)		14BP2.5(1)
Lab Sample No. (2891)	75A	75B	47A	47B	48	49	50	51	52	53A	53B	54A
Naphthalene	0.11	0.15	0.1	0.1	0.1	0.14	0.1	0.1	0.15	0.52	0.07	0.06
Acenaphthylene	0.11	0.32	0.05	0.1	0.05	0.1	0.05	0.05	0.07	0.47	0.08	0.07
Acenaphthene	0.06	0.14	0.009	0.1	0.09	0.16	0.09	0.1	0.13	0.51	0.08	0.07
Fluorene	0.07	0.08	0.03	0.06	0.03	0.07	0.03	0.03	0.04	0.27	0.04	0.04
Phenanthrene	0.12	0.08	0.1	0.06	0.1	0.12	0.09	0.1	0.11	0.2	0.04	0.04
Anthracene	0.14	0.08	0.11	0.1	0.1	0.12	0.1	0.11	0.11	0.22	0.05	0.04
Fluoranthene	0.2	0.09	0.06	0.06	0.06	0.07	0.05	0.06	0.06	0.21	0.05	0.05
Pyrene	0.21	0.1	0.06	0.08	0.06	0.07	0.05	0.06	0.06	0.23	0.06	0.05
Benz(a)anthracene	0.32	0.09	0.12	0.06	0.1	0.17	0.11	0.15	0.17	0.19	0.05	0.04
Chrysene	0.3	0.09	0.12	0.08	0.11	0.17	0.11	0.15	0.17	0.21	0.06	0.04
Benzofluoranthenes	0.36	0.13	0.22	0.26	0.21	0.1	0.21	0.24	0.35	0.65	0.21	0.15
Benzo(e)pyrene	0.36	0.13	0.21	0.26	0.2	0.1	0.2	0.23	0.32	0.63	0.2	0.14
Benzo(a)pyrene	0.49	0.16	0.27	0.26	0.26	0.13	0.26	0.3	0.42	0.78	0.24	0.17
Perylene	0.56	0.16	0.25	0.28	0.24	0.13	0.23	0.27	0.36	0.65	0.22	0.16
Dibenz(ah)anthracene	1.0	0.63	0.27	4.8	0.3	0.41	0.49	0.5	0.46	5.4	2.0	2.2
Indeno(1,2,3-cd)pyrene	1.3	0.81	0.33	1.1	0.37	0.26	0.35	0.45	0.51	2.6	0.82	1.8
Benzo(ghi)perylene	0.85	0.65	0.24	0.9	0.26	0.19	0.25	0.3	0.36	2.2	0.68	1.5
C1 naphthalenes	---	---	---	---	---	0.28	---	---	---	---	---	---
C2 naphthalenes	---	---	---	---	---	0.2	---	---	---	---	---	---
C3 naphthalenes	---	---	---	---	---	0.18	---	---	---	---	---	---
C4 naphthalenes	---	---	---	---	---	0.17	---	---	---	---	---	---
C5 naphthalenes	---	---	---	---	---	0.2	---	---	---	---	---	---
C1 phen,anth	---	---	---	---	---	0.16	---	---	---	---	---	---
C2 phen,anth	---	---	---	---	---	0.13	---	---	---	---	---	---
C3 phen,anth	---	---	---	---	---	0.19	---	---	---	---	---	---
C4 phen,anth	---	---	---	---	---	0.21	---	---	---	---	---	---
Retene	---	---	---	---	---	0.21	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	0.24	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	0.08	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	0.2	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	0.52	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	0.57	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	0.77	---	---	---	---	---	---
Dibenzothiophene	---	---	---	---	---	0.12	---	---	---	---	---	---
C1 dibenzothiophene	---	---	---	---	---	0.14	---	---	---	---	---	---
C2 dibenzothiophene	---	---	---	---	---	0.1	---	---	---	---	---	---
Dibenzofuran	---	---	---	---	---	0.12	---	---	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin- Day14.

Sample I.D.	BMP Site								Mechanical Control		
		14BP2.0(1)	14BP1.5(1)		14BP1.0(1)		14BP0.5(1)		14MC5.0(1)		14MC2.0(1)
Lab Sample No. (2891)	54B	55	56A	56B	57A	57B	58	59	59A	59B	60
Naphthalene	0.14	0.12	0.13	0.14	0.13	0.12	0.12	0.14	0.06	0.07	0.14
Acenaphthylene	0.06	0.1	0.1	0.11	0.13	0.12	0.12	0.12	0.07	0.08	0.11
Acenaphthene	0.12	0.13	0.13	0.16	0.14	0.14	0.13	0.16	0.08	0.09	0.13
Fluorene	0.03	0.08	0.08	0.1	0.07	0.06	0.06	0.1	0.04	0.04	0.08
Phenanthrene	0.09	0.22	0.22	0.24	0.1	0.11	0.1	0.24	0.05	0.05	0.23
Anthracene	0.1	0.22	0.23	0.25	0.11	0.11	0.1	0.24	0.05	0.06	0.23
Fluoranthene	0.05	0.12	0.13	0.13	0.06	0.07	0.06	0.13	3.0	3.0	0.13
Pyrene	0.05	0.12	0.13	0.14	0.07	0.07	0.07	0.13	4.0	4.0	0.13
Benz(a)anthracene	0.14	0.19	0.2	0.21	0.16	0.19	0.18	0.18	0.05	0.06	0.2
Chrysene	0.13	0.19	0.21	0.23	0.16	0.19	0.19	0.18	0.05	0.06	0.21
Benzofluoranthenes	0.23	0.59	0.69	0.71	0.1	0.11	0.13	0.69	0.6	0.6	0.7
Benzo(e)pyrene	0.23	0.62	0.77	0.74	0.1	0.11	0.12	0.75	0.16	0.17	0.77
Benzo(a)pyrene	0.3	0.85	1.1	1.1	0.13	0.15	0.17	1	0.2	0.21	1.1
Perylene	0.25	0.62	0.73	0.76	0.16	0.17	0.19	0.79	0.18	0.2	0.79
Dibenz(ah)anthracene	0.98	2.9	3.4	3.1	0.4	0.4	0.43	4.1	3.0	2.9	2.1
Indeno(1,2,3-cd)pyrene	0.38	1.2	1.3	1.5	0.27	0.26	0.34	1.7	0.65	0.58	1.7
Benzo(ghi)perylene	0.27	0.99	1.1	1.3	0.21	0.21	0.25	1.4	0.54	0.48	1.4
C1 naphthalenes	---	---	---	---	0.26	0.24	0.23	---	---	---	---
C2 naphthalenes	---	---	---	---	0.18	0.17	0.16	---	---	---	---
C3 naphthalenes	---	---	---	---	0.15	0.15	0.14	---	---	---	---
C4 naphthalenes	---	---	---	---	0.18	0.15	0.14	---	---	---	---
C5 naphthalenes	---	---	---	---	0.17	0.17	0.16	---	---	---	---
C1 phen,anth	---	---	---	---	0.14	0.14	0.13	---	---	---	---
C2 phen,anth	---	---	---	---	0.12	0.13	0.12	---	---	---	---
C3 phen,anth	---	---	---	---	0.17	0.19	0.18	---	---	---	---
C4 phen,anth	---	---	---	---	0.19	0.21	0.2	---	---	---	---
Retene	---	---	---	---	0.19	0.21	0.2	---	---	---	---
C5 phen,anth	---	---	---	---	0.22	0.24	0.22	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	0.07	0.08	0.07	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	0.18	0.19	0.19	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	0.5	0.58	0.57	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	0.55	0.63	0.63	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	0.74	0.84	0.84	---	---	---	---
Dibenzothiophene	---	---	---	---	0.1	0.1	0.09	---	---	---	---
C1 dibenzothiophene	---	---	---	---	0.13	0.12	0.11	---	---	---	---
C2 dibenzothiophene	---	---	---	---	0.09	0.09	0.08	---	---	---	---
Dibenzofuran	---	---	---	---	0.1	0.1	0.1	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin- Day14.

Sample I.D.	Mechanical Control			Open Control			Day14			
Lab Sample No. (2891)	14MC0.5(1) 61	14MC0.5(2) 62	14MC0.5(3) 63	14OC0.0(1) 64	14OC0.0(2) 65	14OC0.0(3) 66	Min.	Max.	Mean	Std. Dev
Naphthalene	0.14	0.13	0.13	0.19	0.18	0.12	0.06	2.0	0.08	0.41
Acenaphthylene	0.11	0.1	0.11	0.2	0.19	0.19	0.05	3.8	0.25	0.71
Acenaphthene	0.14	0.13	0.16	0.21	0.2	0.099	0.01	1.7	0.18	0.35
Fluorene	0.1	0.08	0.1	0.1	0.1	0.06	0.03	1.1	0.13	0.24
Phenanthrene	0.24	0.22	0.24	0.15	0.15	0.08	0.04	1.5	0.07	0.29
Anthracene	0.25	0.23	0.25	0.16	0.16	0.087	0.04	2.1	0.09	0.38
Fluoranthene	0.13	0.12	0.14	0.09	0.09	0.078	0.05	3.5	0.07	0.85
Pyrene	0.13	0.13	0.14	0.1	0.09	0.08	0.05	4.0	0.07	1.03
Benz(a)anthracene	0.21	0.18	0.22	0.24	0.26	0.1	0.04	6.6	0.16	1.08
Chrysene	0.22	0.2	0.24	0.26	0.26	0.13	0.04	6.3	0.15	1.04
Benzofluoranthenes	0.72	0.64	0.71	0.16	0.19	0.11	0.10	2.5	0.26	0.46
Benzo(e)pyrene	0.76	0.7	0.79	0.16	0.15	0.11	0.10	2.3	0.25	0.45
Benzo(a)pyrene	1.1	0.96	1.1	0.21	0.25	0.14	0.13	2.9	0.38	0.57
Perylene	0.76	0.69	0.79	0.23	0.28	0.11	0.11	2.7	0.30	0.52
Dibenz(ah)anthracene	4.7	4.2	5.1	0.65	0.96	1.8	0.27	15.0	1.17	2.9
Indeno(1,2,3-cd)pyrene	1.7	1.5	1.8	0.45	0.6	0.63	0.26	13.0	0.70	2.4
Benzo(ghi)perylene	1.4	1.3	1.5	0.33	0.41	0.5	0.19	11.0	0.47	2.0
C1 naphthalenes	---	---	---	0.38	0.35	0.12	0.11	1.8	0.20	0.48
C2 naphthalenes	---	---	---	0.26	0.26	0.12	0.12	1.7	0.17	0.46
C3 naphthalenes	---	---	---	0.24	0.23	0.076	0.06	1.0	0.13	0.27
C4 naphthalenes	---	---	---	0.23	0.22	0.076	0.08	1.4	0.14	0.38
C5 naphthalenes	---	---	---	0.26	0.25	0.14	0.13	1.8	0.17	0.49
C1 phen,anth	---	---	---	0.21	0.2	0.074	0.07	1.0	0.11	0.27
C2 phen,anth	---	---	---	0.17	0.16	0.13	0.12	2.0	0.13	0.56
C3 phen,anth	---	---	---	0.26	0.24	0.34	0.17	5.1	0.25	1.5
C4 phen,anth	---	---	---	0.28	0.3	0.2	0.18	2.6	0.20	0.72
Retene	---	---	---	0.26	0.3	0.2	0.18	2.6	0.20	0.72
C5 phen,anth	---	---	---	0.31	0.31	0.12	0.12	1.8	0.19	0.48
C1 fluor,pyrenes	---	---	---	0.1	0.1	0.084	0.07	1.3	0.08	0.37
C2 fluor,pyrenes	---	---	---	0.26	0.25	0.25	0.18	4.0	0.22	1.1
C3 fluor,pyrenes	---	---	---	0.75	0.82	0.33	0.33	5.1	0.50	1.4
C4 fluor,pyrenes	---	---	---	0.83	0.89	0.33	0.33	4.8	0.54	1.3
C5 fluor,pyrenes	---	---	---	1.1	1.2	0.47	0.47	7.0	0.73	1.9
Dibenzothiophene	---	---	---	0.15	0.15	0.06	0.06	0.85	0.08	0.23
C1 dibenzothiophene	---	---	---	0.18	0.18	0.069	0.07	0.96	0.10	0.26
C2 dibenzothiophene	---	---	---	0.1	0.13	0.05	0.05	0.64	0.08	0.17
Dibenzofuran	---	---	---	0.16	0.16	0.07	0.06	0.56	0.09	0.14

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day180.

Sample I.D. Lab Sample No. (9611)	180WP2.0(1) 39	180WP2.0(2) 40	180WP2.0(3) 41	180WP2.0 (Bioassay) 42	180WP0.5(1) 43	180WP0.5(2) 44	180WP0.5(3) 45	180WP0.5 (Bioassay) 46	180WP0.5(1) (Transect#4) 47	180WP0.5(2) (Transect#4) 48	180WP0.5(3) (Transect#4) 49
Naphthalene	0.08	0.08	0.07	0.06	0.11	0.1	0.08	0.07	0.09	0.1	0.07
Acenaphthylene	0.13	0.14	0.13	0.11	0.11	0.1	0.09	0.08	0.1	0.1	0.09
Acenaphthene	0.2	0.22	0.21	0.19	0.13	0.132	0.11	0.1	0.11	0.12	0.11
Fluorene	0.06	0.07	0.06	0.06	0.11	0.1	0.09	0.08	0.09	0.1	0.09
Phenanthrene	0.05	0.06	0.05	0.05	0.04	0.3	0.06	0.05	0.05	0.06	0.06
Anthracene	0.06	0.06	0.06	0.05	0.04	0.32	0.06	0.06	0.05	0.06	0.06
Fluoranthene	0.04	0.05	0.04	0.04	0.02	0.29	0.06	0.05	0.05	0.06	0.01
Pyrene	0.04	0.05	0.04	0.04	0.02	0.3	0.06	0.06	0.05	0.06	0.07
Benz(a)anthracene	0.05	0.05	0.05	0.05	0.03	0.26	0.06	0.04	0.04	0.08	0.07
Chrysene	0.05	0.05	0.05	0.05	0.03	0.26	0.06	0.04	0.04	0.08	0.08
Benzofluoranthenes	0.06	0.06	0.05	0.06	0.04	0.43	0.04	0.06	0.06	0.24	0.18
Benzo(e)pyrene	0.06	0.06	0.05	0.05	0.04	0.42	0.04	0.05	0.06	0.06	0.18
Benzo(a)pyrene	0.07	0.07	0.06	0.07	0.05	0.52	0.05	0.07	0.07	0.07	0.22
Perylene	0.07	0.07	0.07	0.07	0.05	0.52	0.05	0.07	0.07	0.07	0.23
Dibenz(ah)anthracene	0.13	0.13	0.11	0.01	0.08	0.05	0.07	0.1	0.1	0.1	0.1
Indeno(1,2,3-cd)pyrene	0.11	0.11	0.09	0.11	0.06	0.05	0.07	0.08	0.08	0.08	0.08
Benzo(ghi)perylene	0.08	0.08	0.07	0.08	0.05	0.04	0.05	0.06	0.06	0.06	0.06
C1 naphthalenes	0.07	0.07	0.07	0.06	0.07	0.06	0.05	---	---	---	---
C2 naphthalenes	0.11	0.12	0.11	0.1	0.12	0.11	0.09	---	---	---	---
C3 naphthalenes	0.11	0.12	0.11	0.1	0.13	0.12	0.1	---	---	---	---
C4 naphthalenes	0.1	0.11	0.11	0.09	0.13	0.12	0.1	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	0.05	0.06	0.05	0.05	0.06	0.06	0.05	---	---	---	---
C2 phen,anth	0.09	0.1	0.09	0.08	0.07	0.07	0.06	---	---	---	---
C3 phen,anth	0.12	0.14	0.12	0.12	0.11	0.11	0.1	---	---	---	---
C4 phen,anth	0.14	0.15	0.14	0.14	0.11	0.11	0.1				
Retene	---	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	0.04	0.05	0.05	0.04	0.05	0.06	0.05	---	---	---	---
C1 dibenzothiophene	0.06	0.07	0.06	0.05	0.06	0.06	0.05	---	---	---	---
C2 dibenzothiophene	0.04	0.05	0.06	0.04	0.06	0.06	0.05	---	---	---	---
Dibenzofuran	---	---	---	---	0.1	0.1	0.1	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day180.

Sample I.D.	180WP2.0(1) (Upstream)	180WP2.0(2) (Upstream)		180WP2.0(3) (Upstream)	180BP30(1)		180BP20(1)	180BP10(1)	180BP10(2)	180BP10(3)	180BP7.5(1)	180BP5.0(1)
Lab Sample No. (9611)	50	51A	51B	52	1A	1B	2	3	4	5	6	7
Naphthalene	0.07	0.09	0.08	0.19	0.11	0.11	0.11	0.12	0.08	0.1	0.11	0.14
Acenaphthylene	0.08	0.1	0.08	0.17	0.24	0.24	0.23	0.26	0.19	0.22	0.22	0.13
Acenaphthene	0.1	0.13	0.1	0.29	0.09	0.09	0.09	0.1	0.07	0.09	0.09	0.13
Fluorene	0.08	0.1	0.08	0.21	0.13	0.13	0.12	0.14	0.1	0.11	0.12	0.09
Phenanthrene	0.04	0.05	0.04	0.17	0.07	0.06	0.05	0.07	0.06	0.07	0.06	0.03
Anthracene	0.05	0.05	0.04	0.17	0.07	0.06	0.06	0.07	0.06	0.07	0.07	0.03
Fluoranthene	0.05	0.04	0.04	0.15	0.06	0.05	0.05	0.06	0.05	0.06	0.05	0.06
Pyrene	0.05	0.04	0.04	0.15	0.08	0.05	0.05	0.05	0.05	0.06	0.05	0.06
Benz(a)anthracene	0.04	0.04	0.04	0.25	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04
Chrysene	0.04	0.04	0.04	0.47	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.04
Benzofluoranthenes	0.07	0.06	0.07	0.28	0.07	0.06	0.07	0.07	0.07	0.09	0.08	0.08
Benzo(e)pyrene	0.06	0.06	0.06	0.27	0.07	0.06	0.07	0.07	0.07	0.08	0.07	0.07
Benzo(a)pyrene	0.06	0.07	0.08	0.42	0.08	0.07	0.08	0.08	0.09	0.1	0.08	0.12
Perylene	0.07	0.06	0.07	0.32	0.08	0.07	0.07	0.06	0.08	0.10	0.09	0.09
Dibenz(ah)anthracene	0.12	0.1	0.19	0.6	0.65	0.64	0.69	1.0	1.1	0.9	0.87	0.14
Indeno(1,2,3-cd)pyrene	0.1	0.08	0.13	0.46	0.18	0.18	0.2	0.21	0.22	0.27	0.22	0.1
Benzo(ghi)perylene	0.07	0.06	0.1	0.41	0.15	0.15	0.16	0.17	0.18	0.22	0.18	0.06
C1 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	0.07
C2 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	0.1
C3 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	0.11
C4 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	0.12
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	---	---	---	---	---	---	---	---	---	---	---	0.05
C2 phen,anth	---	---	---	---	---	---	---	---	---	---	---	0.08
C3 phen,anth	---	---	---	---	---	---	---	---	---	---	---	0.12
C4 phen,anth												0.14
Retene	---	---	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	---	---	---	---	---	---	---	---	---	---	---	0.04
C1 dibenzothiophene	---	---	---	---	---	---	---	---	---	---	---	0.04
C2 dibenzothiophene	---	---	---	---	---	---	---	---	---	---	---	0.04
Dibenzofuran	---	---	---	---	---	---	---	---	---	---	---	0.1

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day180.

Sample I.D.	180BP5.0(2)	180BP5.0(3)	180BP5.0 (Bioassay)	180BP3.5(1)	180BP3.0(1)		180BP2.5(1)	180BP2.0(1)	1802.0 (Bioassay)	180BP1.5(1)	180BP1.0(1)	
Lab Sample No. (9611)	8	9	10	11	12A	12B	13	14	15	16	17A	17B
Naphthalene	0.1	6.9	0.11	0.1	0.14	0.07	0.12	0.1	0.11	0.1	0.16	0.12
Acenaphthylene	0.11	0.13	0.12	0.1	0.12	0.06	0.12	0.11	0.11	0.11	0.14	0.11
Acenaphthene	0.19	0.23	0.21	0.18	0.22	0.14	0.22	0.19	0.19	0.19	0.25	0.21
Fluorene	0.09	0.11	0.1	0.08	0.1	0.07	0.1	0.09	0.09	0.09	0.18	0.13
Phenanthrene	0.04	0.05	0.04	0.04	0.14	0.13	0.04	0.04	0.04	0.04	0.14	0.12
Anthracene	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.04	0.05	0.15	0.13
Fluoranthene	0.07	0.08	0.07	0.07	0.28	0.24	0.07	0.09	0.07	0.09	0.11	0.1
Pyrene	0.07	0.08	0.07	0.07	0.25	0.23	0.07	0.09	0.07	0.09	0.12	0.11
Benz(a)anthracene	0.06	0.07	0.06	0.06	0.08	0.06	0.06	0.08	0.06	0.07	0.34	0.32
Chrysene	0.07	0.06	0.06	0.06	0.08	0.06	0.06	0.08	0.08	0.07	0.35	0.34
Benzofluoranthenes	0.35	0.35	0.3	0.38	0.35	0.31	0.35	0.39	0.36	0.34	0.19	0.19
Benzo(e)pyrene	0.34	0.33	0.29	0.37	0.34	0.3	0.34	0.36	0.35	0.32	0.19	0.19
Benzo(a)pyrene	0.44	0.42	0.36	0.46	0.45	0.37	0.44	0.47	0.45	0.41	0.29	0.3
Perylene	0.41	0.4	0.35	0.45	0.44	0.36	0.43	0.46	0.43	0.41	0.22	0.22
Dibenz(ah)anthracene	0.45	0.33	0.77	0.36	0.37	0.26	0.39	0.32	0.42	0.29	0.43	0.45
Indeno(1,2,3-cd)pyrene	0.29	0.22	0.22	0.26	0.28	0.2	0.29	0.23	0.3	0.22	0.34	0.35
Benzo(ghi)perylene	0.21	0.17	0.16	0.18	0.2	0.14	0.21	0.17	0.22	0.16	0.28	0.31
C1 naphthalenes	0.06	0.07	---	---	---	---	---	---	---	---	---	---
C2 naphthalenes	0.08	0.1	---	---	---	---	---	---	---	---	---	---
C3 naphthalenes	0.1	0.12	---	---	---	---	---	---	---	---	---	---
C4 naphthalenes	0.09	0.11	---	---	---	---	---	---	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	0.06	0.07	---	---	---	---	---	---	---	---	---	---
C2 phen,anth	0.1	0.1	---	---	---	---	---	---	---	---	---	---
C3 phen,anth	0.17	0.18	---	---	---	---	---	---	---	---	---	---
C4 phen,anth	0.15	0.16	---	---	---	---	---	---	---	---	---	---
Retene	---	---	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	0.04	0.05	---	---	---	---	---	---	---	---	---	---
C1 dibenzothiophene	0.06	0.06	---	---	---	---	---	---	---	---	---	---
C2 dibenzothiophene	0.04	0.04	---	---	---	---	---	---	---	---	---	---
Dibenzofuran	0.05	0.05	---	0.05	---	---	---	---	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day180.

Sample I.D.	180BP0.5(1)	180BP0.5(2)	180BP0.5(3)	180BP0.5 (Bioassay)	180BP2.0(1) (Upstream)	180BP2.0(2) (Upstream)	180BP2.0(3) (Upstream)	180BP5.0(1) (Upstream)	180BP5.0(1) (Upstream)	180BP5.0(2) (Upstream)	180BP5.0(3) (Upstream)	180BP10(1) (Upstream)
Lab Sample No. (9611)	18	19	20	21	28	29	30	25A	25B	26	27	22
Naphthalene	0.09	0.08	0.09	0.13	0.1	0.1	0.1	0.1	0.08	0.12	0.09	0.07
Acenaphthylene	0.08	0.07	0.08	0.2	0.17	0.17	0.17	0.19	0.14	0.19	0.15	0.07
Acenaphthene	0.08	0.06	0.08	0.21	0.09	0.09	0.09	0.1	0.07	0.1	0.08	0.06
Fluorene	0.06	0.05	0.05	0.16	0.08	0.08	0.08	0.09	0.07	0.09	0.07	0.05
Phenanthrene	0.03	0.05	0.03	0.13	0.04	0.04	0.04	0.04	0.03	0.04	0.03	0.02
Anthracene	0.03	0.02	0.02	0.13	0.04	0.04	0.04	0.04	0.03	0.04	0.03	0.02
Fluoranthene	0.06	0.1	0.08	0.11	0.06	0.06	0.06	0.06	0.05	0.06	0.05	0.05
Pyrene	0.08	0.1	0.08	0.11	0.05	0.06	0.06	0.06	0.05	0.06	0.05	0.05
Benz(a)anthracene	0.04	0.04	0.04	0.34	0.11	0.14	0.13	0.12	0.09	0.11	0.09	0.04
Chrysene	0.04	0.04	0.04	0.35	0.1	0.12	0.13	0.11	0.08	0.1	0.09	0.04
Benzofluoranthenes	0.05	0.06	0.06	0.2	0.08	0.12	0.12	0.09	0.07	0.1	0.07	0.06
Benzo(e)pyrene	0.05	0.06	0.06	0.2	0.08	0.11	0.12	0.08	0.06	0.09	0.07	0.06
Benzo(a)pyrene	0.08	0.09	0.09	0.31	0.1	0.14	0.14	0.11	0.08	0.11	0.09	0.1
Perylene	0.06	0.07	0.07	0.24	0.1	0.15	0.14	0.1	0.08	0.11	0.08	0.07
Dibenz(ah)anthracene	0.09	0.09	0.11	0.52	0.18	0.42	0.27	0.19	0.15	0.22	0.16	0.12
Indeno(1,2,3-cd)pyrene	0.07	0.08	0.09	0.36	0.13	0.23	0.18	0.14	0.12	0.15	0.11	0.09
Benzo(ghi)perylene	0.06	0.06	0.06	0.33	0.1	0.17	0.14	0.1	0.09	0.12	0.08	0.07
C1 naphthalenes	0.05	0.04	0.04	---	---	---	---	---	---	---	---	---
C2 naphthalenes	0.06	0.05	0.06	---	---	---	---	---	---	---	---	---
C3 naphthalenes	0.08	0.06	0.07	---	---	---	---	---	---	---	---	---
C4 naphthalenes	0.08	0.07	0.07	---	---	---	---	---	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	0.04	0.04	0.04	---	---	---	---	---	---	---	---	---
C2 phen,anth	0.07	0.07	0.07	---	---	---	---	---	---	---	---	---
C3 phen,anth	0.11	0.11	0.1	---	---	---	---	---	---	---	---	---
C4 phen,anth	0.13	0.12	0.12	---	---	---	---	---	---	---	---	---
Retene	---	---	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	0.04	0.03	0.03	---	---	---	---	---	---	---	---	---
C1 dibenzothiophene	0.04	0.03	0.03	---	---	---	---	---	---	---	---	---
C2 dibenzothiophene	0.04	0.04	0.03	---	---	---	---	---	---	---	---	---
Dibenzofuran	0.07	0.06	0.06	---	---	---	---	---	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day180.

Sample I.D. Lab Sample No. (9611)	180BP10(2) (Upstream) 23	180BP10(3) (Upstream) 24	180MC5.0(1) 31	180MC2.0(1) 32	180MC0.5(1) 33	180MC0.5 (Bioassay) 34A	 34B	180OC0.0(1) 35	180OC0.0(2) 36	180OC0.0(3) 37	180OC0.0 (Bioassay) 38
Naphthalene	0.11	0.09	0.13	0.07	0.09	0.06	0.05	0.05	0.05	0.07	0.06
Acenaphthylene	0.1	0.09	0.2	0.13	0.17	0.12	0.09	0.1	0.09	0.13	0.12
Acenaphthene	0.1	0.09	0.11	0.07	0.09	0.19	0.15	0.16	0.14	0.2	0.2
Fluorene	0.08	0.06	0.09	0.07	0.08	0.06	0.04	0.05	0.04	0.06	0.06
Phenanthrene	0.03	0.03	0.04	0.04	0.04	0.06	0.04	0.05	0.04	0.06	0.06
Anthracene	0.03	0.03	0.04	0.04	0.04	0.07	0.04	0.06	0.04	0.06	0.06
Fluoranthene	0.06	0.06	0.05	0.06	0.06	0.05	0.03	0.04	0.03	0.04	0.05
Pyrene	0.06	0.06	0.05	0.06	0.06	0.05	0.03	0.04	0.03	0.04	0.05
Benz(a)anthracene	0.04	0.04	0.1	0.13	0.11	0.06	0.04	0.05	0.04	0.04	0.06
Chrysene	0.04	0.04	0.09	0.12	0.11	0.06	0.04	0.05	0.04	0.05	0.06
Benzofluoranthenes	0.06	0.08	0.08	0.12	0.09	0.08	0.06	0.06	0.06	0.05	0.08
Benzo(e)pyrene	0.06	0.07	0.08	0.11	0.09	0.07	0.05	0.05	0.06	0.05	0.08
Benzo(a)pyrene	0.09	0.12	0.1	0.13	0.11	0.09	0.07	0.07	0.07	0.07	0.1
Perylene	0.07	0.09	0.1	0.12	0.11	0.08	0.07	0.06	0.06	0.06	0.09
Dibenz(ah)anthracene	0.12	0.16	0.18	0.19	0.25	0.2	0.17	0.11	0.12	0.13	0.18
Indeno(1,2,3-cd)pyrene	0.09	0.12	0.14	0.24	0.17	0.13	0.1	0.09	0.09	0.1	0.13
Benzo(ghi)perylene	0.07	0.09	0.1	0.12	0.12	0.1	0.08	0.07	0.07	0.08	0.1
C1 naphthalenes	---	---	---	---	---	---	---	---	---	---	---
C2 naphthalenes	---	---	---	---	---	---	---	---	---	---	---
C3 naphthalenes	---	---	---	---	---	---	---	---	---	---	---
C4 naphthalenes	---	---	---	---	---	---	---	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	---	---	---	---	---	---	---	---	---	---	---
C2 phen,anth	---	---	---	---	---	---	---	---	---	---	---
C3 phen,anth	---	---	---	---	---	---	---	---	---	---	---
C4 phen,anth	---	---	---	---	---	---	---	---	---	---	---
Retene	---	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	---	---	---	---	---	---	---	---	---	---	---
C1 dibenzothiophene	---	---	---	---	---	---	---	---	---	---	---
C2 dibenzothiophene	---	---	---	---	---	---	---	---	---	---	---
Dibenzofuran	---	---	0.02	0.02	0.02	---	---	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day180.

Sample I.D. Lab Sample No. (9611)	Min.	Max.	Mean	Std. Dev
Naphthalene	0.05	6.9	0.21	0.9
Acenaphthylene	0.06	0.3	0.13	0.05
Acenaphthene	0.06	0.3	0.14	0.1
Fluorene	0.04	0.2	0.09	0.03
Phenanthrene	0.02	0.3	0.06	0.04
Anthracene	0.02	0.3	0.06	0.05
Fluoranthene	0.01	0.3	0.07	0.1
Pyrene	0.02	0.3	0.07	0.1
Benz(a)anthracene	0.03	0.3	0.08	0.1
Chrysene	0.03	0.5	0.09	0.1
Benzofluoranthenes	0.04	0.4	0.14	0.1
Benzo(e)pyrene	0.04	0.4	0.13	0.1
Benzo(a)pyrene	0.05	0.5	0.17	0.1
Perylene	0.05	0.5	0.16	0.1
Dibenz(ah)anthracene	0.01	1.1	0.30	0.3
Indeno(1,2,3-cd)pyrene	0.05	0.5	0.17	0.1
Benzo(ghi)perylene	0.04	0.4	0.13	0.1
C1 naphthalenes	0.04	0.1	0.06	0.01
C2 naphthalenes	0.05	0.1	0.09	0.02
C3 naphthalenes	0.06	0.1	0.10	0.02
C4 naphthalenes	0.07	0.1	0.10	0.02
C5 naphthalenes	---	---	---	---
C1 phen,anth	0.04	0.1	0.05	0.01
C2 phen,anth	0.06	0.1	0.08	0.01
C3 phen,anth	0.10	0.2	0.12	0.03
C4 phen,anth	0.10	0.2	0.13	0.02
Retene	---	---	---	---
C5 phen,anth	---	---	---	---
C1 fluor,pyrenes	---	---	---	---
C2 fluor,pyrenes	---	---	---	---
C3 fluor,pyrenes	---	---	---	---
C4 fluor,pyrenes	---	---	---	---
C5 fluor,pyrenes	---	---	---	---
Dibenzothiophene	0.03	0.1	0.04	0.01
C1 dibenzothiophene	0.03	0.1	0.05	0.01
C2 dibenzothiophene	0.03	0.1	0.05	0.01
Dibenzofuran	0.02	0.1	0.06	0.03

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D.	WP Site 384WP0.0	384WP0.5 2-4cm	384WP0.5 4-6cm		384WP0.5 8-10cm	384WP0.5(1)	384WP0.5(2)	384WP0.5(3)		384WP0.5(3) mixed	384WP2.0 (1)	
Lab Sample No. (9611)	80	140	141A	141B	142	143	144	145A	145B	146	147A	147B
Naphthalene	0.20	0.04	0.05	0.04	0.04	0.16	0.14	0.14	0.14	0.06	0.05	.0 5
Acenaphthylene	0.34	0.07	0.08	0.07	0.07	0.37	0.30	0.34	0.31	0.10	0.48	0.51
Acenaphthene	0.30	0.25	0.27	0.25	0.23	0.17	0.14	0.16	0.14	0.12	0.34	0.35
Fluorene	0.12	0.05	0.05	0.05	0.04	0.26	0.21	0.23	0.21	0.10	0.16	0.16
Phenanthrene	0.73	0.13	0.14	0.14	0.13	0.36	2.10	0.35	1.60	0.08	0.31	1.10
Anthracene	0.04	0.14	0.15	0.14	0.14	0.34	0.30	0.33	0.28	0.08	0.32	0.35
Fluoranthene	0.80	0.12	0.08	0.07	0.07	0.59	0.82	1.10	1.50	0.04	0.11	1.30
Pyrene	0.80	0.12	0.08	0.07	0.06	0.58	0.84	1.10	1.50	0.04	0.11	1.20
Benz(a)anthracene	3.30	0.19	0.20	0.18	0.18	0.42	0.40	0.42	4.20	0.10	0.16	0.20
Chrysene	3.40	0.21	0.22	0.20	0.19	0.44	2.40	3.00	4.30	0.10	0.17	0.22
Benzofluoranthenes	4.50	0.18	0.21	0.16	0.17	0.78	0.74	0.74	0.67	0.17	0.21	0.27
Benzo(e)pyrene	0.33	0.19	0.22	0.18	0.18	0.85	0.78	0.80	0.72	0.19	0.22	0.28
Benzo(a)pyrene	0.48	0.29	0.33	0.27	0.27	1.20	1.10	1.20	1.00	0.27	0.34	0.44
Perylene	0.40	0.23	0.27	0.21	0.21	1.10	0.92	0.97	0.82	0.22	0.26	0.33
Dibenz(ah)anthracene	0.43	0.58	0.73	0.55	0.56	1.00	0.96	0.95	0.86	0.21	0.31	0.38
Indeno(1,2,3-cd)pyrene	0.44	0.29	0.39	0.29	0.29	2.20	1.90	2.00	1.90	0.30	0.28	0.35
Benzo(ghi)perylene	0.38	0.25	0.33	0.25	0.24	2.00	1.70	1.80	1.70	0.27	0.23	0.26
C1 naphthalenes	0.24	---	---	---	---	---	---	---	---	0.15	---	---
C2 naphthalenes	0.94	---	---	---	---	---	---	---	---	0.08	---	---
C3 naphthalenes	0.21	---	---	---	---	---	---	---	---	0.12	---	---
C4 naphthalenes	0.42	---	---	---	---	---	---	---	---	0.09	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	0.15	---	---	---	---	---	---	---	---	0.11	---	---
C2 phen,anth	0.40	---	---	---	---	---	---	---	---	0.11	---	---
C3 phen,anth	0.23	---	---	---	---	---	---	---	---	0.18	---	---
C4 phen,anth	0.38	---	---	---	---	---	---	---	---	0.11	---	---
Retene	---	---	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	0.23	---	---	---	---	---	---	---	---	0.05	---	---
C1 dibenzothiophene	0.09	---	---	---	---	---	---	---	---	0.13	---	---
C2 dibenzothiophene	0.08	---	---	---	---	---	---	---	---	0.05	---	---
Dibenzofuran	0.38	---	---	---	---	---	---	---	---	0.13	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	384WP2.0 (2) 148	384WP2.0 (3) 149	384WP2.0 mixed 150	384WP5.0(1) 151A	 151B	384WP5.0(2) 152	384WP5.0(3) 153	384WP10(1) 154	384WP2.0(1) (upstream) 155	384WP2.0(2) (upstream) 156
Naphthalene	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.06
Acenaphthylene	0.50	0.44	0.10	0.12	0.10	0.55	0.60	0.68	0.56	0.63
Acenaphthene	0.42	0.39	0.13	0.13	0.12	0.39	0.42	0.48	0.40	0.46
Fluorene	0.20	0.18	0.10	0.12	0.10	0.18	0.20	0.22	0.18	0.21
Phenanthrene	0.36	0.37	0.86	0.08	0.08	0.35	0.41	0.44	0.35	0.40
Anthracene	0.37	0.38	0.87	0.08	0.08	0.36	0.41	0.46	0.38	0.41
Fluoranthene	0.13	0.14	0.44	0.04	0.04	0.13	0.14	0.15	0.18	0.15
Pyrene	0.12	0.14	0.46	0.04	0.04	0.13	0.13	0.16	0.12	0.15
Benz(a)anthracene	0.18	0.21	0.94	0.09	0.10	0.21	0.19	0.23	0.18	0.22
Chrysene	0.19	0.21	0.96	0.09	0.10	0.22	0.20	0.24	0.18	0.23
Benzofluoranthenes	0.25	0.26	1.50	0.14	0.16	0.31	0.25	0.33	0.24	0.30
Benzo(e)pyrene	0.26	0.27	0.23	0.17	0.18	0.33	0.25	0.33	0.24	0.31
Benzo(a)pyrene	0.42	0.43	0.31	0.23	0.26	0.51	0.39	0.52	0.38	0.47
Perylene	0.32	0.32	0.28	0.19	0.21	0.39	0.30	0.39	0.30	0.36
Dibenz(ah)anthracene	0.41	0.38	0.25	0.20	0.21	0.53	0.37	0.50	0.36	0.43
Indeno(1,2,3-cd)pyrene	0.35	0.33	0.38	0.27	0.32	0.45	0.32	0.40	0.33	0.39
Benzo(ghi)perylene	0.29	0.27	0.34	0.26	0.28	0.37	0.26	0.33	0.26	0.31
C1 naphthalenes	---	---	0.17	0.16	0.17	---	---	---	---	---
C2 naphthalenes	---	---	0.09	0.09	0.09	---	---	---	---	---
C3 naphthalenes	---	---	0.13	0.14	0.13	---	---	---	---	---
C4 naphthalenes	---	---	0.09	0.10	0.09	---	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	---	---	0.11	0.12	0.12	---	---	---	---	---
C2 phen,anth	---	---	0.12	0.10	0.10	---	---	---	---	---
C3 phen,anth	---	---	0.21	0.17	0.18	---	---	---	---	---
C4 phen,anth	---	---	0.13	0.11	0.11	---	---	---	---	---
Retene	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	---	---	0.05	0.06	0.05	---	---	---	---	---
C1 dibenzothiophene	---	---	0.13	0.22	0.13	---	---	---	---	---
C2 dibenzothiophene	---	---	0.05	0.09	0.05	---	---	---	---	---
Dibenzofuran	---	---	0.13	0.14	0.14	---	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	384WP2.0(3) (upstream) 157A	 157B	384BP50(1) (WP28) 158	384BP50(2) (WP28) 159	384BP50(3) (WP28) 160	384BP50 (WP28) mixed 161	384WP0.5 (offshore) 162	384WP2.0 (offshore) 163	384WP5.0 (offshore) 164	384WP10 (offshore) 165
Naphthalene	0.10	0.11	0.11	0.13	0.10	0.06	0.09	0.11	0.12	0.10
Acenaphthylene	0.09	0.09	0.10	0.12	0.09	0.11	0.08	0.09	0.11	0.09
Acenaphthene	0.28	0.27	0.30	0.36	0.27	0.13	0.25	0.28	0.33	0.25
Fluorene	0.07	0.07	0.08	0.10	0.07	0.10	0.06	0.08	0.09	0.07
Phenanthrene	0.09	0.10	0.10	0.14	0.10	0.08	2.00	0.66	0.13	0.09
Anthracene	0.10	0.10	0.10	0.14	0.10	0.08	0.15	0.05	0.13	0.09
Fluoranthene	0.06	0.07	0.07	0.09	0.07	0.04	1.20	0.41	0.09	0.07
Pyrene	0.06	0.07	0.07	0.09	0.07	0.04	1.20	0.40	0.09	0.06
Benz(a)anthracene	0.14	0.17	0.17	0.22	0.15	0.11	2.20	0.81	0.23	0.15
Chrysene	0.14	0.18	0.18	0.23	0.16	0.11	2.40	0.87	0.24	0.16
Benzofluoranthenes	0.11	0.13	0.15	0.17	0.12	0.19	1.70	0.12	0.18	0.13
Benzo(e)pyrene	0.11	0.14	0.15	0.18	0.13	0.22	0.16	0.12	0.19	0.13
Benzo(a)pyrene	0.13	0.16	0.18	0.21	0.15	0.30	0.18	0.15	0.22	0.16
Perylene	0.14	0.17	0.18	0.22	0.15	0.26	0.20	0.16	0.23	0.16
Dibenz(ah)anthracene	0.38	0.43	0.59	0.59	0.41	0.26	0.47	0.40	0.61	0.47
Indeno(1,2,3-cd)pyrene	0.17	0.19	0.23	0.27	0.18	0.36	0.24	0.18	0.27	0.21
Benzo(ghi)perylene	0.14	0.16	0.20	0.22	0.15	0.33	0.21	0.16	0.23	0.17
C1 naphthalenes	---	---	---	---	---	0.17	---	---	---	---
C2 naphthalenes	---	---	---	---	---	0.09	---	---	---	---
C3 naphthalenes	---	---	---	---	---	0.13	---	---	---	---
C4 naphthalenes	---	---	---	---	---	0.09	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	---	---	---	---	---	0.11	---	---	---	---
C2 phen,anth	---	---	---	---	---	0.11	---	---	---	---
C3 phen,anth	---	---	---	---	---	0.18	---	---	---	---
C4 phen,anth	---	---	---	---	---	0.12	---	---	---	---
Retene	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	---	---	---	---	---	0.05	---	---	---	---
C1 dibenzothiophene	---	---	---	---	---	0.21	---	---	---	---
C2 dibenzothiophene	---	---	---	---	---	0.13	---	---	---	---
Dibenzofuran	---	---	---	---	---	0.13	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D.	BMP Site	384BP0.5 4cm	2- 384BP0.5 6cm	4- 384BP0.5 10cm	8- 384BP0.5(1)	384BP0.5(2)	384BP0.5(3)		384BP0.5 mixed	
Lab Sample No. (9611)	79	81	82	83	84	85	86A	86B	87A	87B
Naphthalene	0.16	0.11	0.03	0.03	0.37	0.12	0.07	0.34	0.21	0.06
Acenaphthylene	0.3	0.34	0.09	0.09	1.1	0.38	0.21	1.0	0.36	0.34
Acenaphthene	0.26	1.0	0.25	0.26	3.1	1.1	0.62	3.0	0.3	0.3
Fluorene	0.1	0.22	0.05	0.05	0.7	0.25	0.14	0.65	0.13	0.13
Phenanthrene	0.33	0.34	0.09	0.1	1.0	0.38	0.21	0.94	0.37	0.2
Anthracene	0.35	0.36	0.09	0.1	1.0	0.38	0.22	0.96	0.04	0.04
Fluoranthene	0.35	0.18	0.04	0.05	0.55	0.19	0.11	0.5	0.42	0.23
Pyrene	0.37	0.17	0.05	0.05	0.53	0.19	0.11	0.5	0.43	0.23
Benz(a)anthracene	1.4	0.28	0.08	0.11	0.89	0.35	0.19	0.84	1.9	0.96
Chrysene	1.5	0.3	0.08	0.11	0.9	0.35	0.2	0.88	2.0	1.0
Benzofluoranthenes	0.32	0.64	0.08	0.2	2.1	0.78	0.44	2.0	0.28	2.8
Benzo(e)pyrene	0.34	0.65	0.09	0.2	2.1	0.79	0.46	2.1	0.29	0.3
Benzo(a)pyrene	0.49	0.96	0.27	0.3	3.1	1.2	0.65	3.0	0.42	0.44
Perylene	0.4	0.78	0.22	0.23	2.5	0.96	0.52	2.4	0.33	0.36
Dibenz(ah)anthracene	0.44	0.85	0.23	0.22	2.4	1.1	0.53	2.3	0.4	0.47
Indeno(1,2,3-cd)pyrene	0.43	0.86	0.24	0.22	2.6	1.0	0.54	2.4	0.39	0.4
Benzo(ghi)perylene	0.36	0.68	0.19	0.18	2.1	0.85	0.43	1.9	0.32	0.34
C1 naphthalenes	0.2	---	---	---	---	---	---	---	0.25	0.23
C2 naphthalenes	0.83	---	---	---	---	---	---	---	0.98	0.93
C3 naphthalenes	0.19	---	---	---	---	---	---	---	0.22	0.21
C4 naphthalenes	0.36	---	---	---	---	---	---	---	0.45	0.43
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	0.14	---	---	---	---	---	---	---	0.17	0.16
C2 phen,anth	0.4	---	---	---	---	---	---	---	0.4	0.41
C3 phen,anth	0.23	---	---	---	---	---	---	---	0.22	0.23
C4 phen,anth	0.37	---	---	---	---	---	---	---	0.35	0.39
Retene	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	0.21	---	---	---	---	---	---	---	0.24	0.24
C1 dibenzothiophene	0.08	---	---	---	---	---	---	---	0.09	0.09
C2 dibenzothiophene	0.07	---	---	---	---	---	---	---	0.08	0.08
Dibenzofuran	0.34	---	---	---	---	---	---	---	0.4	0.38

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	384BP1.0 4cm 88	2-384BP1.0 6cm 89	4- 384BP1.0 10cm 90	8- 384BP1.0 91A	 91B	384BP1.0 mixed 92	384BP1.5 93	384BP1.5 mixed 94	384BP2.0 4cm 95	2- 384BP2.0 6cm 96	4
Naphthalene	0.07	0.29	0.04	0.64	0.49	0.1	0.58	0.06	0.53	0.05	
Acenaphthylene	0.22	1.5	0.2	3	2.3	0.38	3.1	0.37	2.5	0.24	
Acenaphthene	0.65	0.9	0.12	1.1	1.4	0.32	1.6	0.31	1.5	0.14	
Fluorene	0.14	0.79	0.11	0.16	1.3	0.14	1.6	0.13	1.4	0.13	
Phenanthrene	0.22	0.92	0.12	1.8	1.5	0.05	1.9	0.04	1.5	0.14	
Anthracene	0.22	0.98	0.12	1.9	1.6	0.05	2.0	0.05	1.7	0.15	
Fluoranthene	0.12	0.32	0.04	0.63	0.52	0.15	0.7	0.05	0.55	0.05	
Pyrene	0.11	0.31	0.04	0.63	0.5	0.05	0.66	0.05	0.53	0.05	
Benz(a)anthracene	0.21	0.37	0.04	0.67	0.56	0.2	0.74	0.19	0.62	0.05	
Chrysene	0.21	0.37	0.04	0.66	0.56	0.2	0.73	0.19	0.61	0.05	
Benzofluoranthenes	0.45	0.81	0.12	1.5	1.3	0.29	1.7	0.29	1.5	0.14	
Benzo(e)pyrene	0.47	0.84	0.12	1.6	1.4	0.3	1.8	0.31	1.6	0.15	
Benzo(a)pyrene	0.66	1.0	0.14	1.8	1.6	0.44	2.1	0.44	1.8	0.16	
Perylene	0.54	0.96	0.14	1.8	1.6	0.34	2.0	0.35	1.7	0.17	
Dibenz(ah)anthracene	0.5	0.83	0.14	1.5	1.4	0.43	1.7	0.5	1.6	0.17	
Indeno(1,2,3-cd)pyrene	0.53	1.5	0.25	2.7	2.6	0.42	3.0	0.44	2.9	0.32	
Benzo(ghi)perylene	0.42	1.2	0.21	2.1	2.1	0.33	2.4	0.37	2.3	0.25	
C1 naphthalenes	---	---	---	---	---	0.25	---	0.25	---	---	
C2 naphthalenes	---	---	---	---	---	1.3	---	1.1	---	---	
C3 naphthalenes	---	---	---	---	---	0.24	---	0.22	---	---	
C4 naphthalenes	---	---	---	---	---	0.47	---	0.46	---	---	
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---	
C1 phen,anth	---	---	---	---	---	0.18	---	0.18	---	---	
C2 phen,anth	---	---	---	---	---	0.44	---	0.44	---	---	
C3 phen,anth	---	---	---	---	---	0.25	---	0.24	---	---	
C4 phen,anth	---	---	---	---	---	0.41	---	0.4	---	---	
Retene	---	---	---	---	---	---	---	---	---	---	
C5 phen,anth	---	---	---	---	---	---	---	---	---	---	
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---	
Dibenzothiophene	---	---	---	---	---	0.26	---	0.25	---	---	
C1 dibenzothiophene	---	---	---	---	---	0.1	---	0.1	---	---	
C2 dibenzothiophene	---	---	---	---	---	0.09	---	0.09	---	---	
Dibenzofuran	---	---	---	---	---	0.43	---	0.42	---	---	

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D.	384BP2.0 8-10cm	384BP2.0	384BP2.0 mixed	384BP2.5	384BP2.5 (mixed)	384BP3.0	384BP3.0 (mixed)		384BP3.5	
Lab Sample No. (9611)	97	98	99	100	101	102	103A	103B	104A	104B
Naphthalene	0.04	0.65	0.08	0.5	0.09	0.06	0.27	0.28	0.06	0.05
Acenaphthylene	0.19	3.4	0.35	2.4	0.4	0.54	0.22	0.22	0.53	0.48
Acenaphthene	0.11	2.0	0.31	1.4	0.38	0.77	0.44	0.44	0.76	0.69
Fluorene	0.1	1.9	0.19	1.2	0.14	0.31	0.26	0.26	0.31	0.27
Phenanthrene	0.12	2.2	0.04	1.4	0.05	0.2	0.34	0.34	0.19	0.17
Anthracene	0.13	2.4	0.06	1.5	0.05	0.21	0.32	0.29	0.2	0.18
Fluoranthene	0.04	0.78	0.13	0.51	0.05	0.1	0.14	0.13	0.08	0.07
Pyrene	0.04	0.78	0.04	0.51	0.05	0.1	0.14	0.13	0.08	0.07
Benz(a)anthracene	0.04	0.93	0.19	0.56	0.22	0.05	0.14	0.14	0.04	0.03
Chrysene	0.04	0.92	0.56	0.56	0.23	0.05	0.14	0.14	0.04	0.03
Benzofluoranthenes	0.12	2.2	0.28	1.3	0.33	0.25	0.55	0.57	0.21	0.18
Benzo(e)pyrene	0.12	2.2	0.29	1.4	0.35	0.26	0.58	0.58	0.22	0.19
Benzo(a)pyrene	0.14	2.7	0.42	1.6	0.49	0.38	0.86	0.9	0.34	0.29
Perylene	0.14	2.5	0.33	1.6	0.4	0.29	0.68	0.71	0.26	0.22
Dibenz(ah)anthracene	0.14	2.2	0.43	1.3	0.53	0.33	1.8	2.2	0.31	0.26
Indeno(1,2,3-cd)pyrene	0.25	4	0.41	2.6	0.48	0.3	0.44	0.51	0.31	0.26
Benzo(ghi)perylene	0.21	3.1	0.34	2.0	0.38	0.25	0.37	0.42	0.25	0.22
C1 naphthalenes	---	---	0.23	---	0.27	---	0.072	0.075	---	---
C2 naphthalenes	---	---	1.0	---	1.1	---	0.33	0.34	---	---
C3 naphthalenes	---	---	0.22	---	0.25	---	0.42	0.53	---	---
C4 naphthalenes	---	---	0.44	---	0.5	---	0.23	0.23	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	---	---	0.17	---	0.19	---	0.44	0.44	---	---
C2 phen,anth	---	---	0.42	---	0.49	---	0.32	0.3	---	---
C3 phen,anth	---	---	0.23	---	0.27	---	2.4	2.4	---	---
C4 phen,anth	---	---	0.39	---	0.44	---	0.62	0.6	---	---
Retene	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	---	---	0.25	---	0.28	---	0.13	0.12	---	---
C1 dibenzothiophene	---	---	0.1	---	0.11	---	0.38	0.37	---	---
C2 dibenzothiophene	---	---	0.08	---	0.1	---	0.38	0.22	---	---
Dibenzofuran	---	---	0.4	---	0.46	---	0.33	0.34	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	384BP3.5 (mixed) 105	384BP5.0 4cm 106	2- 384BP5.0 6cm 107	4- 384BP5.0 10cm 108	8- 384BP5.0(1) 109	384BP5.0(2) 110	384BP5.0(3) 111 (missing)	384BP5.0 (mixed) 112	384BP7.5 113	384BP7.5 (mixed) 114
Naphthalene	0.26	0.06	0.11	0.05	0.12	0.05		0.31	0.09	0.31
Acenaphthylene	0.22	0.55	0.55	0.49	0.53	0.49		0.25	0.63	0.25
Acenaphthene	0.44	0.81	0.77	0.72	0.73	0.7		0.48	0.9	0.49
Fluorene	0.26	0.32	0.31	0.29	0.3	0.29		0.29	0.38	0.3
Phenanthrene	0.35	0.19	0.18	0.16	0.18	0.16		0.42	0.21	0.39
Anthracene	0.32	0.2	0.19	0.17	0.19	0.17		0.38	0.21	0.36
Fluoranthene	0.14	0.08	0.07	0.07	0.07	0.07		0.16	0.09	0.16
Pyrene	0.14	0.08	0.07	0.07	0.07	0.07		0.17	0.09	0.16
Benz(a)anthracene	0.14	0.04	0.04	0.03	0.04	0.03		0.19	0.05	0.17
Chrysene	0.13	0.04	0.04	0.03	0.04	0.04		0.19	0.05	0.17
Benzofluoranthenes	0.52	0.19	0.2	0.18	0.21	0.2		0.81	0.27	0.69
Benzo(e)pyrene	0.55	0.21	0.21	0.19	0.22	0.21		0.84	0.28	0.74
Benzo(a)pyrene	0.81	0.3	0.3	0.29	0.32	0.31		1.2	0.42	1.1
Perylene	0.64	0.24	0.25	0.21	0.26	0.24		1.0	0.33	1.9
Dibenz(ah)anthracene	2.1	0.28	0.34	0.28	0.3	0.29		2.9	0.37	0.85
Indeno(1,2,3-cd)pyrene	0.46	0.27	0.31	0.27	0.31	0.3		0.68	0.38	0.61
Benzo(ghi)perylene	0.39	0.22	0.28	0.23	0.26	0.25		0.56	0.31	0.5
C1 naphthalenes	0.073	---	---	---	---	---	---	0.079	---	0.085
C2 naphthalenes	0.29	---	---	---	---	---	---	0.31	---	0.33
C3 naphthalenes	0.7	---	---	---	---	---	---	0.66	---	0.83
C4 naphthalenes	0.23	---	---	---	---	---	---	0.25	---	0.26
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	0.46	---	---	---	---	---	---	0.54	---	0.51
C2 phen,anth	2.2	---	---	---	---	---	---	0.36	---	2.3
C3 phen,anth	1.2	---	---	---	---	---	---	2.0	---	2.4
C4 phen,anth	0.61	---	---	---	---	---	---	0.73	---	0.72
Retene	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	0.13	---	---	---	---	---	---	0.15	---	0.15
C1 dibenzothiophene	0.41	---	---	---	---	---	---	0.68	---	0.52
C2 dibenzothiophene	0.23	---	---	---	---	---	---	0.43	---	0.39
Dibenzofuran	0.34	---	---	---	---	---	---	0.38	---	0.38

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D.	384BP10(1)		384BP10(2)	384BP10(3)	384BP10 (mixed)	384BP20	384BP20 (mixed)	384BP30	384BP30 (mixed)	384BP2.0(!) (upstream)
Lab Sample No. (9611)	115A	115B	116	117	118	119	120	121	122	123
Naphthalene	0.03	0.07	0.07	0.07	0.30	0.08	0.36	0.06	0.36	0.05
Acenaphthylene	0.27	0.3	0.3	0.29	0.22	0.33	0.29	0.1	0.86	0.25
Acenaphthene	0.64	0.74	0.72	0.69	0.44	0.83	0.58	0.13	0.55	0.61
Fluorene	0.18	0.22	0.21	0.21	0.26	0.23	0.34	0.1	0.32	0.18
Phenanthrene	0.12	0.13	0.13	0.12	0.34	0.14	0.48	0.08	0.45	0.11
Anthracene	0.12	0.13	0.14	0.13	0.30	0.14	0.42	0.08	0.41	0.12
Fluoranthene	0.13	0.15	0.14	0.14	0.13	0.16	0.18	0.04	0.17	0.12
Pyrene	0.13	0.14	0.14	0.14	0.13	0.16	0.18	0.04	0.17	0.12
Benz(a)anthracene	0.18	0.21	0.2	0.21	0.14	0.22	0.2	0.11	0.19	0.16
Chrysene	0.19	22	0.21	0.22	0.14	0.23	0.19	0.11	0.18	0.17
Benzofluoranthenes	0.27	0.32	0.31	0.34	0.60	0.38	0.86	0.18	0.81	0.24
Benzo(e)pyrene	0.29	0.34	0.32	0.36	0.65	0.4	0.9	0.19	0.85	0.26
Benzo(a)pyrene	0.4	0.49	0.47	0.49	0.94	0.56	1.3	0.27	1.2	0.36
Perylene	0.32	0.37	0.36	0.39	2.30	0.44	1.3	0.24	1.6	0.29
Dibenz(ah)anthracene	1.5	1.7	1.5	1.9	0.76	2.0	1.0	0.2	1.0	1.10
Indeno(1,2,3-cd)pyrene	0.44	0.53	0.48	0.6	0.56	0.59	0.82	0.3	0.8	0.38
Benzo(ghi)perylene	0.35	0.44	0.4	0.5	0.47	0.5	0.69	0.28	0.67	0.32
C1 naphthalenes	---	---	---	---	0.076	---	0.098	---	0.092	---
C2 naphthalenes	---	---	---	---	0.28	---	0.37	---	0.36	---
C3 naphthalenes	---	---	---	---	0.66	---	0.68	---	0.48	---
C4 naphthalenes	---	---	---	---	0.23	---	0.3	---	0.28	---
C5 naphthalenes	---	---	---	---		---	---	---	---	---
C1 phen,anth	---	---	---	---	0.41	---	0.61	---	0.59	---
C2 phen,anth	---	---	---	---	1.40	---	2.3	---	2.4	---
C3 phen,anth	---	---	---	---	1.10	---	1.9	---	1.5	---
C4 phen,anth	---	---	---	---	0.59	---	0.8	---	0.74	---
Retene	---	---	---	---		---	---	---	---	---
C5 phen,anth	---	---	---	---		---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---		---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---		---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---		---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---		---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---		---	---	---	---	---
Dibenzothiophene	---	---	---	---	0.13	---	0.18	---	0.18	---
C1 dibenzothiophene	---	---	---	---	0.29	---	0.25	---	0.41	---
C2 dibenzothiophene	---	---	---	---	0.34	---	0.24	---	0.28	---
Dibenzofuran	---	---	---	---	0.34	---	0.44	---	0.42	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	384BP2.0(2) (upstream) 124	384BP2.0(3) (upstream) 125	384BP5.0(1) 126	384BP5.0(2) 127A	 127B	384BP5.0(3) 128	Blind N.R.C. Std. 129	384BP10(1) (upstream) 130	384BP10(2) (upstream) 131	384BP10(3) (upstream) 132
Naphthalene	0.06	0.05	0.08	0.54	0.62	0.49	1.4	0.36	0.37	0.42
Acenaphthylene	0.27	0.24	0.35	0.71	0.78	0.63	1.9	0.51	0.55	0.56
Acenaphthene	0.66	0.60	0.87	0.64	0.7	0.57	1.7	0.46	0.49	0.49
Fluorene	0.20	0.17	0.25	0.34	0.36	0.3	0.91	0.25	0.26	0.27
Phenanthrene	0.12	0.10	0.16	0.45	0.48	0.39	5.4	0.33	0.35	0.37
Anthracene	0.13	0.11	0.16	0.45	0.49	0.4	1.4	0.34	0.37	0.38
Fluoranthene	0.14	0.12	0.18	0.18	0.18	0.18	1.2	0.14	0.13	0.15
Pyrene	0.14	0.12	0.18	0.18	0.19	0.18	1.2	0.14	0.14	0.15
Benz(a)anthracene	0.19	0.17	0.24	0.93	0.96	1.0	2.5	0.75	0.69	0.84
Chrysene	0.20	0.17	0.25	0.97	0.99	1.1	2.7	0.81	0.73	0.87
Benzofluoranthenes	0.29	0.27	0.35	1.2	1.2	1.4	2.9	0.98	0.83	1.1
Benzo(e)pyrene	0.31	0.30	0.37	1.2	1.2	1.4	2.9	0.96	0.84	1.1
Benzo(a)pyrene	0.44	0.40	0.53	2	1.8	2.3	4.7	1.6	1.3	1.8
Perylene	0.34	0.33	0.43	2.3	2.1	2.7	4.4	1.9	2.1	1.9
Dibenz(ah)anthracene	1.40	1.60	0.41	1.5	1.5	1.8	3.5	1.2	1.0	1.3
Indeno(1,2,3-cd)pyrene	0.45	0.47	0.59	0.89	0.84	1.0	1.8	0.73	0.58	0.76
Benzo(ghi)perylene	0.37	0.39	0.50	0.72	0.68	0.83	1.4	0.62	0.47	0.59
C1 naphthalenes	---	---	---	---	---	---	---	---	---	---
C2 naphthalenes	---	---	---	---	---	---	---	---	---	---
C3 naphthalenes	---	---	---	---	---	---	---	---	---	---
C4 naphthalenes	---	---	---	---	---	---	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---	---
C1 phen,anth	---	---	---	---	---	---	---	---	---	---
C2 phen,anth	---	---	---	---	---	---	---	---	---	---
C3 phen,anth	---	---	---	---	---	---	---	---	---	---
C4 phen,anth	---	---	---	---	---	---	---	---	---	---
Retene	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	---	---	---	---	---	---	---	---	---	---
C1 dibenzothiophene	---	---	---	---	---	---	---	---	---	---
C2 dibenzothiophene	---	---	---	---	---	---	---	---	---	---
Dibenzofuran	---	---	---	---	---	---	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	384BP28(1) (upstream) 133	384BP28(2) (upstream) 134	384BP28(3) (upstream) 135	384BP0.5 (offshore) 136	384BP2.0 (offshore) 137	384BP5.0 (offshore) 138	384BP10 (offshore) 139	384MC0.5 166	384MC2.0 167
Naphthalene	0.061	0.14	0.14	0.2	0.14	0.16	0.2	0.11	0.045
Acenaphthylene	0.11	0.33	0.34	0.42	0.31	0.37	0.48	0.088	0.073
Acenaphthene	0.13	0.16	0.16	0.2	0.14	0.17	0.22	0.28	0.26
Fluorene	0.1	0.22	0.22	11	0.21	0.26	0.32	0.075	0.05
Phenanthrene	0.084	0.32	0.33	9.1	0.31	0.37	0.47	0.11	0.13
Anthracene	0.083	0.3	0.31	9.6	0.29	0.35	0.45	0.11	0.14
Fluoranthene	0.047	0.13	0.12	3.7	0.29	0.13	0.18	0.068	0.066
Pyrene	0.044	0.12	0.12	3.7	0.12	0.14	0.18	0.067	0.064
Benz(a)anthracene	0.11	0.41	0.36	9.9	0.39	0.42	0.62	0.15	0.17
Chrysene	0.12	0.43	0.37	10	0.41	0.43	0.65	0.16	0.18
Benzofluoranthenes	0.19	0.93	0.77	16	0.84	0.89	1.3	0.12	0.17
Benzo(e)pyrene	0.22	0.98	0.8	0.94	0.91	0.96	1.4	0.13	0.18
Benzo(a)pyrene	0.31	1.4	1.1	1.3	1.3	1.3	2.0	0.15	0.26
Perylene	0.24	1.5	1.2	1.1	1.2	1.2	1.8	0.16	0.2
Dibenz(ah)anthracene	0.24	1.2	0.96	1.2	1.1	1.1	1.7	0.43	0.56
Indeno(1,2,3-cd)pyrene	0.32	3.0	2.5	2.4	2.4	2.5	3.6	0.19	0.3
Benzo(ghi)perylene	0.28	2.8	2.3	2.3	2.3	2.3	3.4	0.16	0.25
C1 naphthalenes	0.17	---	---	---	---	---	---	---	---
C2 naphthalenes	0.091	---	---	---	---	---	---	---	---
C3 naphthalenes	0.13	---	---	---	---	---	---	---	---
C4 naphthalenes	0.1	---	---	---	---	---	---	---	---
C5 naphthalenes	---	---	---	---	---	---	---	---	---
C1 phen,anth	0.12	---	---	---	---	---	---	---	---
C2 phen,anth	0.11	---	---	---	---	---	---	---	---
C3 phen,anth	0.2	---	---	---	---	---	---	---	---
C4 phen,anth	0.13	---	---	---	---	---	---	---	---
Retene	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---
Dibenzothiophene	0.057	---	---	---	---	---	---	---	---
C1 dibenzothiophene	0.27	---	---	---	---	---	---	---	---
C2 dibenzothiophene	0.11	---	---	---	---	---	---	---	---
Dibenzofuran	0.14	---	---	---	---	---	---	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	384MC5.0 168	384OC0.0 2-4cm 169	384OC0.0 4-6cm 170	384OC0.0 8-10cm 171	384OC0.0(1) 172	384OC0.0(2) 173	384OC0.0(3) 174	384OC0.0 (mixed) 175	384BP0.5 Kaolin - Top 176A	176B
Naphthalene	0.041	0.04	0.04	0.16	0.16	0.15	0.19	0.067	0.2	0.23
Acenaphthylene	0.07	0.07	0.07	0.47	2.4	0.49	0.58	0.11	0.59	0.64
Acenaphthene	0.25	0.25	0.23	0.29	0.26	0.3	0.34	0.13	0.34	0.39
Fluorene	0.04	0.05	0.04	0.1	0.1	0.1	0.13	0.12	0.13	0.14
Phenanthrene	0.13	0.14	0.12	0.22	0.21	0.21	0.27	0.07	0.84	0.73
Anthracene	0.15	0.14	0.13	0.18	0.17	0.17	0.21	0.07	0.88	0.78
Fluoranthene	0.067	0.07	0.06	0.25	0.24	0.25	0.29	0.03	1.1	0.97
Pyrene	0.064	0.07	0.06	0.25	0.23	0.25	0.28	0.03	1.1	0.94
Benz(a)anthracene	0.17	0.18	0.17	0.61	0.56	0.61	0.64	0.08	3.0	2.2
Chrysene	0.18	0.20	0.18	0.64	0.57	0.63	0.66	0.09	2.8	2.1
Benzofluoranthenes	0.15	0.19	0.17	0.36	0.37	0.34	0.36	0.14	0.44	0.51
Benzo(e)pyrene	0.17	0.20	0.18	0.38	0.4	0.37	0.38	0.16	0.47	0.57
Benzo(a)pyrene	0.25	0.30	0.27	0.57	0.57	0.52	0.56	0.22	0.69	0.82
Perylene	0.19	0.22	0.20	0.41	0.44	0.42	0.44	0.19	0.54	0.64
Dibenz(ah)anthracene	0.5	0.60	0.61	0.51	0.6	0.56	0.56	0.2	0.56	0.66
Indeno(1,2,3-cd)pyrene	0.27	0.31	0.31	0.58	0.68	0.6	0.64	0.28	0.67	0.82
Benzo(ghi)perylene	0.23	0.26	0.26	0.53	0.58	0.51	0.55	0.24	0.58	0.72
C1 naphthalenes	---	---	---	---	---	---	---	0.19	---	---
C2 naphthalenes	---	---	---	---	---	---	---	0.10	---	---
C3 naphthalenes	---	---	---	---	---	---	---	0.14	---	---
C4 naphthalenes	---	---	---	---	---	---	---	0.1	---	---
C5 naphthalenes	---	---	---	---	---	---	---			
C1 phen,anth	---	---	---	---	---	---	---	0.1	---	---
C2 phen,anth	---	---	---	---	---	---	---	0.084	---	---
C3 phen,anth	---	---	---	---	---	---	---	0.15	---	---
C4 phen,anth	---	---	---	---	---	---	---	0.10	---	---
Retene	---	---	---	---	---	---	---	---	---	---
C5 phen,anth	---	---	---	---	---	---	---	---	---	---
C1 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C2 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C3 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C4 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
C5 fluor,pyrenes	---	---	---	---	---	---	---	---	---	---
Dibenzothiophene	---	---	---	---	---	---	---	0.047	---	---
C1 dibenzothiophene	---	---	---	---	---	---	---	0.11	---	---
C2 dibenzothiophene	---	---	---	---	---	---	---	0.07	---	---
Dibenzofuran	---	---	---	---	---	---	---	0.15	---	---

Appendix V (D). Laboratory Sample Detection Limits (ng/g, dry wt.): Sooke Basin - Day 384

Sample I.D. Lab Sample No. (9611)	Day384 Min	Max	Mean	Std. Dev.
Naphthalene	0.03	1.4	0.17	0.19
Acenaphthylene	0.07	3.4	0.52	0.65
Acenaphthene	0.11	3.1	0.53	0.50
Fluorene	0.04	11	0.36	1.1
Phenanthrene	0.04	9.1	0.53	1.1
Anthracene	0.04	9.6	0.44	0.98
Fluoranthene	0.03	3.7	0.28	0.45
Pyrene	0.03	3.7	0.28	0.45
Benz(a)anthracene	0.03	9.9	0.56	1.1
Chrysene	0.03	22	0.82	2.4
Benzofluoranthenes	0.08	16	0.74	1.6
Benzo(e)pyrene	0.09	2.9	0.54	0.52
Benzo(a)pyrene	0.13	4.7	0.77	0.74
Perylene	0.14	4.4	0.73	0.76
Dibenz(ah)anthracene	0.14	3.5	0.84	0.65
Indeno(1,2,3-cd)pyrene	0.17	4.0	0.81	0.87
Benzo(ghi)perylene	0.14	3.4	0.69	0.75
C1 naphthalenes	0.072	0.27	0.16	0.07
C2 naphthalenes	0.08	1.3	0.50	0.41
C3 naphthalenes	0.12	0.83	0.33	0.23
C4 naphthalenes	0.09	0.5	0.27	0.15
C5 naphthalenes	---	---	---	---
C1 phen,anth	0.1	0.61	0.27	0.18
C2 phen,anth	0.084	2.4	0.68	0.81
C3 phen,anth	0.15	2.4	0.79	0.86
C4 phen,anth	0.095	0.8	0.41	0.24
Retene	---	---	---	---
C5 phen,anth	---	---	---	---
C1 fluor,pyrenes	---	---	---	---
C2 fluor,pyrenes	---	---	---	---
C3 fluor,pyrenes	---	---	---	---
C4 fluor,pyrenes	---	---	---	---
C5 fluor,pyrenes	---	---	---	---
Dibenzothiophene	0.047	0.28	0.15	0.08
C1 dibenzothiophene	0.08	0.68	0.23	0.16
C2 dibenzothiophene	0.046	0.43	0.16	0.12
Dibenzofuran	0.34	0.46	0.40	0.04

APPENDIX VI

Raw Data and Descriptive Statistics for Surface Sediment *parental* PAH Concentrations - Day0 to Day384

A. Site Selection Samples

B. Weathered Piling Treatment Site (WP)

C. Best Management Practices Treatment Site (BMP)

D. Mechanical Control Treatment Site (MC)

E. Open Control Site (OC)

APPENDIX VI (A)

Raw Data and Descriptive Statistics for Surface Sediment *parental* PAH Concentrations - Day0 to Day384

Site Selection Samples

Appendix VI (A) . Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Site Selection Samples.

Area	Howe Sd.	Howe Sd.	Howe Sd.	Howe Sd.	Howe Sd.	Howe Sd.	Howe Sd.	Howe Sd.			Howe Sound	Howe Sound	Sechelt Inlet
Sampling Location	Port Graves	Port Graves	Port Graves	Port Graves	Port Graves	Port Graves	Port Graves	Port Graves			Centre Bay	Centre Bay	Storm Bay
Sampling Station	PG 1	PG 2	PG 3	PG 4	PG 5	PG 6	PG 7	PG 8			CB 1	CB 2	1
Sampling Date	06/Jan/95	06/Jan/95	06/Jan/95	06/Jan/95	06/Jan/95	06/Jan/95	06/Jan/95	06/Jan/95			21/Feb/95	21/Feb/95	20/Jan/95
Depth	13 ft.	13 ft.	13 ft.	20 ft.	20 ft.	20 ft.	20 ft.	20 ft.			28ft.	28ft.	25 ft.
Lab Sample No.	2891- 09	2891- 10	2891- 01	2891- 02	2891- 11	2891- 12	2891- 03	2891- 04A	2891- 04B	2891-04 mean	2891- 21	2891- 22	2891- 06A
Sediment Description	Coarse sand	Coarse sand	Coarse sand	Mud	Mud	Mud	Mud	Mud	Mud		Sand/mud	Sand/mud	Coarse sand
Moisture Content (%)	33	27	26	39	42	33	58	46	54	50	79	39	22
Sample Weight (g)	6.69	7.28	7.63	6.2	5.8	6.7	4.34	5.49	4.73	5.11	2.21	6.06	7.9
TOC (%)	0.38	0.37	0.09	1.4	0.69	0.51	1.9	2.3	---		1.3	1.9	0.2
Naphthalene	NDR(1.7)	NDR(1.4)	0.1	6.3	NDR(5.3)	1.1	24	3.4	3.9	3.7	29	22	1.6
Acenaphthylene	1.9	0.71	0.57	1.2	2.4	1.6	21	2.0	3.2	2.6	19	13	0.8
Acenaphthene	ND	ND	0.33	16	2.6	ND	20	3.6	7.0	5.3	14	20	ND
Fluorene	ND	ND	0.51	16	3.7	1.7	100	6.1	7.8	7.0	26	40	1.1
Phenanthrene	13	5.3	11	129	27	9.8	499	59	99	79	219	219	12
Anthracene	NDR(3.6)	NDR(1.5)	2.1	34	8.0	4.2	360	13	21	17	63	58	8.1
LPAH	15	6.0	14	202	44	18	1023	87	142	114	369	371	24
Fluoranthene	72	20	32	190	95	37	880	130	260	195	440	290	14
Pyrene	54	16	22	280	78	32	850	99	180	140	470	290	13
Benz(a)anthracene	16	6.2	7.9	62	28	14	700	32	83	58	200	170	5.7
Chrysene	33	12	16	82	44	26	1200	51	130	91	260	190	7.0
Benzofluoranthenes	38	24	18	82	65	44	1200	72	170	121	440	260	6.3
Benzo(e)pyrene	15.0	9.0	6.8	28	25	17	420	27	64	46	180	92	NDR(2.0)
Benzo(a)pyrene	13	8.1	4.9	40	8.4	17	510	25	60	43	260	160	NDR(4.5)
Dibenz(ah)anthracene	NDR(2.7)	0.5	NDR (1.0)	NDR(5.0)	2.2	1.6	72	NDR(3.4)	NDR(7.3)	NDR(7.3)	37	21	ND
Indeno(1,2,3-cd)pyrene	NDR(10)	6.7	5.4	24	18	13.2	320	19	35	27	200	98	NDR(2.2)
Benzo(ghi)perylene	NDR(8.9)	NDR(7.0)	4.5	20	18	13	270	18	30	24	180	82	1.7
HPAH	239	102	117	808	382	215	6422	473	1012	742	2664	1650	48
TPAH	254	109	131	1009	425	233	7445	559	1153	856	3034	2022	71
TPAH (µg/g)	0.25	0.11	0.13	1.01	0.42	0.23	7.4	0.56	1.2	0.86	3.0	2.0	0.1
Perylene	2.9	2.7	2.1	14	8.4	5.5	130	11	19	15	84	38	NDR(0.85)
Surrogate Stds. (% Recovery)													
Naph d-8	37	45	46	57	30	76	67	55	65	60	59	48	69
Acen d-10	43	58	54	64	40	45	81	65	71	68	72	58	71
Phen d-10	60	67	71	79	62	66	92	76	91	84	79	81	78
Pyr d-10	92	95	89	89	93	95	89	88	89	89	83	92	85
Cry d-12	88	86	86	84	94	92	81	85	87	86	73	95	83
B(a)P d-12	86	83	98	96	86	86	89	93	96	95	77	96	92
Perylene d-12	88	85	98	95	87	86	88	92	95	94	76	94	94
DiB(ah)A d-14	53	45	72	74	58	51	94	70	81	76	49	74	71
B(ghi)P d-12	64	58	90	84	69	63	93	82	90	86	61	78	96

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (A) . Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Site Selection Samples.

Area			Sechelt Inlet	Sechelt Inlet	Sidney	Cowichan Bay	Prevost Is.	Prevost Is.	
Sampling Location			Snake Bay	Rivtow	Pat Bay	Genoa Bay	Ellen Bay	Ellen Bay	
Sampling Station			1	1	PB 1	GB 3	EB 9	EB 9	
Sampling Date			20/Jan/95	20/Jan/95	11/Mar./95	11/Mar./95	11/Mar./95	11/Mar./95	
Depth			20 ft.	15 ft.	15 ft.	25ft.	20ft.	20ft.	
Lab Sample No.	2891 - 06B	2891-06 mean	2891- 07	2891 - 08	2891 - 18	2891 - 19	2891 - 17A	2891 - 17B	2891-17 mean
Sediment Description			Coarse sand	Mud	Mud	Mud	Mud	Mud	
Moisture Content (%)	23	23	22	---	37	64	52	52	52
Sample Weight (g)	7.6	7.8	7.8	7.0	6.36	3.80	4.8	4.9	4.8
TOC (%)	---	---	0.1	1.0	0.72	4.0	1.3	1.5	1.4
Naphthalene	0.9	1.3	1.0	2.4	3.4	61	31	25	28
Acenaphthylene	NDR(0.09)	0.8	ND	0.7	1.6	17	3.0	4.1	3.6
Acenaphthene	ND	ND	ND	0.7	3.2	13	5.0	4.3	4.7
Fluorene	NDR(0.09)	1.1	ND	1.1	5.0	25	16	17	17
Phenanthrene	0.4	6.2	0.4	4.1	17	67	45	51	48
Anthracene	ND	8.1	ND	2.0	6.5	32	11	12	12
LPAH	1.3	12	1.4	11	36	214	110	113	112
Fluoranthene	0.4	7.2	0.6	22	52	150	54	62	58
Pyrene	0.3	6.6	0.4	17	50	310	50	57	53
Benz(a)anthracene	ND	5.7	ND	5.4	19	100	23	25	24
Chrysene	ND	7.0	ND	6.9	20	130	22	25	24
Benzofluoranthenes	NDR(0.3)	6.3	NDR(0.38)	12	48	240	50	53	52
Benzo(e)pyrene	NDR(0.24)	NDR(2.0)	ND	4.7	18	81	21	22	22
Benzo(a)pyrene	ND	ND	ND	NDR(3.8)	17	78	18	19	19
Dibenz(ah)anthracene	ND	ND	ND	NDR(0.5)	ND	NDR(9.2)	NDR(3.1)	0.7	0.7
Indeno(1,2,3-cd)pyrene	ND	ND	ND	NDR(3.1)	15	60	17	18	18
Benzo(ghi)perylene	ND	1.7	ND	3.4	13	48	18	19	19
HPAH	0.6	24	1.1	71	251	1194	270	300	285
TPAH	1.9	37	2.5	82	288	1408	380	413	397
TPAH (µg/g)	0.002	0.04	0.002	0.08	0.3	1.4	0.38	0.41	0.40
Perylene	ND	ND	NDR(0.43)	5.6	8.9	140	64	63	64
Surrogate Stds. (% Recovery)									
Naph d-8	75	72	73	62	80	42	36	36	36
Acen d-10	79	75	81	72	83	45	43	41	41
Phen d-10	81	80	85	78	85	54	50	48	48
Pyr d-10	86	86	86	84	110	73	71	69	69
Cry d-12	78	81	73	83	94	62	66	61	61
B(a)P d-12	89	91	95	83	100	66	66	62	62
Perylene d-12	90	92	98	85	110	70	70	66	66
DiB(ah)A d-14	46	59	64	67	81	48	52	48	48
B(ghi)P d-12	66	81	88	85	92	57	63	58	58

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (A) . Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Site Selection Samples.

Area	North Pender Is.	North Pender Is.		Sooke Basin	Sooke Basin	Sooke Basin	Sooke Basin	Sooke Basin			
Sampling Location	Port Browning	Port Browning		Pim Head	Pim Head	St. Anne	Gillespie	Min	Max	Mean	Std. Dev.
Sampling Station	PT.B 10	PT.B 10		5A	5B	5C	5D	5A-5D	5A-5D	5A-5D	5A-5D
Sampling Date	11/Mar./95	11/Mar./95		11/Mar./95	11/Mar./95	11/Mar./95	11/Mar./95				
Depth	30ft.	30ft.		20ft.	25ft.	21ft.	20ft.				
Lab Sample No.	2891 - 20A	2891 - 20B	2891-20 mean	2891 - 13	2891 - 14	2891 - 15	2891 - 16	2891:13-16			
Sediment Description	Mud	Mud		Shell/mud	Shell/mud	Shell/mud	Shell/mud				
Moisture Content (%)	58	58	58	26	22	25	37	22	37	28	6.6
Sample Weight (g)	4.23	4.3	4.3	7.57	8.1	7.55	6.61	6.6	8.1	7.5	0.6
TOC (%)	1.87	---		0.35	0.25	0.21	1.72	0.21	1.7	0.6	0.7
Naphthalene	29	37	33	1.4	0.3	0.2	3.9	0.2	3.9	1.45	1.7
Acenaphthylene	6.7	8.3	7.5	0.89	0.53	NDR(0.31)	3.4	0.53	3.4	1.6	1.6
Acenaphthene	3.2	4.7	4.0	0.7	0.59	NDR(0.59)	4.9	0.59	4.9	2.1	2.5
Fluorene	13	17	15	1.8	1.2	1.3	11	1.2	11	3.8	4.8
Phenanthrene	50	63	57	6.1	3.1	1.6	52	1.6	52	16	24
Anthracene	10	13	12	1.5	0.84	0.52	35	0.52	35	9.5	17
LPAH	112	143	127	12	6.5	3.6	110	3.6	110	33	51
Fluoranthene	110	120	115	14	8.1	5.5	120	5.5	120	37	55
Pyrene	80	92	86	12	7.5	3.8	180	3.8	180	51	86
Benz(a)anthracene	31	36	34	5.3	3.3	2.0	61	2.0	61	18	29
Chrysene	42	54	48	5.6	2.7	1.3	98	1.3	98	27	47
Benzofluoranthenes	72	90	81	9.3	5.7	2.8	190	2.8	190	52	92
Benzo(e)pyrene	31	38	34	3.8	NDR(2.0)	1.1	76	1.1	76	27	42
Benzo(a)pyrene	25	31	28	4.2	2.6	1.1	85	1.1	85	23	41
Dibenz(ah)anthracene	4.6	4.6	4.6	NDR(1.2)	ND	NDR(0.3)	7.4	ND	7.4	7.4	---
Indeno(1,2,3-cd)pyrene	25	30	27	4.2	NDR(2.8)	NDR(1.3)	50	4.2	50	27	32
Benzo(ghi)perylene	27	34	30	3.4	2.3	1.2	40	1.2	40	12	19
HPAH	445	527	486	58	30	16	907	16	907	253	436
TPAH	557	670	613	71	37	20	1016	20	1016	286	487
TPAH (µg/g)	0.56	0.67	0.61	0.07	0.04	0.02	1.0	0.02	1.02	0.29	0.49
Perylene	65	83	74	5.6	4.4	1.9	22	1.9	22	8.5	9.1
Surrogate Stds. (% Recovery)											
Naph d-8	67	75	71	45	55	49	40	40	55	47	6.3
Acen d-10	73	79	76	51	61	53	47	47	61	53	5.9
Phen d-10	83	80	82	58	62	57	48	48	62	56	5.9
Pyr d-10	91	82	87	71	75	72	62	62	75	70	5.6
Cry d-12	85	74	80	66	70	68	54	54	70	65	7.2
B(a)P d-12	85	72	79	70	74	73	59	59	74	69	6.9
Perylene d-12	88	74	81	72	76	76	58	58	76	71	8.5
DiB(ah)A d-14	54	40	47	50	56	55	43	43	56	51	5.9
B(ghi)P d-12	62	50	56	62	69	69	51	51	69	63	8.5

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX VI (B)

Raw Data and Descriptive Statistics for Surface Sediment *parental* PAH Concentrations - Day0 to Day384

Weathered Piling Treatment Site (WP)

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval	10 Metres	5 Metres									2 Metres		
Exposure Period/Sampling Station	384WP10	384WP5.0	384WP5.0	384WP5.0	384WP5.0	384WP5.0	384WP5.0				14WP2.0		
Replicate No.	1	1A	1B	mean	2	3	Min	Max	Mean	Std. Dev.	1A	1B	mean
Batch I.D.	PH-0987	PH-0993	PH-0993	PH-0993	PH-0987	PH-0987					PH-0827	PH-0827	PH-0827
Lab Sample No.	9611-154	9611-151A	9611-151B	9611-151	9611-152	9611-153	9611:151-153				2891-67A	2891-67B	2891-67
Moisture Content (%)	53	35	35	35	46	51	35	51	44	8.2	44	43	44
Sample Weight (g dry)	5.0	6.68	6.66	6.67	5.65	5.19	5.19	6.7	5.8	0.8	5.7	5.8	5.8
TOC (%)	1.20			0.58					0.60	---			1.24
Naphthalene	20	6.5	7.0	6.8	19	21	6.5	21	16	7.7	9.9	9.8	9.9
Acenaphthylene	4.0	2.0	3.4	2.7	6.5	6.0	2.0	6.5	5.1	2.1	3.7	3.6	3.7
Acenaphthene	8.4	11	12	12	21	34	11	34	22	11	61	58	60
Fluorene	21	20	22	21	49	52	20	52	41	17	88	84	86.0
Phenanthrene	53	44	170	107	190	130	44	190	142	43	400	530	465
Anthracene	28	14	38	26	47	46	14	47	40	12	35	34	35
LPAH	134	98	252	175	333	289	98	333	265	81	598	719	659
Fluoranthene	230	180	690	435	960	710	180	960	702	263	600	680	640
Pyrene	140	100	390	245	510	360	100	510	372	133	370	430	400
Benz(a)anthracene	68	39	150	95	170	160	39	170	142	41	71	81	76
Chrysene	130	81	250	166	390	350	81	390	302	120	140	170	155
Benzofluoranthenes	110	61	200	131	330	280	61	330	247	104	140	140	140
Benzo(e)pyrene	39	22	69	46	120	100	22	120	89	39	46	46	46
Benzo(a)pyrene	42	21	75	48	110	100	21	110	86	33	NDR(24)	NDR(28)	NDR(28)
Dibenz(ah)anthracene	3.4	2.1	6.1	4.1	9.8	9.5	2.1	10	7.8	3.2	ND(2.6)	ND(2.4)	ND(2.4)
Indeno(1,2,3-cd)pyrene	21	10	32	21	50	44	10	50	38	15	17	15	16
Benzo(ghi)perylene	19	9.2	24	17	40	36	9.2	40	31	13	16	13	15
HPAH	802	525	1886	1206	2690	2150	525	2690	2015	751	1400	1575	1488
TPAH	937	623	2139	1381	3022	2439	623	3022	2280	832	1998	2294	2146
TPAH (µg/g)	0.94	0.62	2.14	1.4	3.0	2.4	0.6	3.0	2.3	0.8	2.0	2.3	2.1
Perylene	35	17	28	23	40	41	17	41	35	10.4	26	21	24
Surrogate Stds. (% Recovery)													
Naph d-8	97	77	81	79	95	100	77	100	91	11	59	57	58
Acen d-10	99	75	86	81	100	98	75	100	93	11	62	60	61
Phen d-10	94	79	87	83	100	94	79	100	92	8.6	56	68	62
Pyr d-10	85	88	93	91	82	86	82	93	86	4.0	69	71	70
Cry d-12	75	84	83	84	69	80	69	84	78	7.5	61	60	61
B(a)P d-12	87	98	100	99	87	90	87	100	92	6.4	55	53	54
Perylene d-12	83	92	93	93	81	85	81	93	86	5.8	58	54	56
DiB(ah)A d-14	76	82	86	84	68	79	68	86	77	8.1	22	20	21
B(ghi)P d-12	78	76	76	76	68	79	68	79	74	6.0	29	27	28

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval

Exposure Period/Sampling Station	14WP2.0			14WP2.0			14WP2.0				180WP2.0	180WP2.0	180WP2.0
Replicate No.	2A	2B	mean	3A	3B	mean	Min	Max	Mean	Std. Dev.	1	2	3
Batch I.D.	PH-0819	PH-0819	PH-0819	PH-0819	PH-0819						PH-0900	PH-0900	PH-0900
Lab Sample No.	2891-68A	2891-68B	2891-68	2891-69A	2891-69B	2891-69	2891:67-69				9611-39	9611-40	9611-41
Moisture Content (%)	43	44	44	44	44	44	43	44	44	0.3	42	42	38
Sample Weight (g dry)	6.0	5.5	5.8	5.9	5.5	5.7	5.5	6.0	5.8	0.0	5.8	6.0	6.7
TOC (%)			1.36			1.29	1.20	1.40	1.30	0.08	1.98	1.29	0.75
Naphthalene	9.7	11	10	13	13	13	10	13	11	1.7	64	9.1	18
Acenaphthylene	4.7	5.3	5	7.7	5.4	6.55	3.6	7.7	5.1	1.5	9.8	9.0	14
Acenaphthene	62	69	66	66	57	61.5	57	69	62	3.1	170	41	61
Fluorene	80	110	95	120	79	99.5	79	120	94	6.9	180	58	81
Phenanthrene	470	780	625	960	510	735	400	960	608	136	840	380	520
Anthracene	40	64	52	100	44	72	34	100	53	19	110	55	80
LPAH	666	1039	853	1267	708	988	598	1267	833	165	1374	552	774
Fluoranthene	630	1200	915	1500	840	1170	600	1500	908	265	1500	1300	1800
Pyrene	380	770	575	840	520	680	370	840	552	141	850	680	880
Benz(a)anthracene	84	180	132	240	100	170	71	240	126	47	230	250	390
Chrysene	150	290	220	370	130	250	130	370	208	49	480	420	600
Benzofluoranthenes	110	250	180	240	150	195	110	250	172	28	330	330	540
Benzo(e)pyrene	38	89	64	80	54	67	38	89	59	11	110	110	180
Benzo(a)pyrene	26	62	44	68	34	51	26	68	48	4.9	74.0	84	140
Dibenz(ah)anthracene	6.8	ND(8.0)	7	8.4	ND(3.6)	8.4	6.8	8.4	8	1.1	9.3	10	17
Indeno(1,2,3-cd)pyrene	18	ND(2.0)	18	37	ND(0.88)	37	15	37	24	12	45	49	81
Benzo(ghi)perylene	14	21	18	25	16	21	13	25	18	3.0	35	36	58
HPAH	1457	2862	2159	3408	1844	2626	1400	3408	2091	572	3663	3269	4686
TPAH	2123	3901	3012	4675	2552	3614	1998	4675	2924	738	5037	3821	5460
TPAH (µg/g)	2.1	3.9	3.0	4.7	2.6	3.6	2.0	4.7	2.9	0.7	5.0	3.8	5.5
Perylene	27	23	25	40	22	31	21	40	27	4.0	35	35	48
Surrogate Stds. (% Recovery)													
Naph d-8	74	56	65	72	64	68	56	74	64	5.1	40	45	43
Acen d-10	71	59	65	70	69	70	59	71	65	4.3	49	49	46
Phen d-10	72	59	66	73	67	70	56	73	66	4.0	66	62	62
Pyr d-10	81	55	68	76	65	71	55	81	70	1.3	74	76	74
Cry d-12	76	47	62	70	65	68	47	76	63	3.8	75	78	76
B(a)P d-12	88	40	64	98	48	73	40	98	64	9.5	72	76	74
Perylene d-12	91	42	67	101	48	75	42	101	66	9.3	65	68	65
DiB(ah)A d-14	49	16	33	71	21	46	16	71	33	13	53	56	60
B(ghi)P d-12	71	26	49	85	32	59	26	85	45	16	49	53	54

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval

Exposure Period/Sampling Station	180WP2.0				384WP2.0	384WP2.0	384WP2.0	384WP2.0	384WP2.0	384WP2.0			
Replicate No.	Min	Max	Mean	Std. Dev.	1A	1B	mean	2	3	Min	Max	Mean	Std. Dev.
Batch I.D.					PH-0987	PH-0987	PH-0987	PH-0987	PH-0987				
Lab Sample No.	9611:39 - 41				9611-147A	9611-147B	9611-147	9611-148	9611-149	9611:149-149			
Moisture Content (%)	38	42	41	2.3	37	37	37	45	46	37	46	43	5.0
Sample Weight (g dry)	5.8	6.7	6.2	0.5	6.7	6.6	6.6	5.7	5.7	5.7	6.7	6.0	0.5
TOC (%)	0.75	1.98	1.34	0.62			0.63					0.60	---
Naphthalene	9.1	64	30	29	30	18	24	18	31	18	31	24	6.5
Acenaphthylene	9.0	14	11	2.7	6.9	22	14	6.6	9.0	6.6	22	10	4.0
Acenaphthene	41	170	91	69	56	72	64	43	56	43	72	54	11
Fluorene	58	180	106	65	83	140	112	64	90	64	140	89	24
Phenanthrene	380	840	580	236	290	1400	845	210	430	210	1400	495	322
Anthracene	55	110	82	28	91	87	89	52	81	52	91	74	19
LPAH	552	1374	900	425	557	1739	1148	394	697	394	1739	746	380
Fluoranthene	1300	1800	1533	252	1000	3800	2400	1300	2000	1000	3800	1900	557
Pyrene	680	880	803	108	710	2300	1505	670	1100	670	2300	1092	418
Benz(a)anthracene	230	390	290	87	420	470	445	240	400	240	470	362	108
Chrysene	420	600	500	92	1000	1100	1050	500	990	500	1100	847	302
Benzofluoranthenes	330	540	400	121	800	960	880	440	750	440	960	690	226
Benzo(e)pyrene	110	180	133	40	270	310	290	150	270	150	310	237	76
Benzo(a)pyrene	74	140	99	36	260	300	280	140	270	140	300	230	78
Dibenz(ah)anthracene	9.3	17	12	4.3	28	24	26	13	24.0	13	28	21	7.0
Indeno(1,2,3-cd)pyrene	45	81	58	20	150	150	150	62	120	62	150	111	45
Benzo(ghi)perylene	35	58	43	13	110	100	105	49	93	49	110	82	29
HPAH	3269	4686	3873	731	4748	9514	7131	3564	6017	3564	9514	5571	1825
TPAH	3821	5460	4773	851	5305	11253	8279	3958	6714	3958	11253	6317	2188
TPAH (µg/g)	3.8	5.5	4.8	0.9	5.3	11.3	8.3	4.0	6.7	4.0	11.3	6.3	2.2
Perylene	35	48	39	7.5	61	51	56	41	64	41	64	54	12
Surrogate Stds. (% Recovery)													
Naph d-8	40	45	43	2.5	98	110	104	79	110	79	110	98	16
Acen d-10	46	49	48	1.7	100	120	110	90	110	90	120	103	11
Phen d-10	62	66	63	2.3	98	110	104	95	99	95	110	99	4.6
Pyr d-10	74	76	75	1.2	85	80	83	84	80	80	85	82	2.0
Cry d-12	75	78	76	1.5	80	74	77	78	75	74	80	76	1.6
B(a)P d-12	72	76	74	2.0	92	92	92	92	91	91	92	92	0.4
Perylene d-12	65	68	66	1.7	85	86	86	85	85	85	86	85	0.5
DiB(ah)A d-14	53	60	56	3.5	82	86	84	78	84	78	86	82	3.7
B(ghi)P d-12	49	54	52	2.6	78	82	80	75	81	75	82	79	3.2

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval	0.5 Metres										
Exposure Period/Sampling Station	384WP2.0	BWP0.5	BWP0.5	BWP0.5	BWP0.5				14WP0.5 (Transect 4)	14WP0.5 (Transect 4)	14WP0.5 (Transect 4)
Replicate No.	mixed	1	2	3	Min	Max	Mean	Std. Dev.	1	2	3
Batch I.D.	PH-0993	PH-0814	PH-0814	PH-0814					PH-0827	PH-0819	PH-0837
Lab Sample No.	9611-150	2891-32	2891-33	2891-34	2891:32-34				2891-70	2891-71	2891-72
Moisture Content (%)	37	43	42	42	42	43	42	0.6	44	48	45
Sample Weight (g dry)	6.45	5.8	7.5	5.9	5.8	7.5	6.4	1.0	5.7	5.5	5.7
TOC (%)	0.70	1.16	0.84	1.06	0.84	1.16	0.97	0.16	1.33	1.50	1.17
Naphthalene	14	7.9	6.5	8.4	6.5	8.4	7.6	1.0	64	290	94
Acenaphthylene	21	2.1	1.8	2.3	1.8	2.3	2.1	0.3	53	98	43
Acenaphthene	320	1.0	0.93	1.8	0.9	1.8	1.2	0.5	1300	2500	2000
Fluorene	660	3.5	3.2	4.3	3.2	4.3	3.7	0.6	3200	4500	3800
Phenanthrene	6300	20	14	18	14	20	17	3.1	17000	36000	27000
Anthracene	740	4.1	3.1	3.4	3.1	4.1	3.5	0.5	470	2500	1300
LPAH	8055	39	30	38	30	39	35	5.1	22087	45888	34237
Fluoranthene	11000	37	30	38	30	38	35	4.4	26000	46000	27000
Pyrene	7500	34	26	30	26	34	30	4.0	15000	24000	16000
Benz(a)anthracene	2500	12	9.6	10	10	12	11	1.3	5400	5300	3600
Chrysene	4500	18	13	17	13	18	16	2.6	7700	7500	4000
Benzofluoranthenes	3000	27	21	26	21	27	25	3.2	5800	5000	4500
Benzo(e)pyrene	830	11	8.7	11	8.7	11	10	1.3	1600	1500	1500
Benzo(a)pyrene	1100	12	9.6	11	10	12	11	1.2	1300	1600	1100
Dibenz(ah)anthracene	91	NDR(1.5)	NDR(1.4)	ND(2.0)	ND	NDR(1.5)	NDR(1.5)		160	180	110
Indeno(1,2,3-cd)pyrene	480	12	10	8.9	8.9	12	10	1.6	230	790	320
Benzo(ghi)perylene	320	12	10	8.8	8.8	12	10	1.6	160	480	230
HPAH	31321	175	138	161	138	175	158	18.7	63350	92350	58360
TPAH	39376	214	167	199	167	214	193	23.6	85437	138238	92597
TPAH (µg/g)	39.4	0.20	0.16	0.20	0.16	0.20	0.19	0.02	85.4	138.2	93
Perylene	270	35	32	21	21	35	29	7.4	240	450	240
Surrogate Stds. (% Recovery)											
Naph d-8	100	63	58	78	58	78	66	10	57	74	72
Acen d-10	100	69	61	80	61	80	70	10	66	82	77
Phen d-10	110	71	68	82	68	82	74	7.4	77	81	75
Pyr d-10	92	87	84	84	84	87	85	1.7	75	81	71
Cry d-12	78	74	77	57	57	77	69	11	69	74	52
B(a)P d-12	100	89	84	72	72	89	82	8.7	72	92	58
Perylene d-12	93	90	86	80	80	90	85	5.0	71	86	55
DiB(ah)A d-14	97	66	60	65	60	66	64	3.2	40	88	35
B(ghi)P d-12	83	73	67	77	67	77	72	5.0	60	78	50

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval												
Exposure Period/Sampling Station	14WP0.5 (Transect 4)				14WP0.5 (bioassay)	180WP0.5 (Transect 4)	180WP0.5 (Transect 4)	180WP0.5 (Transect 4)	180WP0.5 (Transect 4)			
Replicate No.	Min	Max	Mean	Std. Dev.	mixed	1	2	3	Min	Max	Mean	Std. Dev.
Batch I.D.					PH-0861	PH-0837	PH-0815	PH-0825				
Lab Sample No.	2891:70-72				2891-115	9611-47	9611-48	9611-49	9611:47-49			
Moisture Content (%)	44	48	46	2.1	35	34	35	40	34	40	36	3.2
Sample Weight (g dry)	5.5	5.7	5.6	0.1	6.1	7.2	6.5	6.2	6.2	7	6.6	0.5
TOC (%)	1.17	1.50	1.36	0.14	---	0.97	0.87		0.87	0.97	0.92	0.07
Naphthalene	64	290	149	123	14	16	39	47	16	47	34	16
Acenaphthylene	43	98	65	29	3.0	10	21	24	10	24	18	7.4
Acenaphthene	1300	2500	1933	603	28	95	390	510	95	510	332	214
Fluorene	3200	4500	3833	651	38	140	590	520	140	590	417	242
Phenanthrene	17000	36000	26667	9504	180	680	2800	2200	680	2800	1893	1093
Anthracene	470	2500	1423	1021	21	73	240	250	73	250	188	99
LPAH	22087	45888	34071	11901	284	1014	4080	3551	1014	4080	2882	1639
Fluoranthene	26000	46000	33000	11269	220	1700	5600	5800	1700	5800	4367	2312
Pyrene	15000	24000	18333	4933	140	770	3000	2900	770	3000	2223	1260
Benz(a)anthracene	3600	5400	4767	1012	35	460	1100	1400	460	1400	987	480
Chrysene	4000	7700	6400	2081	48	580	1500	1400	580	1500	1160	505
Benzofluoranthenes	4500	5800	5100	656	46	580	1800	1700	580	1800	1360	677
Benzo(e)pyrene	1500	1600	1533	58	15	190	420	520	190	520	377	169
Benzo(a)pyrene	1100	1600	1333	252	13	230	570	470	230	570	423	175
Dibenz(ah)anthracene	110	180	150	36	ND(1.2)	20	44	52	20	52	39	17
Indeno(1,2,3-cd)pyrene	230	790	447	301	11	90	220	230	90	230	180	78
Benzo(ghi)perylene	160	480	290	168	NDR(9.6)	65	160	160	65	160	128	55
HPAH	58360	92350	71353	18354	528	4685	14414	14632	4685	14632	11244	5681
TPAH	85437	138238	105424	28642	812	5699	18494	18183	5699	18494	14125	7299
TPAH (µg/g)	85	138	105.4	28.6	0.81	5.7	18.5	18.2	5.7	18.5	14.1	7.3
Perylene	240	450	310	121	22	59	120	130	59	130	103	38.4
Surrogate Stds. (% Recovery)												
Naph d-8	57	74	68	9.3	48	42	40	55	40	55	46	8.1
Acen d-10	66	82	75	8.2	40	46	45	53	45	53	48	4.4
Phen d-10	75	81	78	3.1	49	58	56	54	54	58	56	2.0
Pyr d-10	71	81	76	5.0	57	64	62	58	58	64	61	3.1
Cry d-12	52	74	65	12	52	62	58	53	53	62	58	4.5
B(a)P d-12	58	92	74	17	44	61	65	51	51	65	59	7.2
Perylene d-12	55	86	71	16	41	54	48	45	45	54	49	4.6
DiB(ah)A d-14	35	88	54	29	22	47	46	44	44	47	46	1.5
B(ghi)P d-12	50	78	63	14	23	44	43	40	40	44	42	2.1

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval

Exposure Period/Sampling Station Replicate No.	180WP0.5 (Transect 3) 1	180WP0.5 (Transect 3) 2	180WP0.5 (Transect 3) 3	180WP0.5 (Transect 3) Min	Max	Mean	Std. Dev.	180WP0.5 (bioassay) mixed	384WP0.5 1	384WP0.5 2	384WP0.5 3A	384WP0.5 3B	384WP0.5 mean
Batch I.D.	PH-0827	PH-0827	PH-0845					PH-0902	PH-0986	PH-0986	PH-0986	PH-0986	PH-0986
Lab Sample No.	9611-43	9611-44	9611-45	9611:43-45				9611-46	9611-143	9611-144	9611-145A	9611-145B	9611-145
Moisture Content (%)	34	42	38	34	42	38	4.0	34	38	38	39	38	39
Sample Weight (g dry)	6.4	6.1	6.4	6.1	6.4	6.3	0.2	6.3	6.2	6.79	6.45	6.87	6.7
TOC (%)	1.27	1.47	1.02	1.02	1.47	1.25	0.23	1.47	0.71				
Naphthalene	20	26	18	18	26	21	4.2	14	19	22	22	24	23
Acenaphthylene	11	88	13	11	88	37	44	9.0	6.0	13	15	18	17
Acenaphthene	210	270	120	120	270	200	75	95	69	98	74	300	187
Fluorene	350	660	180	180	660	397	243	130	110	140	110	380	245
Phenanthrene	1700	480	1100	480	1700	1093	610	820	330	750	610	2000	1305
Anthracene	150	13000	100	100	13000	4417	7433	82	92	160	130	280	205
LPAH	2441	14524	1531	1531	14524	6165	7253	1150	626	1183	961	3002	1982
Fluoranthene	3300	8600	2600	2600	8600	4833	3281	1900	1800	2900	3500	6500	5000
Pyrene	1900	1900	1400	1400	1900	1733	289	1100	1000	1500	1900	3700	2800
Benz(a)anthracene	450	4100	540	450	4100	1697	2082	430	510	700	700	1400	1050
Chrysene	830	3000	810	810	3000	1547	1259	500	670	1800	1900	2500	2200
Benzofluoranthenes	610	920	680	610	920	737	163	500	680	1200	1400	1800	1600
Benzo(e)pyrene	200	790	220	200	790	403	335	160	220	380	450	540	495
Benzo(a)pyrene	210	190	250	190	250	217	31	200	260	400	440	690	565
Dibenz(ah)anthracene	20	78	22	20	78	40	33	17	21	30	33	52	43
Indeno(1,2,3-cd)pyrene	90	490	120	90	490	233	223	78	90	150	200	260	230
Benzo(ghi)perylene	65	310	78	65	310	151	138	56	71	120	150	200	175
HPAH	7675	20378	6720	6720	20378	11591	7625	4941	5322	9180	10673	17642	14158
TPAH	10116	34902	8251	8251	34902	17756	14878	6091	5948	10363	11634	20644	16139
TPAH (µg/g)	10.1	34.9	8.3	8.3	34.9	17.8	14.9	6.1	5.9	10.4	11.6	20.6	16.1
Perylene	50	190	62	50	190	101	78	51	61	80	87	150	119
Surrogate Stds. (% Recovery)													
Naph d-8	35	44	42	35	44	40	4.7	64	68	70	73	65	69
Acen d-10	41	50	44	41	50	45	4.6	63	71	76	76	74	75
Phen d-10	58	63	56	56	63	59	3.6	63	75	75	75	75	75
Pyr d-10	71	80	67	67	80	73	6.7	56	75	77	79	80	79
Cry d-12	76	88	68	68	88	77	10	67	68	64	67	66	66
B(a)P d-12	67	61	62	61	67	63	3.2	64	84	87	88	90	89
Perylene d-12	59	54	54	54	59	56	2.9	56	74	77	80	81	80
DiB(ah)A d-14	55	59	49	49	59	54	5.0	49	75	83	82	88	85
B(ghi)P d-12	50	47	45	45	50	47	2.5	47	73	80	77	78	77

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval											0.0 Metres
Exposure Period/Sampling Station	384WP0.5				384WP0.5	384WP0.5 (core)	384WP0.5 (core)	384WP0.5 (core)		384WP0.5 (core)	384WP0.0
Replicate No.	Min	Max	Mean	Std. Dev.	mixed	1 2-4 cm	1A 4-6cm	1B 4-6cm	mean 4-6cm	1 8-10cm	mixed
Batch I.D.					PH-0993	PH-0990	PH-0990	PH-0990	PH-0990	PH-0990	PH-0981
Lab Sample No.	9611:143-145				9611-146	9611-140	9611-141A	9611-141B	9611-141	9611-142	9611-80
Moisture Content (%)	38	39	38	0.3	35	34	34	34	34	37	38
Sample Weight (g dry)	6.2	6.8	6.6	0.3	6.79	6.86	6.65	6.71	6.68	6.67	6.8
TOC (%)			0.71	---	0.53	0.51	---	---	0.71	0.70	0.71
Naphthalene	19	23	21	2.1	33	10	10	8.6	9.3	13	24
Acenaphthylene	6.0	17	12	5.3	4.1	5.2	3.4	3.4	3.4	2.6	71
Acenaphthene	69	187	118	61	65	95	61	58	60	88	270
Fluorene	110	245	165	71	74	120	66	60	63	91	610
Phenanthrene	330	1305	795	489	170	400	150	150	150	170	3400
Anthracene	92	205	152	57	35	91	31	27	29	15	660
LPAH	626	1982	1264	681	381	721	321	307	314	380	5035
Fluoranthene	1800	5000	3233	1626	510	1800	490	440	465	190	13000
Pyrene	1000	2800	1767	929	290	1100	310	270	290	110	6300
Benz(a)anthracene	510	1050	753	274	110	450	120	95	108	31	3100
Chrysene	670	2200	1557	793	250	510	170	160	165	39	9500
Benzofluoranthenes	680	1600	1160	461	220	550	160	130	145	47	5600
Benzo(e)pyrene	220	495	365	138	81	190	54	48	51	18	1700
Benzo(a)pyrene	260	565	408	153	75	210	70	58	64	22	1700
Dibenz(ah)anthracene	21	43	31	11	6.8	20	6	5.2	5.6	2.4	180
Indeno(1,2,3-cd)pyrene	90	230	157	70	35	70	31	27	29	15	710
Benzo(ghi)perylene	71	175	122	52	27	54	24	22	23	13	530
HPAH	5322	14158	9553	4430	1605	4954	1435	1255	1345	487	42320
TPAH	5948	16139	10817	5111	1986	5675	1756	1562	1659	867	47355
TPAH (µg/g)	5.9	16.1	10.8	5.1	2.0	5.7	1.8	1.6	1.7	0.87	47.4
Perylene	61	119	87	29	27	52	32	30	31	23	270
Surrogate Stds. (% Recovery)											
Naph d-8	68	70	69	0.6	91	100	98	100	99	99	76
Acen d-10	71	76	74	2.7	90	100	97	100	98	100	83
Phen d-10	75	75	75	0.1	89	100	98	99	99	100	90
Pyr d-10	75	79	77	2.1	86	91	94	93	94	96	87
Cry d-12	64	68	66	2.4	79	87	86	91	88	90	70
B(a)P d-12	84	89	87	2.6	98	100	100	100	100	100	99
Perylene d-12	74	80	77	3.0	92	96	92	94	93	95	90
DiB(ah)A d-14	75	85	81	5.5	94	100	86	96	91	96	110
B(ghi)P d-12	73	80	77	3.6	85	98	80	90	85	93	85

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval	Offshore				2.0 Metres (Upstream)						
Exposure Period/Sampling Station	384WP0.5	385WP2.0	384WP5.0	384WP10	14WP2.0	14WP2.0			14WP2.0	14WP2.0	
Replicate No.	mixed	mixed	mixed	mixed	1	2A	2B	mean	3A	3B	mean
Batch I.D.	PH-0988	PH-0988	PH-0988	PH-0988	PH-0827	PH-0852	PH-0852	PH-0852	PH-0819	PH-0819	PH-0819
Lab Sample No.	9611-162	9611-163	9611-164	9611-165	2891-73	2891-74A	2891-74B	2891-74	2891-75A	2891-75B	2891-75
Moisture Content (%)	32	39	48	48	44	43	43	43	50	50	50
Sample Weight (g dry)	7.91	6.43	5.41	5.66	5.8	5.9	5.8	5.9	5.0	4.8	4.9
TOC (%)	0.58	0.92	1.52	2.79	1.20	1.26			1.28	1.12	1.20
Naphthalene	21	21	20	16	130	16	16	16	67	71	69
Acenaphthylene	40	11	4.5	4.7	5.2	3.0	2.5	2.8	5.4	4.5	5.0
Acenaphthene	250	98	20	10	230	12	12	12	84	96	90
Fluorene	590	360	30	15	100	9.8	12	11	73	89	81
Phenanthrene	2700	1600	110	43	510	35	37	36	340	440	390
Anthracene	1000	960	26	13	46	5.3	4.8	5.1	32	36	34
LPAH	4601	3050	211	102	1021	81	84.3	82.7	601	737	669
Fluoranthene	8400	3700	360	150	380	56	48	52	360	550	455
Pyrene	4100	2300	220	99	240	41	37	39	230	330	280
Benz(a)anthracene	2500	1300	73	39	61	17	12	15	60	80	70
Chrysene	5900	2200	170	60	100	25	18	22	110	120	115
Benzofluoranthenes	3600	1300	120	71	79	32	22	27	71	120	96
Benzo(e)pyrene	1700	450	48	28	28	12	8.9	10	25	41	33
Benzo(a)pyrene	1700	570	49	28	20	11	10	11	20	29	25
Dibenz(ah)anthracene	170	53	5.4	4.3	ND(2.5)	NDR(3.6)	NDR(1.3)	NDR(3.6)	NDR(2.5)	NDR(2.5)	NDR(2.5)
Indeno(1,2,3-cd)pyrene	660	190	27	25	14	11	9.2	10.1	15	20	18
Benzo(ghi)perylene	500	150	25	24	14	9.0	8.9	9.0	12	17	15
HPAH	29230	12213	1097.4	528.3	936	214	174	194	903	1307	1105
TPAH	33831	15263	1308	630	1957	295	258	277	1504	2044	1774
TPAH (µg/g)	33.8	15.3	1.31	0.63	2.0	0.29	0.26	0.28	1.5	2.0	1.8
Perylene	330	140	48	55	20	22	20	21	31	31	31
Surrogate Stds. (% Recovery)											
Naph d-8	100	85	89	78	64	62	72	67	67	66	67
Acen d-10	98	84	84	78	66	63	66	65	70	67	69
Phen d-10	91	81	75	76	71	71	73	72	69	63	66
Pyr d-10	75	83	74	78	74	82	82	82	80	64	72
Cry d-12	72	80	63	71	70	80	82	81	75	54	65
B(a)P d-12	88	90	69	78	66	93	93	93	91	55	73
Perylene d-12	78	81	63	71	70	99	89	94	94	54	74
DiB(ah)A d-14	86	80	63	65	40	61	88	75	64	38	51
B(ghi)P d-12	73	77	63	65	51	78	92	85	78	46	62

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval

Exposure Period/Sampling Station	14WP 2.0				180WP2.0	180WP2.0			180WP2.0	180WP2.0			
Replicate No.	Min	Max	Mean	Std. Dev.	1	2A	2B	mean	3	Min	Max	Mean	Std. Dev.
Batch I.D.					PH-0815	PH-0815	PH-0815	PH-0815	PH-0815				
Lab Sample No.	2891:73-75				9611-50	9611-51A	9611-51B	9611-51	9611-52	9611:50-52			
Moisture Content (%)	43	50	46	3.8	44	41	43	42	41	41	44	42	1.5
Sample Weight (g dry)	4.8	5.9	5.5	0.5	5.9	6.1	5.8	6.0	6.5	5.8	6.5	6.1	0.3
TOC (%)	1.12	1.28	1.22	0.03		1.08	1.18	1.13		1.08	1.18	1.10	---
Naphthalene	16	130	72	57	17	18	23	21	11	11	23	16	4.8
Acenaphthylene	2.5	5.4	4.3	1.3	5.7	3.4	3.3	3.4	5.9	3.3	5.9	5.0	1.4
Acenaphthene	12	230	111	110	55	83	96	90	43	43	96	63	24
Fluorene	10	100	64	47	57	74	82	78	68	57	82	68	11
Phenanthrene	35	510	312	246	230	160	150	155	340	150	340	242	93
Anthracene	4.8	46	28	21	48	30	23	27	73	23	73	49	23
LPAH	81	1021	591	474	413	368	377	373	375	368	413	387	22
Fluoranthene	48	550	296	214	650	400	350	375	1200	350	1200	742	420
Pyrene	37	330	186	129	310	170	170	170	590	170	590	357	214
Benz(a)anthracene	12	80	49	30	120	78	57	68	280	57	280	156	111
Chrysene	18	120	79	50	200	140	97	119	420	97	420	246	156
Benzofluoranthenes	22	120	67	36	160	96	89	93	310	89	310	188	111
Benzo(e)pyrene	8.9	41	24	12	55	34	32	33	100	32	100	63	34
Benzo(a)pyrene	10	29	18	7.1	56	36	29	33	120	29	120	70	45
Dibenz(ah)anthracene	NDR(1.3)	NDR(3.6)	NDR(3.6)		5.2	3.4	2.7	3	9.3	2.7	9.3	5.9	3.2
Indeno(1,2,3-cd)pyrene	9.2	20	14	3.7	25	18.0	16.0	17	38	16	38	27	11
Benzo(ghi)perylene	8.9	17	12	3.1	20	15.0	14.0	15	34	14	34	23	10
HPAH	174	1307	745	485	1601	990	857	924	890	857	1601	1138	401
TPAH	258	2044	1336	922	2014	1359	1234	1296	1265	1234	2014	1525	424
TPAH (µg/g)	0.3	2.0	1.3	0.9	2.0	1.4	1.2	1.3	1.3	1.2	2.0	1.5	0.4
Perylene	20	31	24	6.1	30	25	23	24	41	23	41	32	8.6
Surrogate Stds. (% Recovery)													
Naph d-8	62	72	66	1.6	59	42	51	47	53	42	59	51	6.3
Acen d-10	63	70	66	2.0	57	45	54	50	60	45	60	52	5.4
Phen d-10	63	73	70	3.2	58	53	57	55	73	53	73	56	9.6
Pyr d-10	64	82	76	5.3	61	66	65	66	77	61	77	64	8.3
Cry d-12	54	82	72	8.4	58	64	60	62	73	58	73	61	7.8
B(a)P d-12	55	93	77	14	59	66	83	75	82	59	83	69	12
Perylene d-12	54	99	79	13	54	61	79	70	77	54	79	65	12
DiB(ah)A d-14	38	88	55	18	43	50	41	46	73	41	73	45	17
B(ghi)P d-12	46	92	66	17	42	49	46	48	73	42	73	46	17

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval										28 Metres (Upstream)		
Exposure Period/Sampling Station	384WP2.0	384WP2.0	384WP2.0			384WP2.0				14WP28 (BP50)		
Replicate No.	1	2	3A	3B	mean	Min	Max	Mean	Std. Dev.	1A	1B	mean
Batch I.D.	PH-0987	PH-0987	PH-0988	PH-0988	PH-0988					PH-0861	PH-0861	PH-0861
Lab Sample No.	9611-155	9611-156	9611-157A	9611-157B	9611-157	9611:155-157				2891-117A	2891-117B	2891-117
Moisture Content (%)	45	46	37	37	37	37	46	43	4.9	45	43	44
Sample Weight (g dry)	5.9	5.7	6.53	6.5	6.5	5.7	6.5	6.0	0.4	5.6	5.6	5.6
TOC (%)	0.74							0.70	---			
Naphthalene	20	23	14	12	13	12	23	19	5.1	8.8	7.6	8.2
Acenaphthylene	9.4	5.5	5.4	5.3	5.4	5.3	9.4	6.8	2.3	3.3	3.4	3.4
Acenaphthene	30	65	45	39	42	30	65	46	18	44	39	42
Fluorene	77	81	60	49	55	49	81	71	14	61	52	57
Phenanthrene	350	180	190	140	165	140	350	232	103	260	250	255
Anthracene	140	130	57	45	51	45	140	107	49	49	48	49
LPAH	626	485	371	290	331	290	626	481	148	426	400	413
Fluoranthene	1800	640	860	740	800	640	1800	1080	629	290	270	280
Pyrene	1100	330	390	340	365	330	1100	598	435	190	180	185
Benz(a)anthracene	620	270	250	190	220	190	620	370	218	66	58	62
Chrysene	960	620	590	460	525	460	960	702	229	87	80	84
Benzofluoranthenes	820	400	390	290	340	290	820	520	262	70	67	69
Benzo(e)pyrene	280	150	140	110	125	110	280	185	83	23	21	22
Benzo(a)pyrene	300	160	140	110	125	110	300	195	93	22	21	21.5
Dibenz(ah)anthracene	25.0	14.0	15	11	13	11	25	17	6.7	ND(2.0)	ND(1.7)	ND
Indeno(1,2,3-cd)pyrene	110	58	58	44	51	44	110	73	32	14	16	15
Benzo(ghi)perylene	83	44	47	37	42	37	83	56	23.1	13	12	13
HPAH	6098	2686	2880	2332	2606	2332	6098	3797	1993	775	725	750
TPAH	6724	3171	3251	2622	2937	2622	6724	4277	2123	1201	1125	1163
TPAH (µg/g)	0.7	3.2	3.25	2.62	2.94	0.67	3.3	2.3	1.4	1.2	1.1	1.2
Perylene	67.0	47.0	43	35	39	35	67	51	14	27	24	26
Surrogate Stds. (% Recovery)												
Naph d-8	90	99	81	82	81	81	99	90	8.9	50	61	56
Acen d-10	92	96	78	81	80	78	96	89	8.5	39	49	44
Phen d-10	92	96	78	79	79	78	96	89	9.3	51	53	52
Pyr d-10	81	81	82	77	80	77	82	81	1.1	60	56	58
Cry d-12	77	73	82	69	76	69	82	75	2.0	56	49	53
B(a)P d-12	91	89	85	81	83	81	91	88	4.3	51	42	47
Perylene d-12	83	83	76	73	74	73	83	80	5.0	48	41	45
DiB(ah)A d-14	80	80	75	75	75	75	80	78	3.0	34	25	30
B(ghi)P d-12	77	77	74	76	75	74	77	76	1.4	32	24	28

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (B). Raw Data and Descriptive Statistics for Sediment parental PAH Concentrations (ng/g, dry weight): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval

Exposure Period/Sampling Station	180WP28 (BP50)			384WP28 (BP50)	384WP28 (BP50)	384WP28 (BP50)	384WP28 (BP50)				384WP28 (BP50)
Replicate No.	1A	1B	mean	1	2	3	Min	Max	Mean	Std. Dev.	mixed
Batch I.D.	PH-0819	PH-0819	PH-0819	PH-0988	PH-0988	PH-0988					PH-0993
Lab Sample No.	9611-75A	9611-75B	9611-75	9611-158	9611-159	9611-160	9611:158-160				9611-161
Moisture Content (%)	37	37	37	46	45	42	42	46	44	2.1	40
Sample Weight (g dry)	6.5	7.5	7.0	5.63	5.52	6.03	5.52	6.03	5.73	0.3	6.31
TOC (%)				0.49					0.49	---	0.82
Naphthalene	5.8	5.9	5.9	8.3	8.9	7.5	7.5	8.9	8.2	0.7	7.3
Acenaphthylene	2.0	2.0	2.0	3.1	4.3	2.4	2.4	4.3	3.3	1.0	3.0
Acenaphthene	7.0	6.4	6.7	6.6	6.2	5.2	5.2	6.6	6.0	0.7	6.8
Fluorene	11	9.6	10	14	11	10	10	14	12	2.1	13
Phenanthrene	32	35	34	36	25	36	25	36	32	6.4	56
Anthracene	16	5.5	11	11	16	8.3	8.3	16	12	3.9	10
LPAH	74	64	69	79	71	69	69	79	73	5.1	96
Fluoranthene	95	81	88	110	100	120	100	120	110	10	260
Pyrene	36	53	45	73	62	71	62	73	69	5.9	170
Benz(a)anthracene	24	13	19	28	39	26	26	39	31	7.0	30
Chrysene	43	28	36	41	79	44	41	79	55	21	74
Benzofluoranthenes	34	27	31	48	76	44	44	76	56	17	71
Benzo(e)pyrene	12	10	11	19	36	17	17	36	24	10	25
Benzo(a)pyrene	16	11	14	25	42	20	20	42	29	12	23
Dibenz(ah)anthracene	1.5	1.2	1.4	NDR(3.1)	5.5	2.3	2.3	5.5	3.9	2.3	NDR(2.0)
Indeno(1,2,3-cd)pyrene	8.6	7.6	8.1	16	30	13	13	30	20	9.1	15
Benzo(ghi)perylene	8.1	7.4	7.8	15	25	12	12	25	17	6.8	13
HPAH	278	239	259	375	495	369	369	495	413	71	681
TPAH	352	304	328	454	566	439	439	566	486	69	777
TPAH (µg/g)	0.4	0.3	0.3	0.45	0.57	0.44	0.44	0.57	0.49	0.07	0.78
Perylene	17	17	17	28	37	25	25	37	30	6.2	22
Surrogate Stds. (% Recovery)											
Naph d-8	88	89	89	78	78	85	78	85	80	4.2	81
Acen d-10	84	84	84	79	73	83	73	83	78	5.1	85
Phen d-10	87	85	86	80	66	78	66	80	75	7.4	89
Pyr d-10	86	85	86	81	70	80	70	81	77	5.8	86
Cry d-12	83	85	84	72	63	75	63	75	70	6.3	73
B(a)P d-12	92	91	92	82	68	89	68	89	80	11	99
Perylene d-12	84	85	85	74	62	83	62	83	73	11	91
DiB(ah)A d-14	68	71	70	63	60	83	60	83	68	13	84
B(ghi)P d-12	71	69	70	67	59	82	59	82	69	12	78

ND = Less than Detection Limit
NDR = Peak Detected (value) but did not meet quanification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX VI (C)

Raw Data and Descriptive Statistics for Surface Sediment *parental* PAH Concentrations - Day0 to Day384

Best Management Practices Treatment Site (BMP)

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval	50 Metres										
Exposure Period/Sampling Station	14BP50 (WP28)			180BP50 (WP28)			384BP50 (WP28))	384BP50 (WP28))	384BP50 (WP28))		
Replicate No.	1A	1B	mean	1A	1B	mean	1	2	3	Min	Max
Batch I.D.	PH-0861	PH-0861		PH-0961	PH-0961	PH-0961	PH-0988	PH-0988	PH-0988		
Lab Sample No.	2891-117A	2891-117B	2891-117	9611-75A	9611-75B	9611-75	9611-158	9611-159	9611-160	9611:158-160	
Moisture Content (%)	45	43	44	37	37	37	46	45	42	42	46
Sample Weight (g dry)	5.6	5.6	5.6	6.5	7.5	7.0	5.63	5.52	6.03	5.52	6.03
TOC							0.49				
Naphthalene	8.8	7.6	8.2	5.8	5.9	5.9	8.3	8.9	7.5	7.5	8.9
Acenaphthylene	3.3	3.4	3.4	2.0	2.0	2.0	3.1	4.3	2.4	2.4	4.3
Acenaphthene	44	39	42	7.0	6.4	6.7	6.6	6.2	5.2	5.2	6.6
Fluorene	61	52	57	11	9.6	10	14	11	10	10	14
Phenanthrene	260	250	255	32	35	34	36	25	36	25	36
Anthracene	49	48	49	16	5.5	11	11	16	8.3	8.3	16
LPAH	426	400	413	74	64	69	79	71	69	69	79
Fluoranthene	290	270	280	95	81	88	110	100	120	100	120
Pyrene	190	180	185	36	53	45	73	62	71	62	73
Benz(a)anthracene	66	58	62	24	13	19	28	39	26	26	39
Chrysene	87	80	84	43	28	36	41	79	44	41	79
Benzofluoranthenes	70	67	69	34	27	31	48	76	44	44	76
Benzo(e)pyrene	23	21	22	12	10	11	19	36	17	17	36
Benzo(a)pyrene	22	21	22	16	11	14	25	42	20	20	42
Dibenz(ah)anthracene	ND(2.0)	ND(1.7)	ND	1.5	1.2	1.4	NDR(3.1)	5.5	2.3	2.3	5.5
Indeno(1,2,3-cd)pyrene	14	16	15	8.6	7.6	8.1	16	30	13	13	30
Benzo(ghi)perylene	13	12	13	8.1	7.4	7.8	15	25	12	12	25
HPAH	775	725	750	278	239	259	375	495	369	369	495
TPAH	1201	1125	1163	352	304	328	454	566	439	439	566
TPAH (µg/g)	1.2	1.1	1.2	0.4	0.3	0.3	0.45	0.57	0.44	0.44	0.57
Perylene	27	24	26	17	17	17	28	37	25	25	37
Surrogate Stds. (% Recovery)											
Naph d-8	50	61	56	88	89	89	78	78	85	78	85
Acen d-10	39	49	44	84	84	84	79	73	83	73	83
Phen d-10	51	53	52	87	85	86	80	66	78	66	80
Pyr d-10	60	56	58	86	85	86	81	70	80	70	81
Cry d-12	56	49	53	83	85	84	72	63	75	63	75
B(a)P d-12	51	42	47	92	91	92	82	68	89	68	89
Perylene d-12	48	41	45	84	85	85	74	62	83	62	83
DiB(ah)A d-14	34	25	30	68	71	70	63	60	83	60	83
B(ghi)P d-12	32	24	28	71	69	70	67	59	82	59	82

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval			30 Metres								
Exposure Period/Sampling Station	384BP50 (WP28))		384BP50 (WP28))	BBP30	14BP30			180BP30			384BP30
Replicate No.	Mean	Std. Dev.	mixed	1	1A	1B	mean	1A	1B	mean	1
Batch I.D.			PH-0993	PH-0814	PH-0837	PH-0837	PH-0837				PH-0993
Lab Sample No.			9611-161	2891-28	2891-47A	2891-47B	2891-47	9611-01A	9611-01B	9611-01	9611-121
Moisture Content (%)	44	2.1	40	40	48	46	47	41	40	41	37
Sample Weight (g dry)	5.73	0.3	6.31	6.2	5.3	5.5	5.4	6.2	6.4	6.3	6.43
TOC	0.49	---	0.82	1.06			1.37			1.35	0.69
Naphthalene	8.2	0.7	7.3	7.2	15	14	15	7.7	8.2	8.0	8.3
Acenaphthylene	3.3	1.0	3.0	2.2	3.6	2.6	3.1	NDR(3.1)	NDR(3.0)	NDR(3.1)	2.0
Acenaphthene	6.0	0.7	6.8	1.8	21	26	24	3.9	3.8	3.9	7.0
Fluorene	12	2.1	13	4.2	19	20	20	6.8	7.3	7.1	10
Phenanthrene	32	6.4	56	14	46	52	49	14	14	14	26
Anthracene	12	3.9	10	2.8	6.3	6.0	6.2	4.1	3.8	4.0	7.8
LPAH	73	5.1	96	32	111	121	116	37	37	37	61
Fluoranthene	110	10	260	25	54	50	52	42	39	41	89
Pyrene	69	5.9	170	22	45	42	44	28	26	27	58
Benz(a)anthracene	31	7.0	30	8.1	17	17	17	10	10	10	30
Chrysene	55	21	74	11	28	22	25	16	16	16	34
Benzofluoranthenes	56	17	71	19	36	24	30	22	20	21	41
Benzo(e)pyrene	24	10	25	7.9	14	14	14	8.7	7.9	8.3	14
Benzo(a)pyrene	29	12	23	8.6	14	11	12.5	10	9	9.6	18
Dibenz(ah)anthracene	3.9	2.3	2.0	ND(1.2)	NDR(1.9)	ND(4.8)	NDR(1.9)	1.1	1.0	1.1	1.9
Indeno(1,2,3-cd)pyrene	20	9.1	15	7.3	15	7.4	11	8.4	8.0	8.2	10
Benzo(ghi)perylene	17	6.8	13	6.0	12	10	11	7.0	6.6	6.8	9.7
HPAH	413	71	683	115	235	197	216	153	144	148	306
TPAH	486	69	779	147	346	318	332	190	181	185	367
TPAH (µg/g)	0.49	0.07	0.8	0.15	0.35	0.32	0.33	0.19	0.18	0.19	0.4
Perylene	30	6.2	22	18	23	20	22	19	18	19	21
Surrogate Stds. (% Recovery)											
Naph d-8	80	4.2	81	78	71	69	70	28	26	27	91
Acen d-10	78	5.1	85	78	75	76	76	35	33	34	90
Phen d-10	75	7.4	89	75	82	77	80	55	61	58	91
Pyr d-10	77	5.8	86	86	82	74	78	77	83	80	89
Cry d-12	70	6.3	73	84	84	59	72	78	83	81	79
B(a)P d-12	80	11	99	73	82	49	66	79	85	82	99
Perylene d-12	73	11	91	79	89	50	70	75	80	78	90
DiB(ah)A d-14	68	13	84	65	70	22	46	70	67	69	88
B(ghi)P d-12	69	12	78	74	76	36	56	66	63	65	83

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval		20 Metres				10 Metres					
Exposure Period/Sampling Station	384BP30	14BP20	180BP20	384BP20	384BP20	BBP10	14BP10	14BP10	14BP10		
Replicate No.	mixed	1	1	1	mixed	1	1	2	3	Min.	Max
Batch I.D.	PH-0983	PH-0815		PH-0982	PH-0983	PH-0814	PH-0825	PH-0854	PH-0854		
Lab Sample No.	9611-122	2891-48	9611-02	9611-119	9611-120	2891-27	2891-49	2891-98	2891-99	2891:49, 98-99	
Moisture Content (%)	38	46	39	44	46	36	41	38	38	38	41
Sample Weight (g dry)	6.4	6.0	6.4	5.6	5.6	6.5	6.2	5.9	6.4	5.9	6.4
TOC	0.61	1.29	0.93	0.90	0.95	0.88	1.19				
Naphthalene	13	8.1	7.1	17	16	5.5	7.1	5.8	6.3	5.8	7.1
Acenaphthylene	NDR(1.3)	2.3	3.1	2.2	2.5	2.0	2.0	2.2	2.4	2.0	2.4
Acenaphthene	5.1	4.6	7	14	18	1.3	3.4	4.4	2.2	2.2	4.4
Fluorene	7.9	6.1	11	20	22	3.7	30	5.6	3.3	3.3	30
Phenanthrene	32	24	17	56	51	13	110	27	18	18	110
Anthracene	6.6	3.3	5.3	14	14	2.1	80	4.5	3.3	3.3	80
LPAH	65	48	51	123	124	28	233	50	36	36	233
Fluoranthene	84	32	49	130	120	20	100	30	29	29	100
Pyrene	60	26	32	81	79	19	70	25	25	25	70
Benz(a)anthracene	20	8.0	12	30	34	7.2	22	9.8	10	10	22
Chrysene	19	14	16	49	45	10	39	13	15	13	39
Benzofluoranthenes	28	19	21	48	51	17	32	18	19	18	32
Benzo(e)pyrene	8.6	6.5	8.3	17	17	6.4	12	6.1	6.7	6.1	12
Benzo(a)pyrene	11	6.5	10	20	23	7.2	12	7.1	7.6	7.1	12
Dibenz(ah)anthracene	ND	ND(0.3)	NDR(1.0)	ND(2.0)	1.5	ND(0.98)	1.5	1	1.2	1.0	1.5
Indeno(1,2,3-cd)pyrene	8.0	8.8	8.7	12	14	6.4	12	7.2	7.0	7.0	12
Benzo(ghi)perylene	7.0	7.8	7.3	11	11	5.6	5.9	5.9	6.9	5.9	6.9
HPAH	246	129	164	398	396	98.8	306	123	127	123	306
TPAH	310	177	215	521	519	126	539	173	163	163	539
TPAH (µg/g)	0.31	0.18	0.22	0.52	0.52	0.13	0.54	0.17	0.16	0.16	0.54
Perylene	15	18	18	22	25	15	25	16	18	16	25
Surrogate Stds. (% Recovery)											
Naph d-8	71	58	25	71	72	76	65	40	56	40	65
Acen d-10	74	63	32	76	74	71	71	42	57	42	71
Phen d-10	73	68	58	79	75	70	71	45	51	45	71
Pyr d-10	80	73	75	73	81	88	90	59	51	51	90
Cry d-12	66	73	74	60	67	81	94	55	45	45	94
B(a)P d-12	70	73	77	64	77	73	97	59	44	44	97
Perylene d-12	63	78	73	61	72	77	101	54	40	40	101
DiB(ah)A d-14	48	52	61	52	59	60	80	43	29	29	80
B(ghi)P d-12	51	57	57	53	59	65	83	48	33	33	83

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station	14BP10	14BP10	180BP10			180BP10				384BP10	384BP10
Replicate No.	Mean	Std. Dev.	1	2	3	Min	Max	Mean	Std. Dev.	1A	1B
Batch I.D.			PH-0891	PH-0891	PH-0891					PH-0982	PH-0982
Lab Sample No.			9611-03	9611-04	9611-05	9611:03-05				9611-115A	9611-115B
Moisture Content (%)	39	1.7	44	48	44	44	48	45	2.3	38	40
Sample Weight (g dry)	6.2	0.3	6.0	5.6	5.8	5.6	6.0	5.8	0.2	6.5	6.8
TOC	1.19		1.53	1.38	1.48	1.38	1.53	1.46	0.08		
Naphthalene	6.4	0.7	13	13	13	13	13	13	0.0	14	14
Acenaphthylene	2.2	0.2	4.1	5.0	3.3	3.3	5.0	4.1	0.9	2.0	1.7
Acenaphthene	3.3	1.1	38	56	16	16	56	37	20	29	29
Fluorene	13	15	39	62	14	14	62	38	24	26	27
Phenanthrene	52	51	95	160	27	27	160	94	67	64	64
Anthracene	29	44	18	25	7.4	7.4	25	17	8.9	15	15
LPAH	106	110	207	321	81	81	321	203	120	150	151
Fluoranthene	53	41	170	230	69	69	230	156	81	160	160
Pyrene	40	26	98	140	44	44	140	94	48	100	99
Benz(a)anthracene	14	7.0	29	44	17	17	44	30	14	36	35
Chrysene	22	14	35	50	22	22	50	36	14	47	51
Benzofluoranthenes	23	7.8	38	51	29	29	51	39	11	45	46
Benzo(e)pyrene	8.3	3.2	14	18	10	10	18	14	4.0	16	17
Benzo(a)pyrene	8.9	2.7	18	26	14	14	26	19	6.1	21	21
Dibenz(ah)anthracene	1.2	0.3	NDR(1.6)	NDR(2.1)	NDR(1.4)	NDR(1.4)	NDR(2.1)	NDR(2.1)		ND(1.5)	ND(1.7)
Indeno(1,2,3-cd)pyrene	8.7	2.8	13	16	11	11	16	13	2.5	11	10
Benzo(ghi)perylene	6.2	0.6	10	12	8.5	8.5	12	10	1.8	9.1	9.0
HPAH	186	105	425	587	225	225	587	412	182	445	448
TPAH	291	214	632	908	305	305	908	615	302	595	599
TPAH (µg/g)	0.29	0.21	0.63	0.91	0.31	0.31	0.91	0.62	0.3	0.6	0.6
Perylene	20	4.7	23	26	20	20	26	23	3.0	18	18
Surrogate Stds. (% Recovery)											
Naph d-8	54	13	25	38	31	25	38	31	6.5	83	70
Acen d-10	57	15	31	43	40	31	43	38	6.2	85	72
Phen d-10	56	14	52	58	59	52	59	56	3.8	87	74
Pyr d-10	67	21	75	77	76	75	77	76	1.0	76	68
Cry d-12	65	26	76	76	75	75	76	76	0.6	64	57
B(a)P d-12	67	27	76	79	75	75	79	77	2.1	74	60
Perylene d-12	65	32	73	75	71	71	75	73	2.0	71	57
DiB(ah)A d-14	51	26	63	63	58	58	63	61	2.9	64	44
B(ghi)P d-12	55	26	58	58	53	53	58	56	2.9	63	47

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval								7.5 Metres			
Exposure Period/Sampling Station	384BP10	384BP10	384BP10	384BP10				384BP10	14BP7.5	180BP7.5	384BP7.5
Replicate No.	mean	2	3	Min	Max	Mean	Std. Dev.	mixed	1	1	1
Batch I.D.	PH-0982	PH-0982	PH-0982					PH-0983	PH-0815	PH-0891	PH-0980
Lab Sample No.	9611-115	9611-116	9611-117	9611: 115-117				9611-118	2891-50	9611-06	9611-113
Moisture Content (%)	39	39	37	37	39	38	1.2	32	41	38	47
Sample Weight (g dry)	6.6	6.2	6.6	6.2	6.6	6.5	0.3	6.9	6.6	6.5	5.2
TOC	0.71					0.71		0.8	1.15	1.17	0.85
Naphthalene	14	14	14	14	14	14	0.0	14	8.1	8.0	38
Acenaphthylene	1.9	1.7	1.9	1.7	1.9	1.8	0.1	4.5	2.5	3.2	7.7
Acenaphthene	29	23	29	23	29	27	3.5	78	3.3	36	460
Fluorene	27	22	26	22	27	25	2.5	79	5.0	31	360
Phenanthrene	64	46	59	46	64	56	9.3	250	25	79	950
Anthracene	15	13	18	13	18	15	2.5	89	3.9	11	120
LPAH	150	120	148	120	150	139	17	515	48	168	1936
Fluoranthene	160	120	180	120	180	153	31	480	36	140	1100
Pyrene	100	72	110	72	110	94	20	210	31	85	730
Benz(a)anthracene	36	27	46	27	46	36	9.5	220	10	26	260
Chrysene	49	37	55	37	55	47	9.2	310	16	25	250
Benzofluoranthenes	46	37	57	37	57	47	10	250	21	31	240
Benzo(e)pyrene	17	13	20	13	20	17	3.5	78	8.3	10	73
Benzo(a)pyrene	21	16	25	16	25	21	4.5	120	8.4	16	120
Dibenz(ah)anthracene	ND(1.5)	ND(1.5)	NDR(1.9)	ND(1.5)	NDR(1.9)	NDR(1.9)		8.7	ND(0.49)	NDR(1.2)	8.2
Indeno(1,2,3-cd)pyrene	11	8.2	12	8.2	12	10	1.9	39	NDR(8.2)	9.4	42
Benzo(ghi)perylene	9.1	7.4	9.8	7.4	10	8.8	1.2	32	7.6	7.1	32
HPAH	447	338	515	338	515	433	89	1748	138	350	2855
TPAH	597	457	663	457	663	572	105	2262	186	518	4791
TPAH (µg/g)	0.6	0.5	0.7	0.5	0.7	0.6	0.1	2.3	0.19	0.52	4.8
Perylene	18	16	18	16	18	17	1.2	39	17	15	44
Surrogate Stds. (% Recovery)											
Naph d-8	77	78	76	76	78	77	1.0	70	57	25	69
Acen d-10	79	82	78	78	82	80	2.2	74	64	34	71
Phen d-10	81	82	80	80	82	81	1.0	81	71	55	76
Pyr d-10	72	76	72	72	76	73	2.3	84	78	73	79
Cry d-12	61	64	56	56	64	60	4.0	72	73	70	69
B(a)P d-12	67	71	63	63	71	67	4.0	82	72	74	79
Perylene d-12	64	68	60	60	68	64	4.0	75	79	70	72
DiB(ah)A d-14	54	59	46	46	59	53	6.6	66	53	60	69
B(ghi)P d-12	55	59	47	47	59	54	6.1	66	60	56	63

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval		5.0 Metres									
Exposure Period/Sampling Station	384BP7.5	BBP5.0	14BP5.0							180BP5.0	
Replicate No.	mixed	1	1	2	3	Min	Max	Mean	Std. Dev.	1	2
Batch I.D.	PH-0983	PH-0814	PH-0815	PH-0854	PH-0854					PH-0897	PH-0896
Lab Sample No.	9611-114	2891-26	2891-51	2891-96	2891-97	2891:51,96-97				9611-07	9611-08
Moisture Content (%)	40	38	38	42	46	38	46	42	4.0	38	39
Sample Weight (g dry)	6.1	6.3	6.3	5.8	5.8	5.8	6.3	6.0	0.3	6.8	6.5
TOC	0.59	0.81	1.3					1.3	0.0	0.58	1.27
Naphthalene	16	5.4	5.4	14	26	5.4	26	15	10	11	12
Acenaphthylene	4.5	1.7	1.7	3.9	3.4	1.7	3.9	3.0	1.2	2.6	2.7
Acenaphthene	52	1.9	2.9	14	11	2.9	14	9.3	5.7	61	34
Fluorene	62	2.9	3.9	49	7.8	3.9	49	20	25	56	23
Phenanthrene	200	9.9	19	250	28	19	250	99	131	110	54
Anthracene	240	2.0	3.1	220	4.5	3.1	220	76	125	17	11
LPAH	575	24	36	551	81	36	551	223	285	258	137
Fluoranthene	680	20	28	190	36	28	190	85	91	210	120
Pyrene	390	17	23	130	30	23	130	61	60	120	69
Benz(a)anthracene	310	6.1	7.4	47	11	7.4	47	22	22	41	34
Chrysene	450	8.6	12	74	17	12	74	34	34	33	33
Benzofluoranthenes	220	13	13	54	23	13	54	30	21	42	34
Benzo(e)pyrene	63	6.7	5.8	18	8.6	5.8	18	11	6.4	14	12
Benzo(a)pyrene	110	6.1	5.1	19	9.2	5.1	19	11	7.1	20	18
Dibenz(ah)anthracene	7.0	ND (2.5)	ND(0.5)	2.7	ND(0.49)	ND(0.49)	2.7	2.7		1.9	2.0
Indeno(1,2,3-cd)pyrene	36	5.7	NDR(4.2)	13	10	10	13	12	2.1	10	11
Benzo(ghi)perylene	24	6.8	5.0	11	9.2	5.0	11	8.4	3.1	9.1	8.3
HPAH	2290	90	99	559	154	99	559	271	251	501	341
TPAH	2865	114	135	1110	235	135	1110	493	536	759	478
TPAH (µg/g)	2.9	0.11	0.14	1.1	0.24	0.14	1.1	0.49	0.54	0.76	0.48
Perylene	35	14	13	23	23	13	23	20	5.8	19	19
Surrogate Stds. (% Recovery)											
Naph d-8	80	73	67	46	48	46	67	54	12	32	50
Acen d-10	82	73	68	47	50	47	68	55	11	41	57
Phen d-10	85	74	74	50	48	48	74	57	14	72	71
Pyr d-10	87	87	77	58	52	52	77	62	13	90	82
Cry d-12	76	75	63	56	46	46	63	55	8.5	87	79
B(a)P d-12	89	78	66	55	49	49	66	57	8.6	91	86
Perylene d-12	83	86	68	51	45	45	68	55	12	83	81
DiB(ah)A d-14	79	65	31	41	37	31	41	36	5.0	77	62
B(ghi)P d-12	76	81	49	44	39	39	49	44	5.0	70	58

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval												
Exposure Period/Sampling Station						384BP5.0	384BP5.0	384BP5.0				
Replicate No.	3	Min	Max	Mean	Std. Dev.	1	2	3	Min.	Max	Mean	Std. Dev.
Batch I.D.	PH-0896					PH-0980	PH-0980	PH-1022				
Lab Sample No.	9611-09	9611:07-09				9611-109	9611-110	9611-111	9611:109-111			
Moisture Content (%)	38	38	39	38	0.6	41	39	46	39	46	42	3.6
Sample Weight (g dry)	6.6	6.5	6.8	6.6	0.1	6.0	6.4	8.1	6.0	8.1	6.8	1.1
TOC	0.93	0.58	1.27	0.93	0.3	0.60				0.6	0.6	
Naphthalene	8.3	8.3	12	10	1.9	21	18	14	14	21	18	3.5
Acenaphthylene	3.8	2.6	3.8	3.0	0.7	6.0	4.6	9.2	4.6	9.2	6.6	2.4
Acenaphthene	65	34	65	53	17	170	96	130	96	170	132	37
Fluorene	61	23	61	47	21	170	86	120	86	170	125	42
Phenanthrene	190	54	190	118	68	630	240	540	240	630	470	204
Anthracene	77	11	77	35	36	120	67	110	67	120	99	28
LPAH	405	137	405	266	134	1117	512	923	512	1117	851	309
Fluoranthene	330	120	330	220	105	760	510	920	510	920	730	207
Pyrene	180	69	180	123	56	560	280	490	280	560	443	146
Benz(a)anthracene	72	34	72	49	20	230	150	240	150	240	207	49
Chrysene	61	33	61	42	16	260	190	270	190	270	240	44
Benzofluoranthenes	61	34	61	46	14	210	160	210	160	210	193	29
Benzo(e)pyrene	20	12	20	15	4.2	67	50	64	50	67	60	9.1
Benzo(a)pyrene	31	18	31	23	7.0	110	75	86	75	110	90	18
Dibenz(ah)anthracene	2.7	1.9	2.7	2.2	0.4	8.0	5.6	8.2	5.6	8.2	7.3	1.4
Indeno(1,2,3-cd)pyrene	14	10	14	12	2.1	38	27	44	27	44	36	8.6
Benzo(ghi)perylene	11	8.3	11	9.5	1.4	28	21	31	21	31	27	5.1
HPAH	783	341	783	542	223	2271	1463	2363	1463	2363	2032	495
TPAH	1188	478	1188	808	357	3388	1975	3286	1975	3388	2883	788
TPAH (µg/g)	1.2	0.5	1.2	0.8	0.4	3.4	2.0	3.3	2.0	3.4	2.9	0.8
Perylene	21	19	21	20	1.2	38	30	40	30	40	36	5.3
Surrogate Stds. (% Recovery)												
Naph d-8	46	32	50	43	9.5	65	68	48	48	68	60	11
Acen d-10	49	41	57	49	8.0	68	68	52	52	68	63	9.4
Phen d-10	64	64	72	69	4.4	71	72	63	63	72	69	5.2
Pyr d-10	82	82	90	85	4.6	75	76	75	75	76	75	0.6
Cry d-12	81	79	87	82	4.2	70	70	84	70	84	75	8.1
B(a)P d-12	90	86	91	89	2.6	75	75	85	75	85	78	5.9
Perylene d-12	84	81	84	83	1.5	69	69	77	69	77	72	4.6
DiB(ah)A d-14	85	62	85	75	12	63	61	77	61	77	67	8.6
B(ghi)P d-12	77	58	77	68	9.6	57	56	68	56	68	60	6.7

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval				3.5 Metres						3.0 Metres
Exposure Period/Sampling Station	384BP5.0	384BP5.0 (core)	384BP5.0 (core)	384BP5.0 (core)	14BP3.5	180BP3.5	384BP3.5	384BP3.5		384BP3.5	14BP3.0
Replicate No.	mixed	2-4 cm	4-6 cm	8-10 cm	1	1	1A	1B	mean	mixed	1A
Batch I.D.	PH-0983	PH-0980	PH-0980	PH-0980	PH-0815	PH-0896	PH-0980	PH-0980	PH-0980	PH-0983	PH-0837
Lab Sample No.	9611-112	9611-106	9611-107	9611-108	2891-52	9611-11	9611-104A	9611-104B	9611-104	9611-105	2891-53A
Moisture Content (%)	41	35	32	32.0	45	38	37	38	38	34	44
Sample Weight (g dry)	6.1	6.5	6.7	7.0	6.4	6.7	6.3	6.6	6.42	6.8	5.9
TOC	0.67	0.48	0.56	0.82	1.12	0.79			0.70	0.85	
Naphthalene	20	15	17	15	8.1	13	17	17	17	16	21
Acenaphthylene	4.2	2.8	1.2	NDR(2.0)	2.7	5.6	6.1	6.0	6.1	NDR(4.4)	3.5
Acenaphthene	99	35	10	NDR(1.7)	5.8	79	250	200	225	99	24
Fluorene	100	32	7.8	NDR(3.8)	8.1	56	230	170	200	79	19
Phenanthrene	380	97	20	16	34	170	790	570	680	240	68
Anthracene	150	27	9.4	2.1	5.7	37	150	95	123	72	5.5
LPAH	753	209	65	33	64.4	361	1443	1058	1251	506	141
Fluoranthene	860	300	68	23	53	430	1200	710	955	550	87
Pyrene	520	180	40	24	42	210	750	510	630	300	64
Benz(a)anthracene	300	89	22	NDR(8.8)	15	110	330	220	275	200	14
Chrysene	380	98	29	11	23	110	470	260	365	270	16
Benzofluoranthenes	250	97	30	20	26	99	280	220	250	180	19
Benzo(e)pyrene	75	32	11	8.0	10	30	88	68	78	55	13
Benzo(a)pyrene	120	46	14	11	10	48	140	110	125	88	7.2
Dibenz(ah)anthracene	8.3	NDR(3.1)	NDR(1.2)	NDR(0.8)	ND(0.46)	4.0	10	7.8	8.9	6.4	ND(5.4)
Indeno(1,2,3-cd)pyrene	39	18	9.3	9.4	NDR(9.6)	21	44	36	40	32	ND(2.6)
Benzo(ghi)perylene	31	14	7.6	9.1	9.1	15	32	27	30	23	8.1
HPAH	2583	874	231	116	188	1077	3344	2169	2756	1704	228
TPAH	3337	1083	296	149	253	1438	4787	3227	4007	2210	369
TPAH (µg/g)	3.3	1.1	0.30	0.15	0.25	1.4	4.8	3.2	4.0	2.2	0.4
Perylene	41	21	17	18	18	27	41	35	38	29	14
Surrogate Stds. (% Recovery)											
Naph d-8	73	68	68	68	43	46	72	75	74	79	38
Acen d-10	74	67	67	69	50	52	72	76	74	78	48
Phen d-10	71	67	69	72	69	71	71	76	74	80	65
Pyr d-10	73	73	75	78	74	80	74	77	76	84	71
Cry d-12	59	72	70	74	55	73	70	77	74	78	63
B(a)P d-12	69	70	66	72	77	84	68	75	72	91	65
Perylene d-12	63	64	60	67	86	77	62	69	66	84	75
DiB(ah)A d-14	61	57	47	56	57	79	54	63	59	81	35
B(ghi)P d-12	60	56	47	53	72	71	52	59	56	75	62

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval										2.5 Metres	
Exposure Period/Sampling Station	14BP3.0		180BP3.0	180BP3.0		384BP3.0	384BP3.0	384BP3.0		14BP2.5	
Replicate No.	1B	mean	1A	1B	mean	1	mixed (A)	mixed (B)	mean	1A	1B
Batch I.D.	PH-0837		PH-0896	PH-0896		PH-0980	PH-0983	PH-0983	PH-0983	PH-0815	PH-0815
Lab Sample No.	2891-53B	2891-53	9611-12A	9611-12B	9611-12	9611-102	9611-103A	9611-103B	9611-103	2891-54A	2891-54B
Moisture Content (%)	42	43	39	39	39	35	37	36	37	37	39
Sample Weight (g dry)	5.7	5.8	6.5	6.5	6.5	6.78	6.31	6.57	6.44	6.4	6.7
TOC		0.96			0.67	0.59			0.75		
Naphthalene	27	24	100	87	94	17	14	17	16	16	24
Acenaphthylene	2.6	3.1	20	16	18	3.7	4.1	7.7	5.9	2.3	2.2
Acenaphthene	36	30	860	840	850	58	90	99	95	31	30
Fluorene	67	43	610	510	560	56	78	99	89	26	24
Phenanthrene	200	134	1600	1700	1650	180	260	350	305	93	62
Anthracene	130	68	120	120	120	55	60	120	90	11	7.9
LPAH	463	302	3310	3273	3292	370	506	693	599	179	150
Fluoranthene	130	109	1800	2100	1950	510	540	740	640	79	60
Pyrene	91	78	1000	1100	1050	300	280	330	305	58	42
Benz(a)anthracene	24	19	400	430	415	140	150	320	235	15	11
Chrysene	24	20	280	270	275	180	220	470	345	14	20
Benzofluoranthenes	30	25	280	260	270	150	150	360	255	22	19
Benzo(e)pyrene	13	13	81	77	79	53	46	110	78	9.8	7.6
Benzo(a)pyrene	9.4	8.3	160	140	150	77	70	180	125	6.9	6.1
Dibenz(ah)anthracene	ND(2.0)	ND(2.0)	11	11	11	5.1	4.2	13	8.6	ND(2.2)	ND(0.98)
Indeno(1,2,3-cd)pyrene	ND(0.82)	ND(0.82)	55	51	53	26	26	63	45	ND(1.8)	NDR(6.5)
Benzo(ghi)perylene	7.6	7.9	35	32	34	21	17	41	29	5.9	6.3
HPAH	329	279	4102	4471	4287	1462	1503	2627	2065	211	172
TPAH	792	580	7412	7744	7578	1832	2009	3320	2665	390	322
TPAH (µg/g)	0.8	0.6	7.4	7.7	7.6	1.83	2.01	3.32	2.66	0.39	0.32
Perylene	16	15	50	49	50	28	25	50	38	14	14
Surrogate Stds. (% Recovery)											
Naph d-8	72	55	33	64	49	74	82	72	77	78	43
Acen d-10	78	63	46	71	59	76	84	76	80	76	53
Phen d-10	77	71	74	78	76	72	87	82	85	73	75
Pyr d-10	73	72	83	80	82	65	88	84	86	68	82
Cry d-12	63	63	83	75	79	58	80	75	78	64	68
B(a)P d-12	56	61	86	90	88	62	93	92	93	51	75
Perylene d-12	55	65	77	80	79	58	97	85	91	52	81
DiB(ah)A d-14	25	30	74	96	85	56	92	80	86	24	50
B(ghi)P d-12	42	52	63	81	72	57	85	75	80	38	65

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval		2.0 Metres									
Exposure Period/Sampling Station		180BP2.5	384BP2.5	384BP2.5	BBP2.0	14BP2.0	180BP2.0	384BP2.0	384BP2.0	384BP2.0 (core)	384BP2.0 (core)
Replicate No.	mean	1	1	mixed	1	1	1	1	mixed	2-4 cm	4-6 cm
Batch I.D.		PH-0896	PH-0976	PH-0981	PH-0825	PH-0816	PH-0896	PH-0976	PH-0981	PH-0976	PH-0976
Lab Sample No.	2891-54	9611-13	9611-100	9611-101	2891-25	2891-55	9611-14	9611-98	9611-99	9611-95	9611-96
Moisture Content (%)	38	42	33	34	43	37	36	35	34	32	29
Sample Weight (g dry)	6.5	6.4	6.8	7.0	5.8	6.3	6.4	6.6	7.1	7.2	7.4
TOC	1.06	1.58	0.60	0.49	0.99	0.93	1.53	0.72	0.66	0.60	0.57
Naphthalene	20	27	20	16	6.7	5.6	15	21	18	26	18
Acenaphthylene	2.3	7.6	11	8.3	NDR(1.5)	2.1	7.8	8.1	21	NDR(9.0)	3.1
Acenaphthene	31	180	180	120	1.0	6.4	170	110	110	130	91
Fluorene	25	140	160	120	2.9	7.8	130	130	180	120	69
Phenanthrene	78	400	460	400	14	31	450	590	620	380	190
Anthracene	9.5	81.0	220.0	130	2.8	6.2	50	220	340	150	53
LPAH	165	836	1051	794	27	59	823	1079	1289	806	424
Fluoranthene	70	720	1200	930	28	34	1000	1100	1800	1100	420
Pyrene	50	340	610	480	23	28	500	610	710	490	290
Benz(a)anthracene	13	150	500	370	9.7	9.4	240	360	950	400	130
Chrysene	17	140	690	470	12	15	190	580	1400	520	140
Benzofluoranthenes	21	120	460	390	21	16	170	370	970	520	130
Benzo(e)pyrene	8.7	38	140	120	NDR(8.7)	5.7	52	110	300	140	41
Benzo(a)pyrene	6.5	62	230	200	NDR(8.5)	NDR(7.0)	91	180	480	220	62
Dibenz(ah)anthracene	ND(0.98)	5.3	14	14	NDR(1.6)	ND(2.9)	6.7	NDR(10)	37	NDR(12)	4.6
Indeno(1,2,3-cd)pyrene	NDR(6.5)	30	80	55	8.4	5.4	33	60	170	73	24
Benzo(ghi)perylene	6.1	19	54	48	6.6	4.6	22	44	120	52	18
HPAH	191	1624	3978	3077	109	118	2305	3414	6937	3515	1260
TPAH	356	2460	5029	3871	136	177	3128	4493	8226	4321	1684
TPAH (µg/g)	0.36	2.5	5.0	3.9	0.14	0.18	3.1	4.5	8.2	4.3	1.7
Perylene	14	34	58	53	26	12	37	44	110	50	25
Surrogate Stds. (% Recovery)											
Naph d-8	61	40	79	81	64	70	64	92	79	78	69
Acen d-10	65	49	80	82	75	69	70	86	80	80	73
Phen d-10	74	65	85	87	87	73	83	85	85	85	79
Pyr d-10	75	77	86	88	85	75	85	88	86	89	82
Cry d-12	66	77	89	75	60	72	82	84	77	88	71
B(a)P d-12	63	82	91	92	84	75	96	85	98	87	81
Perylene d-12	67	74	84	84	87	82	89	80	89	82	74
DiB(ah)A d-14	37	68	75	82	54	68	110	69	90	69	60
B(ghi)P d-12	52	57	73	76	62	78	91	72	78	67	58

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval		1.5 Metres						1.0 Metres			
Exposure Period/Sampling Station	384BP2.0 (core)	14BP1.5			180BP1.5	384BP1.5	384BP1.5	14BP1.0			180BP1.0
Replicate No.	8-10 cm	1A	1B	mean	1	1	mixed	1A	1B	mean	1A
Batch I.D.	PH-0976	PH-0816	PH-0816		PH-0896	PH-0976	PH-0981	PH-0825	PH-0825		PH-0897
Lab Sample No.	9611-97	2891-56A	2891-56B	2891-56	9611-16	9611-93	9611-94	2891-57A	2891-57B	2891-57	9611-17A
Moisture Content (%)	28	38	37	38	33	39	34	38	38	38	35
Sample Weight (g dry)	7.3	6.3	6.5	6.4	6.8	7.0	6.7	6.7	6.4	6.5	7.2
TOC	0.41			0.86	2.8	0.60	0.53			0.92	
Naphthalene	18	20	22	21	25	22	15	360	370	365	13
Acenaphthylene	1.9	2.6	2.8	2.7	9.2	12	5.6	11	11	11	4.9
Acenaphthene	5.3	77	76	77	380	87	40	470	490	480	170
Fluorene	4.4	83	73	78	260	110	44	360	320	340	160
Phenanthrene	16	290	240	265	960	490	160	1200	1100	1150	530
Anthracene	2.8	50	50	50	79	210	99	240	130	185	52
LPAH	48	523	464	493	1713	931	364	2641	2421	2531	930
Fluoranthene	26	220	200	210	1400	1200	450	630	620	625	700
Pyrene	23	140	130	135	800	590	220	440	430	435	420
Benz(a)anthracene	NDR(9.8)	32	29	31	280	540	190	110	110	110	160
Chrysene	13	45	43	44	200	790	280	120	110	115	130
Benzofluoranthenes	19	37	35	36	190	240	190	81	81	81	110
Benzo(e)pyrene	7.7	12	11	12	56	180	60	26	26	26	34
Benzo(a)pyrene	10	NDR(13)	NDR(11)	NDR	100	300	91	34	36	35	57
Dibenz(ah)anthracene	NDR(1.2)	ND(3.4)	ND(3.1)	ND	7.6	NDR(16)	NDR(6.8)	NDR(3.1)	NDR(3.2)	NDR(3.2)	NDR(4.1)
Indeno(1,2,3-cd)pyrene	10	NDR(6.3)	NDR(5.9)	NDR	39	91	35	13	17	15	18
Benzo(ghi)perylene	9.1	5.9	5.5	5.7	24	66	26	12	14	13	14
HPAH	118	492	454	473	3097	3997	1542	1466	1444	1455	1643
TPAH	166	1015	917	966	4810	4928	1906	4107	3865	3986	2573
TPAH (µg/g)	0.2	1.0	0.92	0.97	4.8	4.9	1.9	4.1	3.9	4.0	2.6
Perylene	17	11	10	10.5	38	65	33	30	30	30	23
Surrogate Stds. (% Recovery)											
Naph d-8	78	73	69	71	57	84	80	62	72	67	53
Acen d-10	82	75	68	72	65	79	84	67	78	73	57
Phen d-10	84	75	72	74	75	81	88	68	77	73	68
Pyr d-10	87	74	72	73	81	83	90	85	86	86	79
Cry d-12	75	71	67	69	86	85	83	83	81	82	82
B(a)P d-12	87	72	73	73	93	88	92	86	92	89	87
Perylene d-12	81	80	78	79	82	83	87	86	90	88	82
DiB(ah)A d-14	68	63	60	62	96	75	78	63	76	70	75
B(ghi)P d-12	64	79	73	76	81	75	71	68	79	74	75

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval										0.5 Metres	
Exposure Period/Sampling Station			384BP1.0			384BP1.0	384BP1.0 (core)	384BP1.0 (core)	384BP1.0 (core)	BBP0.5	
Replicate No.	1B	mean	1A	1B	mean	mixed	2-4 cm	4-6 cm	8-10 cm	1	2
Batch I.D.	PH-0897		PH-0976	PH-0976	PH-0976	PH-0981	PH-0976	PH-0976	PH-0976	PH-0827	PH-0827
Lab Sample No.	9611-17B	9611-17	9611-91A	9611-91B	9611-91	9611-92	9611-88	9611-89	9611-90	2891-42	2891-43
Moisture Content (%)	33	34	32	31	32	33	34	30	32	47	44
Sample Weight (g dry)	7.0	7.1	7.1	6.9	7.0	7.1	6.7	7.5	7.1	5.4	5.6
TOC		1.07			0.58	0.53	0.48	0.65	0.73	0.90	0.95
Naphthalene	12	13	20	17	19	18	8.8	24	18	6.3	6.2
Acenaphthylene	4.8	4.9	14	12.0	13	22	13	6.9	2.0	3.1	2.7
Acenaphthene	170	170	99	96	98	160	130	180	3.9	1.4	1.4
Fluorene	130	145	120	130	125	220	140	160	4.9	3.6	3.1
Phenanthrene	470	500	500	530	515	820	540	450	22	25	17
Anthracene	41	47	220	220	220	350	230	210	3.3	5.8	3.5
LPAH	828	879	973	1005	989	1590	1062	1031	54	45	34
Fluoranthene	820	760	1400	1300	1350	2000	1400	1100	33	42	35
Pyrene	480	450	740	610	675	840	620	590	31	41	32
Benz(a)anthracene	170	165	570	590	580	870	540	330	NDR(11)	14	12
Chrysene	110	120	830	890	860	1400	820	460	13	27	22
Benzofluoranthenes	130	120	590	610	600	920	580	310	21	20	24
Benzo(e)pyrene	40	37	190	190	190	280	180	98	8.6	13	10
Benzo(a)pyrene	68	63	300	310	305	440	270	160	12	NDR(12)	NDR(8.8)
Dibenz(ah)anthracene	NDR(4.6)	NDR(4.6	NDR(19)	NDR(21)	NDR	34	22	9.3	NDR(1.2)	ND(3.0)	ND(1.0)
Indeno(1,2,3-cd)pyrene	22	20	97	100	99	160	100	51	11	11	9.2
Benzo(ghi)perylene	17	16	70	76	73	110	69	37	10	10	9.8
HPAH	1857	1750	4787	4676	4732	7054	4601	3145	140	178	154
TPAH	2685	2629	5760	5681	5721	8644	5663	4176	194	223	188
TPAH (µg/g)	2.7	2.6	5.8	5.7	5.7	8.6	5.7	4.2	0.2	0.22	0.19
Perylene	26	25	68	68	68	100	66	39	22	19	18
Surrogate Stds. (% Recovery)											
Naph d-8	61	57	73	74	74	74	79	79	73	58	52
Acen d-10	65	61	76	74	75	78	84	78	79	59	55
Phen d-10	72	70	80	77	79	82	90	80	84	65	65
Pyr d-10	78	79	83	82	83	85	91	84	87	71	73
Cry d-12	76	79	88	83	86	76	84	81	75	70	72
B(a)P d-12	84	86	87	83	85	92	99	83	85	65	66
Perylene d-12	78	80	81	77	79	84	89	77	80	68	69
DiB(ah)A d-14	69	72	75	66	71	88	86	69	64	42	39
B(ghi)P d-12	68	72	75	62	69	76	79	66	61	51	49

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval										
Exposure Period/Sampling Station					14BP0.5	14BP0.5			14BP0.5	
Replicate No.	3	Min	Max	Mean	Std. Dev.	1	2A	2B	mean	3	Min
Batch I.D.	PH-0827					PH-0825	PH-0854	PH-0854		PH-0854	
Lab Sample No.	2891-44	2891:42-44	2891:42-44	2891:42-44		2891-58	2891-94A	2891-94B	2891-94	2891-95	2891:58,94-95
Moisture Content (%)	34	34	47	42	6.8	36	38	38	38	42	36
Sample Weight (g dry)	6.7	5.4	6.7	5.9	0.7	6.7	6.9	5.9	6.4	5.7	5.7
TOC	0.84	0.8	0.95	0.88	0.1	0.83					
Naphthalene	4.2	4.2	6.3	5.6	1.2	82	120	93	107	280	82
Acenaphthylene	1.6	1.6	3.1	2.5	0.8	6.2	17	9.6	13	16	6.2
Acenaphthene	1.1	1.1	1.4	1.3	0.2	250	830	360	595	870	250
Fluorene	1.8	1.8	3.6	2.8	0.9	210	1600	260	930	690	210
Phenanthrene	8.4	8.4	25	17	8.3	830	4800	1300	3050	3200	830
Anthracene	1.6	1.6	5.8	3.6	2.1	170	1900	150	1025	390	150
LPAH	19	19	45	33	13	1548	9267	2173	5720	5446	1548
Fluoranthene	19	19	42	32	12	560	2400	940	1670	2500	560
Pyrene	15	15	41	29	13	390	1600	580	1090	1600	390
Benz(a)anthracene	5.7	5.7	14	11	4.3	99	460	120	290	390	99
Chrysene	8.9	8.9	27	19	9.3	120	640	130	385	450	120
Benzofluoranthenes	12	12	24	19	6.1	75	270	92	181	400	75
Benzo(e)pyrene	5.6	5.6	13	9.5	3.7	23	79	27	53	130	23
Benzo(a)pyrene	NDR(3.9)	NDR(3.9)	NDR(12)	NDR(12)		32	110	35	73	150	32
Dibenz(ah)anthracene	ND(0.53)	ND(0.53)	ND(3.0)	ND(0.5)		2.7	10	3.0	6.5	9.1	2.7
Indeno(1,2,3-cd)pyrene	4.6	4.6	11	8.3	3.3	16	46	16	31	48	16
Benzo(ghi)perylene	5.1	5.1	10	8.3	2.8	13	31	12	22	40	12
HPAH	76	76	178	136	53	1331	5646	1955	3801	5717	1331
TPAH	95	95	223	169	66	2879	14913	4128	9520	11163	2879
TPAH (µg/g)	0.09	0.09	0.22	0.17	0.07	2.9	14.9	4.1	9.5	11.1	2.9
Perylene	12	12	19	16	3.8	28	43	22	33	45	22
Surrogate Stds. (% Recovery)											
Naph d-8	52	52	58	54	3.5	74	58	51	55	12	12
Acen d-10	53	53	59	56	3.1	78	62	52	57	120	52
Phen d-10	63	63	65	64	1.2	81	63	54	59	97	54
Pyr d-10	74	71	74	73	1.5	88	67	59	63	59	59
Cry d-12	74	70	74	72	2.0	76	79	59	69	45	45
B(a)P d-12	69	65	69	67	2.1	94	69	57	63	52	52
Perylene d-12	72	68	72	70	2.1	96	61	51	56	48	48
DiB(ah)A d-14	43	39	43	41	2.1	76	54	43	49	28	28
B(ghi)P d-12	51	49	51	50	1.2	76	54	45	50	34	34

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station				180BP0.5	180BP0.5	180BP0.5					270BP0.5
Replicate No.	Max	Mean	Std. Dev.	1	2	3	Min	Max	Mean	Std. Dev.	mixed A
Batch I.D.				PH-0897	PH-0897	PH-0897					PH-0845
Lab Sample No.	2891:58,94-95	2891:58,94-95		9611-18	9611-19	9611-20	9611:18-20	9611:18-20	9611:18-20	9611:18-20	9611-77A
Moisture Content (%)	42	39		38	33	38	33	38	36	2.9	33
Sample Weight (g dry)	6.9	6.3		6.9	7.2	6.8	6.8	7.2	7.0	0.2	7.2
TOC		0.83		0.91	0.84	0.98	0.84	0.98	0.91	0.1	
Naphthalene	280	156	108	23	30	40	23	40	31	8.5	280
Acenaphthylene	17	12	5.1	14	11	14	11	14	13	1.7	53
Acenaphthene	870	572	311	780	580	750	580	780	703	108	4600
Fluorene	1600	610	367	640	420	570	420	640	543	112	3200
Phenanthrene	4800	2360	1327	2100	1400	1800	1400	2100	1767	351	12000
Anthracene	1900	528	444	170	110	130	110	170	137	31	1100
LPAH	9267	4238	2333	3727	2551	3304	2551	3727	3194	596	21233
Fluoranthene	2500	1577	973	2800	2100	2400	2100	2800	2433	351	15000
Pyrene	1600	1027	607	1700	1100	1400	1100	1700	1400	300	8800
Benz(a)anthracene	460	260	148	670	470	550	470	670	563	101	2600
Chrysene	640	318	175	430	290	370	290	430	363	70	2500
Benzofluoranthenes	400	219	166	440	310	380	310	440	377	65	2300
Benzo(e)pyrene	130	69	55	130	91	110	91	130	110	20	650
Benzo(a)pyrene	150	85	60	250	170	210	170	250	210	40	1100
Dibenz(ah)anthracene	10	6.1	3.2	18	12	15	12	18	15	3.0	54
Indeno(1,2,3-cd)pyrene	48	32	16	83	57	72	57	83	71	13	290
Benzo(ghi)perylene	40	25	14	52	36	46	36	52	45	8.1	220
HPAH	5717	3616	2199	6573	4636	5553	4636	6573	5587	969	33514
TPAH	14913	7854	4386	10300	7187	8857	7187	10300	8781	1558	54747
TPAH (µg/g)	14.9	7.8	4.4	10.3	7.2	8.9	7.2	10.3	8.8	1.6	54.7
Perylene	45	35	8.8	70	50	62	50	70	61	10	220
Surrogate Stds. (% Recovery)											
Naph d-8	74	47	32	49	55	47	47	55	50	4.2	72
Acen d-10	120	85	32	63	74	66	63	74	68	5.7	64
Phen d-10	97	79	19	83	90	90	83	90	88	4.0	76
Pyr d-10	88	70	16	95	94	97	94	97	95	1.5	78
Cry d-12	79	63	16	99	91	97	91	99	96	4.2	81
B(a)P d-12	94	70	22	97	99	100	97	100	99	1.5	72
Perylene d-12	96	67	26	87	89	90	87	90	89	1.5	66
DiB(ah)A d-14	76	51	24	96	98	92	92	98	95	3.1	43
B(ghi)P d-12	76	53	21	78	82	78	78	82	79	2.3	45

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station	270BP0.5	270BP0.5	384BP0.5	384BP0.5	384BP0.5	384BP0.5					
Replicate No.	mixed B	mean	1	2	3A	3B	mean	Min	Max	Mean	Std. Dev.
Batch I.D.	PH-0845		PH-0974	PH-0974	PH-0974	PH-0974		PH-0974	PH-0974	PH-0974	PH-0974
Lab Sample No.	9611-77B	9611-77	9611-84	9611-85	9611-86A	9611-86B	9611-86	9611: 84 - 86	9611: 84-86	9611: 84-86	9611: 84-86
Moisture Content (%)	30	32	39	33	30	31	31	31	39	34	4.4
Sample Weight (g dry)	7.4	7.3	6.5	6.8	7.3	7.3	7.3	6.5	7.3	6.9	0.4
TOC			0.68							0.68	
Naphthalene	320	300	160	22	13	26	20	20	160	67	80
Acenaphthylene	100	77	71	20	10	36	23	20	71	38	29
Acenaphthene	4900	4750	1000	260	170	270	220	220	1000	493	439
Fluorene	3900	3550	940	270	170	570	370	270	940	527	361
Phenanthrene	12000	12000	3200	1100	640	2000	1320	1100	3200	1873	1154
Anthracene	1200	1150	2800	360	200	3400	1800	360	3400	1653	1227
LPAH	22420	21827	8171	2032	1203	6302	3753	705	8171	4652	3167
Fluoranthene	13000	14000	4800	2500	1400	7700	4550	2500	7700	3950	1262
Pyrene	8100	8450	2500	1100	680	3700	2190	1100	3700	1930	735
Benz(a)anthracene	2800	2700	2700	930	440	2400	1420	930	2700	1683	914
Chrysene	3000	2750	5100	1300	700	3100	1900	1300	5100	2767	2043
Benzofluoranthenes	2300	2300	3100	960	490	2300	1395	960	3100	1818	1131
Benzo(e)pyrene	710	680	910	290	150	670	410	290	910	537	329
Benzo(a)pyrene	1200	1150	1600	480	230	1200	715	480	1600	932	591
Dibenz(ah)anthracene	85	70	110	35	19	66	43	35	110	63	41
Indeno(1,2,3-cd)pyrene	320	305	540	170	85	360	223	170	540	311	200
Benzo(ghi)perylene	250	235	390	120	57	220	139	120	390	216	151
HPAH	31765	32640	21750	7885	4251	21716	12984	7885	21750	14206	7013
TPAH	54185	54466	29921	9917	5454	28018	16736	9917	29921	18858	10169
TPAH (µg/g)	54.2	54.4	29.9	9.9	5.5	28.0	16.7	9.9	29.9	18.9	10.2
Perylene	270	245	320	110	58	260	159	110	320	196	110
Surrogate Stds. (% Recovery)											
Naph d-8	58	65	74	70	73	66	70	70	74	71	2.5
Acen d-10	67	66	82	74	81	76	79	74	82	78	4.0
Phen d-10	84	80	88	78	86	85	86	78	88	84	5.2
Pyr d-10	87	83	91	80	89	86	88	80	91	86	5.6
Cry d-12	89	85	93	75	86	84	85	75	93	84	9.0
B(a)P d-12	96	84	96	80	93	88	91	80	96	89	8.1
Perylene d-12	89	78	84	70	83	78	81	70	84	78	7.3
DiB(ah)A d-14	77	60	78	55	75	73	74	55	78	69	12.3
B(ghi)P d-12	80	63	70	56	70	69	70	56	70	65	7.9

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval				0.0 Metres							
Exposure Period/Sampling Station	384BP0.5	384BP0.5		384BP0.5 (core)	384BP0.5 (core)	384BP0.5 (core)	384BP0.0	384BP0.5 (offshore)	384BP2.0 (offshore)	384BP5.0 (offshore)	384BP10 (offshore)
Replicate No.	mixed (A)	mixed (B)	mean	2 - 4 cm	4 - 6 cm	8 - 10 cm	mixed	mixed	mixed	mixed	mixed
Batch I.D.	PH-0981	PH-0981	PH-0981	PH-0974	PH-0974	PH-0974	PH-0981	PH-0986	PH-0986	PH-0986	PH-0986
Lab Sample No.	9611-87A	9611-87B	9611-87	9611-81	9611-82	9611-83	9611-79	9611-136	9611-137	9611-138	9611-139
Moisture Content (%)	35	34	35	28	34	30	33	40	41	42	55
Sample Weight (g dry)	6.9	7.2	7.0	7.4	6.8	7.1	7.2	6.0	6.5	6.0	4.6
TOC			0.47	0.38	0.57	0.61	0.59	1.15	0.93	0.94	1.76
Naphthalene	30	27	29	7.5	6.6	4.9	43	76	15	17	32
Acenaphthylene	33	31	32	8.6	2.8	1.4	46	84	5.2	2.5	6.1
Acenaphthene	170	160	165	81	26	2.6	350	300	83	26	22
Fluorene	260	340	300	83	18	3.2	740	2300	120	31	25
Phenanthrene	1300	1300	1300	410	56	12	3600	6500	210	41	65
Anthracene	550	680	615	180	23	2.1	1800	10000	220	29	17
LPAH	2343	2538	2441	770	132	26	6579	19260	653	147	167
Fluoranthene	3900	3200	3550	1200	140	19	6700	12000	770	180	140
Pyrene	1900	1300	1600	600	81	16	3400	4500	380	110	110
Benz(a)anthracene	1500	1500	1500	380	56	9.1	3100	7100	230	45	32
Chrysene	2200	2500	2350	570	89	11	4600	12000	310	62	44
Benzofluoranthenes	1600	1500	1550	420	73	14	2900	6400	240	60	64
Benzo(e)pyrene	480	470	475	130	25	5.4	900	1800	70	20	23
Benzo(a)pyrene	790	780	785	200	36	7.2	1600	3200	120	26	35
Dibenz(ah)anthracene	58	59	59	14	NDR(3.1)	NDR(0.6)	120	220	6.1	NDR(1.7)	NDR(2.9)
Indeno(1,2,3-cd)pyrene	280	270	275	73	18	NDR(5.8)	530	1100	40	15	23
Benzo(ghi)perylene	190	190	190	51	14	5.4	370	750	32	12	21
HPAH	12898	11769	12334	3638	532	87	24220	49070	2198	530	492
TPAH	15241	14307	14774	4408	664	113	30799	68330	2851	677	659
TPAH (µg/g)	15.2	14.3	14.8	4.4	0.7	0.1	30.8	68.3	2.9	0.7	0.7
Perylene	180	180	180	46	26	14	360	730	46	26	52
Surrogate Stds. (% Recovery)											
Naph d-8	71	78	75	76	64	77	86	51	72	67	71
Acen d-10	79	84	82	82	68	80	92	61	79	72	74
Phen d-10	86	89	88	84	73	83	96	73	81	74	77
Pyr d-10	90	88	89	89	83	86	87	72	80	78	75
Cry d-12	80	75	78	89	86	80	67	75	67	69	62
B(a)P d-12	99	99	99	92	85	91	100	81	83	80	79
Perylene d-12	89	90	90	83	79	86	90	71	75	75	73
DiB(ah)A d-14	97	99	98	67	61	76	100	79	74	71	68
B(ghi)P d-12	80	82	81	64	56	72	88	68	70	70	68

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Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval	2.0 Metres (Upstream)										
Exposure Period/Sampling Station	14BP2.0 (upstream)	14BP2.0 (upstream)	14BP2.0 (upstream)					180BP2.0 (upstream)	180BP2.0 (upstream)	180BP2.0 (upstream)	
Replicate No.	1	2	3	Min	Max	Mean	Std. Dev.	1	2	3	Min
Batch I.D.	PH-0860	PH-0860	PH-0860					PH-0814	PH-0814	PH-0814	
Lab Sample No.	2891-104	2891-105	2891-106	2891:104-106				9611-28	9611-29	9611-30	
Moisture Content (%)	41	34	34	34	41	36	4.0	37	38	43	37
Sample Weight (g dry)	5.9	6.8	6.5	5.9	6.8	6.4	0.5	7.6	6.2	6.2	6.2
TOC								0.84	0.98	1.49	0.8
Naphthalene	54	21	94	21	94	56	37	6.4	43	10	6.4
Acenaphthylene	5.5	8.7	4.7	4.7	8.7	6.3	2.1	3.3	5.6	4.7	3.3
Acenaphthene	140	130	120	120	140	130	10	53	270	100	53
Fluorene	100	660	200	100	660	320	299	47	200	130	47
Phenanthrene	320	2200	440	320	2200	987	1052	170	570	490	170
Anthracene	40	810	330	40	810	393	389	23	72	61	23
LPAH	660	3830	1189	660	3830	1893	1698	303	1161	796	303
Fluoranthene	290	1500	180	180	1500	657	732	340	790	670	340
Pyrene	190	1200	120	120	1200	503	604	180	440	370	180
Benz(a)anthracene	46	280	37	37	280	121	138	60	180	160	60
Chrysene	53	350	55	53	350	153	171	57	130	180	57
Benzofluoranthenes	47	180	30	30	180	86	82	85	120	110	85
Benzo(e)pyrene	16	48	10	10	48	25	20	22	39	35	22
Benzo(a)pyrene	21	85	16	16	85	41	38	32	69	62	32
Dibenz(ah)anthracene	NDR(1.5)	NDR(5.4)	NDR(1.0)	NDR(1.0)	NDR(1.5)	NDR(5.4)		3.1	4.6	4.4	3.1
Indeno(1,2,3-cd)pyrene	13	34	9.9	10	34	19	13	22	23	25	22
Benzo(ghi)perylene	10	21	8	8.0	21	13	7.0	16	19.0	18	16
HPAH	686	3698	466	466	3698	1617	1806	817	1815	1634	817
TPAH	1346	7528	1655	1346	7528	3509	3483	1120	2975	2430	1120
TPAH (µg/g)	1.3	7.5	1.7	1.3	7.5	3.5	3.5	1.1	3.0	2.4	1.1
Perylene	20	29	17	17	29	22	6.2	21	32	32	21
Surrogate Stds. (% Recovery)											
Naph d-8	62	49	50	49	62	54	7.2	45	47	49	45
Acen d-10	56	41	41	41	56	46	8.7	49	53	56	49
Phen d-10	70	58	55	55	70	61	7.9	67	68	73	67
Pyr d-10	74	67	71	67	74	71	3.5	87	82	86	82
Cry d-12	74	69	76	69	76	73	3.6	93	78	81	78
B(a)P d-12	71	69	75	69	75	72	3.1	91	75	89	75
Perylene d-12	66	62	69	62	69	66	3.5	83	63	80	63
DiB(ah)A d-14	48	56	52	48	56	52	4.0	73	38	74	38
B(ghi)P d-12	46	52	57	46	57	52	5.5	66	44	70	44

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Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval											5.0 Metres (Ups
Exposure Period/Sampling Station				384BP2.0 (upstream)	384BP2.0 (upstream)	384BP2.0 (upstream)					14BP5.0 (upstream)
Replicate No.	Max	Mean	Std. Dev.	1	2	3	Min	Max	Mean	Std. Dev.	1
Batch I.D.				PH-0982	PH-0982	PH-0982					PH-0860
Lab Sample No.		9611-28-30		9611-123	9611-124	9611-125					2891-107
Moisture Content (%)	43	39	3.2	35	36	36	35	36	36	0.6	38
Sample Weight (g dry)	7.6	6.6	0.8	6.9	6.9	7.9	6.9	7.9	7.2	0.6	5.9
TOC	1.5	1.10	0.3						0.46		
Naphthalene	43	20	20	16	17	16	16	17	16	0.6	130
Acenaphthylene	5.6	4.5	1.2	6.6	5.9	7.4	5.9	7.4	6.6	0.8	14
Acenaphthene	270	141	114	130	220	220	130	220	190	52	540
Fluorene	200	126	77	110	170	200	110	200	160	46	380
Phenanthrene	570	410	212	370	480	620	370	620	490	125	990
Anthracene	72	52	26	100	94	140	94	140	111	25	150
LPAH	1161	753	431	733	987	1203	733	1203	974	236	2204
Fluoranthene	790	600	233	710	920	1200	710	1200	943	246	850
Pyrene	440	330	135	430	570	680	430	680	560	125	570
Benz(a)anthracene	180	133	64	240	220	340	220	340	267	64	150
Chrysene	180	122	62	310	230	420	230	420	320	95	150
Benzofluoranthenes	120	105	18	250	220	340	220	340	270	62	99
Benzo(e)pyrene	39	32	8.9	80	70	110	70	110	87	21	30
Benzo(a)pyrene	69	54	20	120	110	160	110	160	130	26	51
Dibenz(ah)anthracene	4.6	4.0	0.8	8.0	7.4	12	7.4	12	9.1	2.5	NDR(3.3)
Indeno(1,2,3-cd)pyrene	25	23	1.5	38	34	52	34	52	41	9.5	21
Benzo(ghi)perylene	19	18	1.5	29	26	40	26	40	32	7.4	15
HPAH	1815	1422	532	2215	2407	3354	2215	3354	2659	610	1936
TPAH	2975	2175	954	2948	3394	4557	2948	4557	3633	831	4140
TPAH (µg/g)	3.0	2.2	1.0	2.9	3.4	4.6	2.9	4.6	3.6	0.8	4.1
Perylene	32	28	6.4	37	34	46	34	46	39	6.2	27
Surrogate Stds. (% Recovery)											
Naph d-8	49	47	2.0	84	83	81	81	84	83	1.5	47
Acen d-10	56	53	3.5	84	85	82	82	85	83	1.5	40
Phen d-10	73	69	3.2	83	83	85	83	85	84	1.5	58
Pyr d-10	87	85	2.6	76	73	75	73	76	75	1.4	72
Cry d-12	93	84	7.9	70	63	63	63	70	65	3.9	73
B(a)P d-12	91	85	8.7	73	71	66	66	73	70	3.6	77
Perylene d-12	83	75	11	68	67	61	61	68	65	4.2	71
DiB(ah)A d-14	74	62	21	62	59	47	47	62	56	7.8	57
B(ghi)P d-12	70	60	14	60	59	50	50	60	56	5.8	69

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Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval	tream)										
Exposure Period/Sampling Station	14BP5.0 (upstream)	14BP5.0 (upstream)					180BP5.0 (Upstream)	180BP5.0 (Upstream)		180BP5.0 (Upstream)	180BP5.0 (Upstream)
Replicate No.	2	3	Min	Max	Mean	Std. Dev.	1A	1B	mean	2	3
Batch I.D.	PH-0860	PH-0860					PH-0825	PH-0825		PH-0814	PH-0814
Lab Sample No.	2891-108	2891-109	2891:107 - 109	2891:107 - 109	2891:107 - 109		9611-25A	9611-25B	9611-25	9611-26	9611-27
Moisture Content (%)	39	40	38	40	39	1.0	32	34	33	41	37
Sample Weight (g dry)	6.1	5.9	5.9	6.1	6.0	0.1	6.9	7.2	7.0	5.9	6.9
TOC							0.64		0.64	0.95	1.44
Naphthalene	680	49	49	680	286	343	13	16	15	11	31
Acenaphthylene	30	7.8	7.8	30	17	11	3.1	2.5	2.8	4.8	5.3
Acenaphthene	1100	220	220	1100	620	445	100	110	105	94	170
Fluorene	690	150	150	690	407	271	62	69	66	91	120
Phenanthrene	1800	500	500	1800	1097	657	130	140	135	280	280
Anthracene	180	66	66	180	132	59	17	19	18	34	56
LPAH	4480	993	993	4480	2559	1770	325	357	341	515	662
Fluoranthene	1600	400	400	1600	950	606	180	180	180	470	350
Pyrene	1100	280	280	1100	650	416	94	94	94	280	210
Benz(a)anthracene	310	69	69	310	176	123	36	32	34	94	71
Chrysene	270	81	81	270	167	96	33	34	34	69	57
Benzofluoranthenes	210	66	66	210	125	75	35	29	32	84	61
Benzo(e)pyrene	64	21	21	64	38	23	12	10	11	27	21
Benzo(a)pyrene	110	30	30	110	64	41	18	14	16	42	34
Dibenz(ah)anthracene	NDR(6.6)	NDR(1.9)	NDR(1.9)	NDR(6.6)	NDR(6.6)	---	NDR(1.5)	1.3	1.3	3.1	2.7
Indeno(1,2,3-cd)pyrene	39	15	15	39	25	12	11	9.3	10	18	18
Benzo(ghi)perylene	28	12	12	28	18	8.5	8.3	7.0	7.7	14	12
HPAH	3731	974	974	3731	2214	1399	427	411	419	1101	837
TPAH	8211	1967	1967	8211	4773	3170	752	767	760	1616	1499
TPAH (µg/g)	8.2	2.0	2.0	8.2	4.8	3.2	0.75	0.77	0.76	1.6	1.5
Perylene	38	22	22	38	29	8.2	15.0	15.0	15	26	23
Surrogate Stds. (% Recovery)											
Naph d-8	54	54	47	54	52	4.0	43	46	45	37	44
Acen d-10	44	44	40	44	43	2.3	47	53	50	44	53
Phen d-10	59	54	54	59	57	2.6	68	67	68	68	72
Pyr d-10	64	67	64	72	68	4.0	86	86	86	87	86
Cry d-12	60	67	60	73	67	6.5	86	97	92	91	96
B(a)P d-12	61	66	61	77	68	8.2	94	93	94	93	92
Perylene d-12	56	61	56	71	63	7.6	86	87	87	83	84
DiB(ah)A d-14	43	43	43	57	48	8.1	79	71	75	73	76
B(ghi)P d-12	45	46	45	69	53	14	74	62	68	66	67

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Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station					384BP5.0 (upstream)	384BP5.0 (upstream)	384BP5.0 (upstream)		384BP5.0 (upstream)		
Replicate No.	Min	Max	Mean	Std. Dev.	1	2A	2B	mean	3	Min	Max
Batch I.D.					PH-0982	PH-0984	PH-0984	PH-0984	PH-0984	PH-0984	
Lab Sample No.	9611: 25-27	9611: 25-27	9611: 25-27		9611-126	9611-127A	9611-127B	9611-127	9611-128	9611:126-128	
Moisture Content (%)	33	41	37	4.0	42	49	48	49	36	36	49
Sample Weight (g dry)	5.9	7.0	6.6	0.6	5.9	5.4	5.5	5.4	6.8	5.4	6.8
TOC	0.6	1.4	1.01	0.4							
Naphthalene	11	31	19	11	21	24	24	24	22	21	24
Acenaphthylene	2.8	5.3	4.3	1.3	8.6	7.2	4.7	6.0	7.6	4.7	8.6
Acenaphthene	94	170	123	41	160	200	200	200	270	160	270
Fluorene	66	120	92	27	130	200	180	190	220	130	220
Phenanthrene	135	280	232	84	370	490	460	475	690	370	690
Anthracene	18	56	36	19	150	180	110	145	93	93	180
LPAH	341	662	506	161	840	1101	979	1040	1303	840	1303
Fluoranthene	180	470	333	146	1100	1200	1000	1100	1900	1000	1900
Pyrene	94	280	195	94	610	610	600	605	750	600	750
Benz(a)anthracene	34	94	66	30	390	360	260	310	390	260	390
Chrysene	34	69	53	18	460	490	260	375	520	260	520
Benzofluoranthenes	32	84	59	26	400	370	220	295	440	220	440
Benzo(e)pyrene	11	27	20	8	130	110.0	68.0	89	130	68	130
Benzo(a)pyrene	16	42	31	13	210	180.0	110.0	145	180	110	210
Dibenz(ah)anthracene	1.3	3.1	2.4	0.9	15	NDR(12)	NDR(4.8)	NDR(12)	11	11	15
Indeno(1,2,3-cd)pyrene	10	18	15	4.5	67	63	39	51	66	39	67
Benzo(ghi)perylene	7.7	14	11	3.2	49	46	28	37	47	28	49
HPAH	419	1101	786	344	3431	3429	2585	3007	4434	2585	4434
TPAH	760	1616	1292	464	4271	4530	3564	4047	5737	3564	5737
TPAH (µg/g)	0.8	1.6	1.3	0.5	4.3	4.5	3.6	4.1	5.7	3.6	5.7
Perylene	15	26	21	5.7	63	58	39	49	47	39	63
Surrogate Stds. (% Recovery)											
Naph d-8	37	45	42	4.2	84	80	73	77	89	73	89
Acen d-10	44	53	49	4.6	83	86	80	83	96	80	96
Phen d-10	68	72	69	2.5	82	91	86	88	100	82	100
Pyr d-10	86	87	86	0.6	75	89	86	87	87	75	89
Cry d-12	91	96	93	2.8	65	91	90	90	82	65	91
B(a)P d-12	92	94	93	0.8	71	93	94	93	95	71	95
Perylene d-12	83	87	85	1.8	65	85	86	85	86	65	86
DiB(ah)A d-14	73	76	75	1.5	54	82	86	84	82	54	86
B(ghi)P d-12	66	68	67	1.0	55	76	78	77	77	55	78

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval			10 Metres (Upstream)								
Exposure Period/Sampling Station	384BP5.0 (upstream)		14BP10 (upstream)	14BP10 (upstream)	14BP10 (upstream)					180BP10 (upstream)	180BP10 (upstream)
Replicate No.	Mean	Std. Dev.	1	2	3	Min	Max	Mean	Std Dev.	1	2
Batch I.D.			PH-0861	PH-0861	PH-0861					PH-0897	PH-0897
Lab Sample No.			2891-110	2891-111	2891-112					9611-22	9611-23
Moisture Content (%)	42	6.3	42	38	38	38	42	39	2.3	35	40
Sample Weight (g dry)	6.1	0.7	5.4	6.1	6.0	5.4	6.1	5.8	0.4	7.1	6.1
TOC	0.79									0.89	0.96
Naphthalene	22	1.5	43	6.9	22	6.9	43	24	18	8.1	40
Acenaphthylene	7.4	1.3	3.1	2.4	3.0	2.4	3.1	2.8	0.4	2.2	3.2
Acenaphthene	210	56	44	7.9	63	7.9	63	38	28	36	70
Fluorene	180	46	39	9.2	47	9.2	47	32	20	23	43
Phenanthrene	512	163	110	36	160	36	160	102	62	55	98
Anthracene	129	32	12	4.8	17	4.8	17	11.3	6.1	8.6	32
LPAH	1061	232	251	67	312	67	312	210	127	133	286
Fluoranthene	1367	462	99	54	140	54	140	98	43	110	230
Pyrene	655	82	70	40	95	40	95	68	28	64	130
Benz(a)anthracene	363	46	17	12	23	12	23	17	5.5	20	54
Chrysene	452	73	23	16	30	16	30	23	7.0	20	49
Benzofluoranthenes	378	75	25	21	29	21	29	25	4.0	26	53
Benzo(e)pyrene	116	24	9.0	7.4	9.8	7.4	10	8.7	1.2	9.3	18
Benzo(a)pyrene	178	33	8.0	6.8	9.7	6.8	10	8.2	1.5	13	27
Dibenz(ah)anthracene	13	2.8	ND(1.3)	ND(1.0)	ND(1.0)	ND(1.3)	ND(1.0)	ND(1.0)		1.1	2.5
Indeno(1,2,3-cd)pyrene	61	9.0	8.1	9.0	8.7	8.1	9.0	8.6	0.5	9.2	14
Benzo(ghi)perylene	44	6.4	7.3	6.8	7.1	6.8	7.3	7.1	0.3	7.5	12
HPAH	3624	733	266	173	352	173	352	264	89.7	280	590
TPAH	4685	918	518	240	664	240	664	474	215	413	876
TPAH (µg/g)	4.7	0.9	0.52	0.24	0.66	0.24	0.66	0.47	0.2	0.4	0.9
Perylene	53	8.8	18	16	15	15	18	16	1.5	17	22
Surrogate Stds. (% Recovery)											
Naph d-8	83	6.1	51	48	62	48	62	54	7.4	55	43
Acen d-10	88	7.6	40	38	50	38	50	43	6.4	69	56
Phen d-10	90	9.2	53	54	65	53	65	57	6.7	84	76
Pyr d-10	83	6.8	60	65	69	60	69	65	4.5	92	93
Cry d-12	79	13	59	66	68	59	68	64	4.7	87	94
B(a)P d-12	86	14	49	54	59	49	59	54	5.0	93	95
Perylene d-12	79	12	47	52	56	47	56	52	4.5	87	87
DiB(ah)A d-14	73	17	28	32	40	28	40	33	6.1	85	82
B(ghi)P d-12	70	13	28	31	36	28	36	32	4.0	76	75

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station	180BP10 (upstream)					384BP10 (upstream)	384BP10 (upstream)	384BP10 (upstream)			
Replicate No.	3	Min	Max	Mean	Std. Dev.	1	2	3	Min	Max	Mean
Batch I.D.	PH-0897					PH-0984	PH-0984	PH-0984	PH-0984		
Lab Sample No.	9611-24					9611-130	9611-131	9611-132	9611:130-132		
Moisture Content (%)	42	35	42	39	3.6	32	33	38	32	38	34
Sample Weight (g dry)	6.2	6.1	7.1	6.5	0.5	7.3	7.2	6.7	6.7	7.3	7.1
TOC	1.21	0.9	1.2	1.02	0.2	0.61					0.61
Naphthalene	12	8.1	40	20	17	14	12	14	12	14	13
Acenaphthylene	3.4	2.2	3.4	2.9	0.6	3.7	1.4	1.9	1.4	3.7	2.3
Acenaphthene	73	36	73	60	21	210	58	40	40	210	103
Fluorene	52	23	52	39	15	140	42	36	36	140	73
Phenanthrene	160	55	160	104	53	360	120	86	86	360	189
Anthracene	19	8.6	32	20	12	48	18	23	18	48	30
LPAH	319	133	319	246	99	776	250	199	199	776	408
Fluoranthene	300	110	300	213	96	450	230	260	230	450	313
Pyrene	170	64	170	121	54	290	140	160	140	290	197
Benz(a)anthracene	54	20	54	43	20	95	39	64	39	95	66
Chrysene	46	20	49	38	16	120	35	75	35	120	77
Benzofluoranthenes	54	26	54	44	16	87	38	65	38	87	63
Benzo(e)pyrene	18	9.3	18	15	5.0	26	12	21	12	26	20
Benzo(a)pyrene	27	13	27	22	8.1	42	18	31	18	42	30
Dibenz(ah)anthracene	2.2	1.1	2.5	1.9	0.7	NDR(3.4)	ND	ND	ND	NDR(3.4)	NDR(3.4)
Indeno(1,2,3-cd)pyrene	13	9.2	14	12	2.5	18	8.6	14	8.6	18	14
Benzo(ghi)perylene	11	7.5	12	10	2.4	14	6.9	11	6.9	14	11
HPAH	695	280	695	522	216	1142	528	701	528	1142	790
TPAH	1015	413	1015	768	315	1918	778	900	778	1918	1198
TPAH (µg/g)	1.0	0.4	1.0	0.8	0.3	1.9	0.8	0.9	0.8	1.9	1.2
Perylene	23	17	23	21	3.2	18	13	19	13	19	17
Surrogate Stds. (% Recovery)											
Naph d-8	49	43	55	49	6.0	94	92	92	92	94	93
Acen d-10	62	56	69	62	6.5	97	92	96	92	97	95
Phen d-10	80	76	84	80	4.0	98	90	95	90	98	95
Pyr d-10	91	91	93	92	1.0	91	92	89	89	92	91
Cry d-12	90	87	94	90	3.5	91	98	87	87	98	92
B(a)P d-12	92	92	95	93	1.5	95	96	96	95	96	96
Perylene d-12	85	85	87	86	1.2	87	90	88	87	90	88
DiB(ah)A d-14	73	73	85	80	6.2	81	86	89	81	89	85
B(ghi)P d-12	65	65	76	72	6.1	75	80	84	75	84	80

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (C). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval		28 Metres (Upstream)								
Exposure Period/Sampling Station		14BP28 (MC49)	180BP28 (MC49)	384BP28 (MC49)	384BP28 (MC49)	384BP28 (MC49)	384BP28 (MC49)			
Replicate No.	Std. Dev.	1	1	1	2	3	Min	Max	Mean	Std. Dev.
Batch I.D.		PH-0861	PH-0961	PH-0993	PH-0986	PH-0986				
Lab Sample No.		2891-116	9611-74	9611-133	9611-134	9611-135				
Moisture Content (%)	3.2	40	32	43	38	39	38	43	40	2.6
Sample Weight (g dry)	0.3	6.2	6.9	5.92	6.6	6.6	5.9	6.6	6.4	0.4
TOC				0.78					0.78	
Naphthalene	1.2	11	5.2	9.9	22	15	10	22	16	6.1
Acenaphthylene	1.2	NDR(2.2)	1.4	2.8	NDR(2.6)	1.9	1.9	2.8	2.4	0.6
Acenaphthene	93	23	11	21	14	11	11	21	15	5.1
Fluorene	58	31	9.2	25	64	14	14	64	34	26
Phenanthrene	149	80	17	34	180	33	33	180	82	85
Anthracene	16.1	12	3.3	13	270	13	13	270	99	148
LPAH	319	157	47	106	550	88	88	550	248	262
Fluoranthene	119	84	33	140	200	98	98	200	146	51
Pyrene	81	59	24	85	120	64	64	120	90	28
Benz(a)anthracene	28	18	6.9	45	98	25	25	98	56	38
Chrysene	43	22	8.4	52	180	33	33	180	88	80
Benzofluoranthenes	25	25	12	62	120	37	37	120	73	43
Benzo(e)pyrene	7.1	9.2	4.9	23	33	11	11	33	22	11
Benzo(a)pyrene	12	8.6	6.6	30	49	16	16	49	32	17
Dibenz(ah)anthracene		ND(1.0)	NDR(0.8)	2.8	NDR(2.8)	1.5	1.5	2.8	2.2	0.9
Indeno(1,2,3-cd)pyrene	4.7	NDR(6.8)	NDR(5.1)	14	22	9.4	9.4	22	15	6.4
Benzo(ghi)perylene	3.6	7.1	5.0	12	17	9.2	9.2	17	13	4.0
HPAH	317	233	101	466	839	304	304	839	536	274
TPAH	626	390	148	572	1389	392	392	1389	784	531
TPAH (µg/g)	0.6	0.39	0.15	0.6	1.39	0.39	0.39	1.39	0.78	0.53
Perylene	3.2	17	12	25	23	17	17	25	22	4.2
Surrogate Stds. (% Recovery)										
Naph d-8	1.1	60	92	93	80	71	71	93	81	11
Acen d-10	2.3	51	88	92	82	76	76	92	83	8.2
Phen d-10	4.2	61	92	91	86	80	80	91	86	5.5
Pyr d-10	1.5	59	89	90	82	82	82	90	85	4.7
Cry d-12	5.4	51	90	79	70	77	70	79	76	4.7
B(a)P d-12	0.3	44	100	97	81	83	81	97	87	8.7
Perylene d-12	1.2	42	93	93	72	77	72	93	81	11
DiB(ah)A d-14	4.2	23	81	92	58	66	58	92	72	18
B(ghi)P d-12	4.4	24	80	86	59	63	59	86	69	15

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX VI (D)

Raw Data and Descriptive Statistics for Surface Sediment *parental* PAH Concentrations - Day0 to Day384

Mechanical Control Treatment Site (MC)

Appendix VI (D). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Mechanical Control Site - Day0 to Day384.

Distance Interval	49 Metres									5 Metres	
Exposure Period/Sampling Station	14MC49 (BP28)	180MC49 (BP28)	384MC49 (BP28)	384MC49 (BP28)	384MC49 (BP28)					14MC5.0	14MC5.0
Replicate No.	1	1	1	2	3	Min	Max	Mean	Std. Dev.	1	re-run (A)
Batch I.D.	PH-0861	PH-0961	PH-0993	PH-0986	PH-0986					PH-0816	PH-0837
Lab Sample No.	2891-116	9611-74	9611-133	9611-134	9611-135					2891-59	2891-59A
Moisture Content (%)	40	32	43	38	39	38	43	40	2.6	44	40
Sample Weight (g dry)	6.2	6.9	5.92	6.6	6.6	5.9	6.6	6.4	0.4	5.94	6.0
TOC			0.78					0.78			
Naphthalene	11	5.2	9.9	22	15	10	22	16	6.1	11	8.3
Acenaphthylene	NDR(2.2)	1.4	2.8	NDR(2.6)	1.9	1.9	2.8	2.4	0.6	8.0	2.6
Acenaphthene	23	11	21	14	11	11	21	15	5.1	62	20
Fluorene	31	9.2	25	64	14	14	64	34	26	180	17
Phenanthrene	80	17	34	180	33	33	180	82	85	660	68
Anthracene	12	3.3	13	270	13	13	270	99	148	390	11
LPAH	157	47	106	550	88	88	550	248	262	1311	127
Fluoranthene	84	33	140	200	98	98	200	146	51	2300	150
Pyrene	59	24	85	120	64	64	120	90	28	1100	110
Benz(a)anthracene	18	6.9	45	98	25	25	98	56	38	760	26
Chrysene	22	8.4	52	180	33	33	180	88	80	1100	23
Benzofluoranthenes	25	12	62	120	37	37	120	73	43	580	36
Benzo(e)pyrene	9.2	4.9	23	33	11	11	33	22	11	180	18
Benzo(a)pyrene	8.6	6.6	30	49	16	16	49	32	17	200	11
Dibenz(ah)anthracene	ND(1.0)	NDR(0.8)	2.8	2.8	1.5	1.5	2.8	2.2	0.9	12	ND(3.0)
Indeno(1,2,3-cd)pyrene	NDR(6.8)	NDR(5.1)	14	22	9.4	9.4	22	15	6.4	50	ND(0.65)
Benzo(ghi)perylene	7.1	5.0	12	17	9.2	9.2	17	13	4.0	39	9.6
HPAH	233	101	466	839	304	304	839	536	274	6321	384
TPAH	390	148	572	1389	392	392	1389	784	531	7632	511
TPAH (µg/g)	0.4	0.1	0.6	1.4	0.4	0.4	1.4	0.8	0.5	7.6	0.5
Perylene	17	12	25	23	17	17	25	22	4.2	49	16
Surrogate Stds. (% Recovery)											
Naph d-8	60	92	93	80	71	71	93	81	11	62	77
Acen d-10	51	88	92	82	76	76	92	83	8.2	63	78
Phen d-10	61	92	91	86	80	80	91	86	5.5	69	71
Pyr d-10	59	89	90	82	82	82	90	85	4.7	72	66
Cry d-12	51	90	79	70	77	70	79	76	4.7	76	64
B(a)P d-12	44	100	97	81	83	81	97	87	8.7	72	54
Perylene d-12	42	93	93	72	77	72	93	81	11	73	57
DiB(ah)A d-14	23	81	92	58	66	58	92	72	18	52	30
B(ghi)P d-12	24	80	86	59	63	59	86	69	15	61	43

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentraions are recovery corrected
Data have not been blank corrected

Appendix VI (D). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Mechanical Control Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station	14MC5.0		14MC5.0	14MC5.0		14MC5.0					180MC5.0
Replicate No.	re-run (B)	mean	2A	2B	mean	3	Min	Max	Mean	Std. Dev.	1
Batch I.D.	PH-0837		PH-0860	PH-0860		PH-0860					PH-0899
Lab Sample No.	2891-59B	2891-59	2891-102A	2891-102B	2891-102	2891-103	2891:59,102-103				9611-31
Moisture Content (%)	44	42	36	37	37	40	36	44	40	3.4	36
Sample Weight (g dry)	5.5	5.7	6.6	6.4	6.5	5.9	5.5	6.6	6.0	0.4	7.5
TOC											0.56
Naphthalene	7.7	8.0	22	6.2	14	7.6	6.2	22	10	5.9	4.6
Acenaphthylene	2.3	2.5	16	3.0	9.5	2.5	2.3	16	5.7	5.5	2.0
Acenaphthene	20	20	74	17	46	9.2	9.2	74	34	27	3.9
Fluorene	16	17	420	42	231	17	16	420	115	162	6.8
Phenanthrene	63	66	820	250	535	42	42	820	317	340	15
Anthracene	9.2	10	1200	37	619	20	9.2	1200	278	476	3.9
LPAH	118	123	2552	355	1454	98	98	2552	760	993	36
Fluoranthene	96	123	6400	310	3355	60	60	6400	1553	2527	38
Pyrene	66	88	4000	200	2100	39	39	4000	919	1562	28
Benz(a)anthracene	18	22	1900	69	985	14	14	1900	465	761	10
Chrysene	20	22	2300	80	1190	23	20	2300	591	939	12
Benzofluoranthenes	23	30	1500	64	782	30	23	1500	372	594	19
Benzo(e)pyrene	12	15	370	23	197	11	11	370	102	147	7.6
Benzo(a)pyrene	9.8	10.4	570	29	300	13	10	570	139	224	9.8
Dibenz(ah)anthracene	ND(2.9)	ND(2.3)	46	2.3	24	NDR(1.4)	2.3	46	20	23	0.8
Indeno(1,2,3-cd)pyrene	ND(0.58)	ND(0.58)	170	14	92	10	10	170	61	75	8.5
Benzo(ghi)perylene	8.1	8.9	110	11	61	8.5	8.1	110	31	40	7.1
HPAH	253	318	17366	802	9084	209	209	17366	4222	6862	141
TPAH	371	441	19918	1158	10538	307	307	19918	4983	7847	177
TPAH (µg/g)	0.4	0.4	20	1.2	11	0.3	0.3	20	5.0	7.8	0.2
Perylene	16	16	130	21	76	18	16	130	42	45	17
Surrogate Stds. (% Recovery)											
Naph d-8	81	79	49	60	55	61	49	81	65	12	33
Acen d-10	81	80	46	48	47	50	46	81	61	16	43
Phen d-10	71	71	71	58	65	63	58	71	67	5.5	65
Pyr d-10	66	66	77	70	74	76	66	77	71	4.8	91
Cry d-12	60	62	74	67	71	72	60	76	69	6.2	96
B(a)P d-12	49	52	74	64	69	71	49	74	64	10	94
Perylene d-12	52	55	65	60	63	68	52	73	63	7.7	88
DiB(ah)A d-14	33	32	68	43	56	48	30	68	46	14	77
B(ghi)P d-12	46	45	57	45	51	47	43	61	50	7.3	67

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentraions are recovery corrected
Data have not been blank corrected

Appendix VI (D). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Mechanical Control Site - Day0 to Day384.

Distance Interval		2.0 Metres									0.5 Metres
Exposure Period/Sampling Station	384MC5.0	14MC2.0	14MC2.0	14MC2.0					180MC2.0	384MC2.0	BMC0.5
Replicate No.	1	1	2	3	Min	Max	Mean	Std. Dev.	1	1	1
Batch I.D.	PH-0990	PH-0816	PH-0854	PH-0854					PH-0899	PH-0990	PH-0814
Lab Sample No.	9611-168	2891-60	2891-100	2891-101	2891:60,100-101				9611-32	9611-167	2891-35
Moisture Content (%)	33	41	41	32	32	41	38	5.2	32	38	38
Sample Weight (g dry)	6.89	6.3	6.0	6.0	6.0	6.3	6.1	0.2	7.7	6.54	6.7
TOC	0.57	0.94					0.94		2.1	0.72	0.87
Naphthalene	5.2	4.8	12	7.7	4.8	12	8.2	3.6	4.0	5.0	4.8
Acenaphthylene	1.8	1.6	2.4	3.3	1.6	3.3	2.4	0.9	1.3	1.5	1.4
Acenaphthene	2.0	2.6	11	2.6	2.6	11	5.4	4.8	2.7	NDR(3.0)	1.2
Fluorene	4.4	4.2	17	5.1	4.2	17	8.8	7.1	7.2	4.8	3
Phenanthrene	19	15	80	29	15	80	41	34	15	13	8.4
Anthracene	3.9	2.2	7.1	5.7	2.2	7.1	5.0	2.5	4.7	2.9	1.8
LPAH	36	30	130	53	30	130	71	52	35	27	21
Fluoranthene	43	27	56	34	27	56	39	15	37	37	19
Pyrene	34	21	39	33	21	39	31	9.2	23	26	16
Benz(a)anthracene	13	8.4	12	12	8.4	12	11	2.1	8.6	9.5	5.4
Chrysene	16	17	21	17	17	21	18	2.3	16	13	9.0
Benzofluoranthenes	21	20	20	20	20	20	20	0.0	16	19	14
Benzo(e)pyrene	9.1	7.9	7.4	7.4	7.4	7.9	7.6	0.3	16	NDR(7.5)	5.6
Benzo(a)pyrene	13	7.2	7.1	8.7	7.1	8.7	7.7	0.9	10	9.1	5.5
Dibenz(ah)anthracene	1.6	ND(2.1)	NDR(0.94)	NDR(0.94)	ND(2.1)	NDR(0.94)	NDR		21	NDR(1.0)	ND(0.96)
Indeno(1,2,3-cd)pyrene	9.4	5.7	8.2	8.4	5.7	8.4	7.4	1.5	NDR(0.8)	6.9	6.4
Benzo(ghi)perylene	8.4	5.4	6.9	7.1	5.4	7.1	6.5	0.9	4.6	6.4	5.6
HPAH	169	120	178	148	120	178	148	29	152	127	87
TPAH	205	150	307	201	150	307	219	80	187	154	107
TPAH (µg/g)	0.2	0.1	0.3	0.2	0.1	0.3	0.2	0.1	0.2	0.2	0.1
Perylene	15	14	17	17	14	17	16	1.7	5.2	14	14
Surrogate Stds. (% Recovery)											
Naph d-8	98	62	55	48	48	62	55	7.0	63	89	74
Acen d-10	96	67	59	48	48	67	58	9.5	66	90	71
Phen d-10	96	70	59	47	47	70	59	12	73	100	74
Pyr d-10	96	69	62	52	52	69	61	8.5	87	96	86
Cry d-12	91	66	58	42	42	66	55	12	79	91	84
B(a)P d-12	100	67	64	47	47	67	59	11	90	100	75
Perylene d-12	96	73	58	43	43	73	58	15	85	93	80
DiB(ah)A d-14	96	50	53	32	32	53	45	11	76	87	62
B(ghi)P d-12	90	61	51	35	35	61	49	13	72	84	65

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentraions are recovery corrected
Data have not been blank corrected

Appendix VI (D). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Mechanical Control Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station	**BMC0.5**	**BMC0.5**		**BMC0.5**	**BMC0.5**				**14MC0.5**	**14MC0.5**	**14MC0.5**
Replicate No.	**2A**	**2B**	**mean**	**3**	**Min**	**Max**	**Mean**	**Std. Dev.**	**1**	**2**	**3**
Batch I.D.	**PH-0814**	**PH-0814**		**PH-0815**					**PH-0816**	**PH-0816**	**PH-0816**
Lab Sample No.	**2891-36A**	**2891-36B**	**2891-36**	**2891-37**	**2891:35-37**				**2891-61**	**2891-62**	**2891-63**
Moisture Content (%)	**37**	**37**	**37**	**37**	**37**	**38**	**37**	**0.6**	**40**	**38**	**33**
Sample Weight (g dry)	**6.3**	**6.7**	**6.5**	**6.9**	**6.3**	**6.9**	**6.7**	**0.2**	**6.0**	**6.3**	**6.8**
TOC	**0.83**		**0.83**	**0.77**	**0.77**	**0.87**	**0.82**	**0.1**	**1.0**	**0.87**	**0.76**
Naphthalene	**5.1**	**5.1**	**5.1**	**4.8**	**4.8**	**5.1**	**4.9**	**0.2**	**5.4**	**4.4**	**3.7**
Acenaphthylene	**2.0**	**1.5**	**1.8**	**1.6**	**1.4**	**2.0**	**1.6**	**0.2**	**1.3**	**2.1**	**1.1**
Acenaphthene	**1.4**	**1.1**	**1.3**	**0.5**	**0.5**	**1.4**	**1.0**	**0.4**	**2.9**	**2.4**	**1.3**
Fluorene	**3.7**	**2.6**	**3.2**	**2.3**	**2.3**	**3.7**	**2.8**	**0.5**	**5.6**	**5.0**	**2.8**
Phenanthrene	**14**	**9.5**	**12**	**8.6**	**8.4**	**14**	**10**	**1.9**	**31**	**25**	**14**
Anthracene	**3.3**	**1.8**	**2.6**	**1.4**	**1.4**	**3.3**	**1.9**	**0.6**	**5.3**	**4**	**2.2**
LPAH	**30**	**22**	**26**	**19**	**19**	**30**	**22**	**3.3**	**52**	**43**	**25**
Fluoranthene	**26**	**20**	**23**	**19**	**19**	**26**	**20**	**2.3**	**55**	**39**	**28**
Pyrene	**23**	**17**	**20**	**15**	**15**	**23**	**17**	**2.6**	**38**	**30**	**22**
Benz(a)anthracene	**8.1**	**6.4**	**7.3**	**6.4**	**5.4**	**8.1**	**6.4**	**0.9**	**14**	**9.5**	**8.8**
Chrysene	**11**	**9.3**	**10**	**8.2**	**8.2**	**11**	**9.1**	**1.0**	**27**	**18**	**15**
Benzofluoranthenes	**18**	**14**	**16**	**12**	**12**	**18**	**14**	**2.0**	**22**	**19**	**14**
Benzo(e)pyrene	**7.1**	**5.9**	**6.5**	**5.5**	**5.5**	**7.1**		**0.6**	**7.8**	**7.2**	**5.9**
Benzo(a)pyrene	**8.0**	**5.6**	**6.8**	**4.6**	**4.6**	**8.0**		**1.1**	**NDR(8.3)**	**NDR(7.2)**	**NDR(6.0)**
Dibenz(ah)anthracene	**ND(1.2)**	**ND(1.0)**	**ND(0.96)**	**ND(1.2)**	**ND(0.96)**	**ND(1.2)**	**ND**		**ND(4.7)**	**ND(4.2)**	**ND(5.1)**
Indeno(1,2,3-cd)pyrene	**7.4**	**5.2**	**6.3**	**5.2**	**5.2**	**7.4**	**6.0**	**0.7**	**4.3**	**5.4**	**5.2**
Benzo(ghi)perylene	**6.6**	**5.5**	**6.1**	**5.2**	**5.2**	**6.6**	**5.6**	**0.4**	**4.9**	**4.5**	**4.1**
HPAH	**115**	**89**	**102**	**81**	**81**	**115**	**90**	**11**	**173**	**133**	**103**
TPAH	**145**	**111**	**128**	**100**	**100**	**145**	**112**	**14**	**225**	**176**	**128**
TPAH (µg/g)	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.01**	**0.2**	**0.2**	**0.1**
Perylene	**14**	**20**	**17**	**13**	**13**	**20**	**15**	**2.1**	**12**	**12**	**9.7**
Surrogate Stds. (% Recovery)											
Naph d-8	**59**	**73**	**66**	**51**	**51**	**74**	**64**	**12**	**60**	**59**	**80**
Acen d-10	**60**	**71**	**66**	**59**	**59**	**71**	**65**	**6.0**	**62**	**61**	**80**
Phen d-10	**65**	**68**	**67**	**76**	**65**	**76**	**72**	**5.0**	**64**	**62**	**80**
Pyr d-10	**90**	**84**	**87**	**74**	**74**	**90**	**82**	**7.2**	**66**	**65**	**80**
Cry d-12	**83**	**79**	**81**	**52**	**52**	**84**	**72**	**18**	**61**	**64**	**71**
B(a)P d-12	**73**	**73**	**73**	**74**	**73**	**75**	**74**	**1.0**	**65**	**61**	**72**
Perylene d-12	**78**	**77**	**78**	**81**	**77**	**81**	**80**	**1.8**	**70**	**67**	**77**
DiB(ah)A d-14	**57**	**53**	**55**	**50**	**50**	**62**	**56**	**6.0**	**46**	**43**	**46**
B(ghi)P d-12	**63**	**64**	**64**	**64**	**63**	**65**	**64**	**0.8**	**58**	**55**	**63**

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentraions are recovery corrected
Data have not been blank corrected

Appendix VI (D). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Mechanical Control Site - Day0 to Day384.

Distance Interval					0.5 Metres	
Exposure Period/Sampling Station					180MC0.5	384MC0.5
Replicate No.	Min	Max	Mean	Std. Dev.	1	1
Batch I.D.					PH-0899	PH-0988
Lab Sample No.	2891:61-63				9611-33	9611-166
Moisture Content (%)	33	40	37	3.6	29	35
Sample Weight (g dry)	6.0	6.8	6.4	0.4	7.4	6.6
TOC	0.76	1.0	0.88	0.1	0.81	0.68
Naphthalene	3.7	5.4	4.5	0.9	4.3	NDR(4.5)
Acenaphthylene	1.1	2.1	1.5	0.5	1.3	NDR(1.0)
Acenaphthene	1.3	2.9	2.2	0.8	1.8	2.1
Fluorene	2.8	5.6	4.5	1.5	3.9	3.7
Phenanthrene	14	31	23	8.6	11	22
Anthracene	2.2	5.3	3.8	1.6	2.6	4.2
LPAH	25	52	40	13	25	32
Fluoranthene	28	55	41	14	25	39
Pyrene	22	38	30	8.0	20	27
Benz(a)anthracene	8.8	14	11	2.8	7.7	10
Chrysene	15	27	20	6.2	9.7	14
Benzofluoranthenes	14	22	18	4.0	14	18
Benzo(e)pyrene	5.9	7.8	7.0	1.0	7.5	6.4
Benzo(a)pyrene	NDR(6.0)	NDR(8.3)	NDR		5.8	6.8
Dibenz(ah)anthracene	ND(4.2)	ND(5.1)	ND		NDR(0.7)	NDR(0.99)
Indeno(1,2,3-cd)pyrene	4.3	5.4	5.0	0.6	7.4	6.7
Benzo(ghi)perylene	4.1	4.9	4.5	0.4	6.5	6.1
HPAH	103	173	136	35	104	134
TPAH	128	225	176	48	129	166
TPAH (µg/g)	0.1	0.2	0.2	0.05	0.1	0.2
Perylene	10	12	11	1.3	15	13
Surrogate Stds. (% Recovery)						
Naph d-8	59	80	66	12	48	73
Acen d-10	61	80	68	11	53	73
Phen d-10	62	80	69	9.9	64	68
Pyr d-10	65	80	70	8.4	88	73
Cry d-12	61	71	65	5.1	89	68
B(a)P d-12	61	72	66	5.6	80	72
Perylene d-12	67	77	71	5.1	60	65
DiB(ah)A d-14	43	46	45	1.7	56	63
B(ghi)P d-12	55	63	59	4.0	66	62

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentraions are recovery corrected
Data have not been blank corrected

APPENDIX VI (E)

Raw Data and Descriptive Statistics for Surface Sediment *parental* PAH Concentrations - Day0 to Day384

Open Control Site (OC)

Appendix VI (E). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Open Control Site - Day0 to Day384.

Distance Interval	0.0 Metres									
Exposure Period/Sampling Station	BOC0.0	BOC0.0	BOC0.0					14OC0.0	14OC0.0	14OC0.0
Replicate No.	1	2	3	Min	Max	Mean	Std. Dev.	1	2	3
Batch I.D.	PH-0814	PH-0814	PH-0814					PH-0825	PH-0825	PH-0825
Lab Sample No.	2891-29	2891-30	2891-31	2891:29-31				2891-64	2891-65	2891-66
Moisture Content (%)	36	34	50	34	50	40	8.7	42	43	38
Sample Weight (g dry)	6.8	6.8	5.0	5.0	6.8	6.2	1.1	5.9	5.8	6.3
TOC	0.8	0.76	1.13	0.8	1.1	0.9	0.2	1.1	1.2	0.9
Naphthalene	5.4	5.0	6.1	5.0	6.1	5.5	0.6	7.0	7.5	4.6
Acenaphthylene	1.6	1.5	2.1	1.5	2.1	1.7	0.3	1.8	1.7	1.8
Acenaphthene	1.4	1.3	1.7	1.3	1.7	1.5	0.2	2.9	2.0	1.5
Fluorene	3.2	3.0	4.1	3.0	4.1	3.4	0.6	5.2	4.9	2.9
Phenanthrene	9.4	9.6	14	9.4	14	11	2.6	22	25	14
Anthracene	2.4	2.1	2.7	2.1	2.7	2.4	0.3	4.6	5.5	2.4
LPAH	23	23	31	23	31	26	4.5	44	47	27
Fluoranthene	20	17	33	17	33	23	8.5	34	39	26
Pyrene	17	16	26	16	26	20	5.5	30	34	33
Benz(a)anthracene	6.5	6.0	8.7	6.0	8.7	7.1	1.4	9.6	12	8.0
Chrysene	9.5	7.9	15	7.9	15	11	3.7	14	16	18
Benzofluoranthenes	16	14	21	14	21	17	3.6	20	24	21
Benzo(e)pyrene	6.6	5.8	8.0	5.8	8.0	6.8	1.1	8.2	7.4	9.3
Benzo(a)pyrene	6.2	5.8	9.6	5.8	10	7.2	2.1	NDR(8.4)	NDR(10)	NDR(7.1)
Dibenz(ah)anthracene	ND(1.5)	ND(0.96)	ND(1.8)	ND(0.96)	ND(1.5)	ND		NDR(1.1)	ND(0.96)	ND(1.8)
Indeno(1,2,3-cd)pyrene	5.6	5.0	8.7	5.0	8.7	6.4	2.0	7.2	9.0	7.3
Benzo(ghi)perylene	5.5	5.0	8.1	5.0	8.1	6.2	1.7	6.6	8.2	8.0
HPAH	93	83	138	83	138	105	30	130	150	131
TPAH	116	105	169	105	169	130	34	173	196	158
TPAH (µg/g)	0.12	0.11	0.17	0.11	0.17	0.13	0.03	0.17	0.20	0.16
Perylene	18	13	18	13	18	16	2.9	26	28	12
Surrogate Stds. (% Recovery)										
Naph d-8	83	71	75	71	83	76	6.1	64	63	55
Acen d-10	80	72	76	72	80	76	4.0	66	65	57
Phen d-10	74	69	72	69	74	72	2.5	69	66	65
Pyr d-10	90	86	85	85	90	87	2.6	87	85	76
Cry d-12	79	77	77	77	79	78	1.2	82	72	70
B(a)P d-12	70	74	78	70	78	74	4.0	88	84	69
Perylene d-12	76	78	83	76	83	79	3.6	90	84	72
DiB(ah)A d-14	59	59	65	59	65	61	3.5	62	46	45
B(ghi)P d-12	71	70	73	70	73	71	1.5	67	62	54

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (E). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Open Control Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station					180OC0.0	180OC0.0	180OC0.0			180OC0.0	
Replicate No.	Min	Max	Mean	Std. Dev.	1	2	3	Min	Max	Mean	Std. Dev.
Batch I.D.					PH-0900	PH-0900	PH-0900	PH-0900			
Lab Sample No.					9611-35	9611-36	9611-37	9611:35-37			
Moisture Content (%)	38	43	41	2.6	44	33	40	33	44	39	5.6
Sample Weight (g dry)	5.8	6.3	6.0	0.3	6.7	7.2	6.5	6.5	7.2	6.8	0.4
TOC	0.9	1.2	1.0	0.2	0.84	0.88	1.2	0.8	1.2	1.0	0.2
Naphthalene	4.6	7.5	6.4	1.6	4.3	4.4	5.6	4.3	5.6	4.8	0.7
Acenaphthylene	1.7	1.8	1.8	0.1	1.8	1.8	3.3	1.8	3.3	2.3	0.9
Acenaphthene	1.5	2.9	2.1	0.7	7.1	11	2.4	2.4	11	6.8	4.3
Fluorene	2.9	5.2	4.3	1.3	6.3	8.5	6.1	6.1	8.5	7.0	1.3
Phenanthrene	14	25	20	5.7	13	18	34	13	34	22	11
Anthracene	2.4	5.5	4.2	1.6	3.6	3.2	5.0	3.2	5.0	3.9	0.9
LPAH	27	47	39	10	36	47	56	36	56	46	10
Fluoranthene	26	39	33	6.6	36	29	46	29	46	37	8.5
Pyrene	30	34	32	2.1	28	22	38	22	38	29	8.1
Benz(a)anthracene	8.0	12	10	2.0	8.7	7.4	13	7.4	13	10	2.9
Chrysene	14	18	16	2.0	10	11	18	10	18	13	4.4
Benzofluoranthenes	20	24	22	2.1	15	15	21	15	21	17	3.5
Benzo(e)pyrene	7.4	9.3	8.3	1.0	6.0	6.1	8.6	6.0	8.6	6.9	1.5
Benzo(a)pyrene	NDR(7.1)	NDR(10)	NDR(10)		6.2	5.4	10	5.4	10	7.2	2.5
Dibenz(ah)anthracene	ND(0.96)	ND(1.8)	ND		NDR(1.0)	NDR(0.81)	NDR(1.3)	NDR(0.81)	NDR(1.3)	NDR	
Indeno(1,2,3-cd)pyrene	7.2	9.0	7.8	1.0	6.4	5.9	6.7	5.9	6.7	6	0.4
Benzo(ghi)perylene	6.6	8.2	7.6	0.9	5.7	5.9	8.2	5.7	8.2	7	1.4
HPAH	130	150	137	11	122	108	170	108	170	133	32
TPAH	158	196	176	19	158	155	226	155	226	180	40.2
TPAH (µg/g)	0.16	0.20	0.18	0.02	0.16	0.15	0.23	0.15	0.23	0.18	0.04
Perylene	12	28	22	8.7	15	14	18	14	18	16	2.1
Surrogate Stds. (% Recovery)											
Naph d-8	55	64	61	4.9	65	57	45	45	65	56	10
Acen d-10	57	66	63	4.9	60	60	46	46	60	55	8.1
Phen d-10	65	69	67	2.1	62	68	54	54	68	61	7.0
Pyr d-10	76	87	83	5.9	75	79	74	74	79	76	2.6
Cry d-12	70	82	75	6.4	72	72	75	72	75	73	1.7
B(a)P d-12	69	88	80	10	71	72	74	71	74	72	1.5
Perylene d-12	72	90	82	9.2	68	69	70	68	70	69	1.0
DiB(ah)A d-14	45	62	51	9.5	56	57	52	52	57	55	2.6
B(ghi)P d-12	54	67	61	6.6	58	58	52	52	58	56	3.5

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VI (E). Raw Data and Descriptive Statistics for Sediment *parental* PAH Concentrations (ng/g, dry wt.): Sooke Basin Open Control Site - Day0 to Day384.

Distance Interval											
Exposure Period/Sampling Station	384OC0.0	384OC0.0	384OC0.0	Min	Max	Mean	Std. Dev.	384OC0.0	384OC0.0 (core)	384OC0.0 (core)	384OC0.0 (core)
Replicate No.	1	2	3					mixed	2-4cm	4-6cm	8-10cm
Batch I.D.	PH-0991	PH-0991	PH-0991	PH-0991				PH-0993	PH-0990	PH-0990	PH-0991
Lab Sample No.	9611-172	9611-173	9611-174	9611:172-174				9611-175	9611-169	9611-170	9611-171
Moisture Content (%)	33	35	39	33	39	36	3.1	34	36	31	33
Sample Weight (g dry)	6.83	6.75	6.43	6.43	6.83	6.7	0.2	7.2	6.83	7.08	6.73
TOC	0.58	0.62	0.98	0.58	0.98	0.73	0.2	0.63			
Naphthalene	5.0	5.0	7.5	5.0	7.5	5.8	1.4	8.8	6.5	5.4	7.6
Acenaphthylene	NDR(1.1)	NDR(1.7)	NDR(1.3)	NDR(1.1)	NDR(1.7)	NDR		2.2	1.3	1.3	2.0
Acenaphthene	1.4	2.6	3	1.4	3.0	2.3	0.8	6.8	2.7	2.0	0.98
Fluorene	4.2	5.7	6.6	4.2	6.6	5.5	1.2	9.8	4.9	4.4	3.9
Phenanthrene	14	24	22	14	24	20	5.3	24	12	12	18
Anthracene	3.5	4.9	7.7	3.5	7.7	5.4	2.1	5.9	3.6	2.7	2.9
LPAH	28	42	47	28	47	39	10	58	31	28	35
Fluoranthene	31	48	48	31	48	42	9.8	43	41	34	30
Pyrene	22	38	37	22	38	32	9.0	33	28	26	28
Benz(a)anthracene	8.8	14	16	8.8	16	13	3.7	13	9.1	8.7	11
Chrysene	12	19	18	12	19	16	3.8	18	13	11	14
Benzofluoranthenes	19	24	28	19	28	24	4.5	21	18	16	24
Benzo(e)pyrene	7.5	9.9	11	7.5	11	9.5	1.8	8.4	7.1	6.7	10
Benzo(a)pyrene	10	13	16	10	16	13	3.0	19	8.8	8.6	14
Dibenz(ah)anthracene	1.2	1.1	1.9	1.1	1.9	1.4	0.4	1.1	1.1	1.5	1.9
Indeno(1,2,3-cd)pyrene	7.4	9.2	11	7.4	11	9.2	1.8	8.3	6.9	6.9	12
Benzo(ghi)perylene	6.8	8.2	9.2	6.8	9.2	8.1	1.2	7.6	6.5	6.3	12
HPAH	126	184	196	126	196	169	38	172	140	126	157
TPAH	154	227	243	154	243	208	47	230	171	154	192
TPAH (µg/g)	0.14	0.23	0.24	0.14	0.24	0.20	0.05	0.23	0.17	0.15	0.19
Perylene	18	18	20	18	20	19	1.2	11	16	14	20
Surrogate Stds. (% Recovery)											
Naph d-8	100	110	100	100	110	103	5.8	63	94	94	110
Acen d-10	120	110	110	110	120	113	5.8	66	98	96	120
Phen d-10	98	100	94	94	100	98	3.0	81	97	100	98
Pyr d-10	90	84	87	84	90	87	3.0	89	92	95	88
Cry d-12	80	75	81	75	81	78	3.2	80	86	87	77
B(a)P d-12	94	89	96	89	96	93	4.0	100	100	98	92
Perylene d-12	93	85	93	85	93	90	4.8	91	94	92	92
DiB(ah)A d-14	88	80	95	80	95	88	7.5	83	96	84	96
B(ghi)P d-12	86	86	94	86	94	88	4.5	77	92	79	93

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX VII

Raw Data and Descriptive Statistics for Surface Sediment *alkylated* PAH and Dibenzofuran Concentrations -

Day0 to Day384

A. Weathered Piling Treatment Site (WP)

B. BMP Piling Treatment Site (BMP)

C. Open Control Site (OC)

APPENDIX VII (A)

Raw Data and Descriptive Statistics for Surface Sediment *alkylated* PAH and Dibenzofuran Concentrations -

Day0 to Day384

Weathered Piling Treatment Site (WP)

Appendix VII (A) . Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval	5 Metres			2 Metres							
Exposure Period/Sampling Station	384WP5.0	384WP5.0	384WP5.0	14WP2.0			180WP2.0	180WP2.0	180WP2.0	180WP2.0	
Replicate No.	1A	1B	mean	1A	1B	mean	1	2	3	Min	Max
Batch I.D.	PH-0993	PH-0993	PH-0993	PH-0827	PH-0827						
Lab Sample No.	9611-151A	9611-151B	9611-151	2891-67A	2891-67B	2891-67	9611-39	9611-40	9611-41	9611:39 - 41	
Moisture Content (%)	35	35	35	44	43	44	42	42	38	38	42
Sample Weight (g dry)	6.68	6.66	6.67	5.7	5.8	5.8	5.8	6.0	6.7	5.8	6.7
TOC (%)			1.52			1.24	1.98	1.29	0.75	0.8	2.0
C1 naphthalenes	10	11	11	20	18	19	84	14	25	14	84
C2 naphthalenes	19	18	19	32	30	31	69	26	30	26	69
C3 naphthalenes	13	18	16	28	26	27	54	21	28	21	54
C4 naphthalenes	0.66	7.3	4.0	7.5	10	8.8	25	7.9	16	7.9	25
C5 naphthalenes				ND(0.15)	ND(0.15)	ND(0.15)					
C1 phen,anth	44	150	97	150	160	155	360	210	320	210	360
C2 phen,anth	46	190	118	140	160	150	250	230	310	230	310
C3 phen,anth	27	130	79	32	56	44	68	110	130	68	130
C4 phen,anth	6.6	39	23	8.3	47	28	24	48	58	24	58
Retene				8.3	47	28					
C5 phen,anth				ND(0.16)	8.9	8.9					
C1 fluor,pyrenes				160	170	165					
C2 fluor,pyrenes				56	61	58.5					
C3 fluor,pyrenes				ND(0.44)	ND(0.44)	ND(0.44)					
C4 fluor,pyrenes				ND(0.44)	ND(0.44)	ND(0.44)					
C5 fluor,pyrenes				ND(0.64)	ND(0.63)	ND(0.63)					
Dibenzothiophene	4.8	9.9	7.4	33	34	34	62	29	34	29	62
C1 dibenzothiophene	2.3	7.2	4.8	10	10	10	20	12	17	12	20
C2 dibenzothiophene	1.5	7.2	4.4	4.6	4.9	4.8	17	17	23.0	17	23
Dibenzofuran	10	11	11	54	51	53					
Surrogate Stds. (% Recovery)											
2-Methylnaphthalene	71	75	73	57	56	57	37	41	39		
Dibenzofuran d-8	76	81	79	69	67	68					

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (A) . Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval				0.5 Metres						
Exposure Period/Sampling Station	180WP2.0		384WP2.0	BWP0.5	BWP0.5	BWP0.5		BWP0.5		14WP0.5
Replicate No.	Mean	Std. Dev.	mixed	1	2	Min	Max	Mean	Std. Dev.	1 (Transect #4
Batch I.D.			PH-0993	PH-0814	PH-0814	PH-0814				PH-0827
Lab Sample No.			9611-150	2891-32	2891-33	2891:32-33				2891-70
Moisture Content (%)	41	2.3	37	43	42	42	43	42	0.6	44
Sample Weight (g dry)	6.2	0.5	6.45	5.8	7.5	5.8	7.5	6.4	1.0	5.7
TOC (%)	1.34	0.6	0.7	1.16	0.84	0.8	1.2	0.97	0.2	1.33
C1 naphthalenes	41	38	27	13	11	11	13	12	1.4	240
C2 naphthalenes	42	24	120	19	19	19	19	19	0.0	590
C3 naphthalenes	34	17	140	18	16	16	18	17	1.4	530
C4 naphthalenes	16	8.6	81	11	5.8	5.8	11	8.4	3.7	310
C5 naphthalenes				0.6	0.42	0.42	0.6	0.51	0.1	ND(1.8)
C1 phen,anth	297	78	2200	34	30	30	34	32	2.8	5900
C2 phen,anth	263	42	3300	41	34	34	41	37.5	4.9	4200
C3 phen,anth	103	32	2500	17	17	17	17	17	0.0	1300
C4 phen,anth	43	17	930	8.4	10	8.4	10	9.2	1.1	NDR(31)
Retene				8.4	10	8.4	10	9.2	1.1	NDR(31)
C5 phen,anth				ND(0.24)	ND(0.21)	ND	ND	ND(0.21)		ND(1.6)
C1 fluor,pyrenes				22	21	21	22	21.5	0.7	9300
C2 fluor,pyrenes				ND(0.2)	ND(0.17)	ND	ND	ND(0.17)		2800
C3 fluor,pyrenes				ND(0.65)	ND(0.52)	ND	ND	ND(0.52)		760
C4 fluor,pyrenes				ND(0.71)	ND(0.57)	ND	ND	ND(0.57)		ND(4.8)
C5 fluor,pyrenes				ND(0.95)	ND(0.76)	ND	ND	ND(0.76)		ND(7.0)
Dibenzothiophene	42	18	340	NDR(1.5)	NDR(1.2)	NDR(1.2)	NDR(1.5)	NDR(1.5)		NDR(940)
C1 dibenzothiophene	16	4.0	120	2.8	2.2	2.2	2.8	2.5	0.4	280
C2 dibenzothiophene	19	3.5	110	2.6	2.3	2.3	2.6	2.45	0.2	180
Dibenzofuran			230	2.9	2.6	2.6	2.9	2.8	0.2	1300
Surrogate Stds. (% Recovery)										
2-Methylnaphthalene	39	2.0	92	66	59	59	66	63	4.9	56
Dibenzofuran d-8			100	78	70	70	70	70	0.0	99

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (A) . Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval									
Exposure Period/Sampling Station	14WP0.5 (bioassay)	180WP0.5	180WP0.5	180WP0.5	180WP0.5				384WP0.5
Replicate No.	mixed	1 (Transect 3)	2 (Transect 3)	3 (Transect 3)	Min (Transect 3)	Max	Mean	Std. Dev.	mixed
Batch I.D.	PH-0861	PH-0827	PH-0827	PH-0845					PH-0993
Lab Sample No.	2891-115	9611-43	9611-44	9611-45	9611:43-45				9611-146
Moisture Content (%)	35	34	42	38	34	42	38	4.0	35
Sample Weight (g dry)	6.1	6.4	6.1	6.4	6.1	6.4	6.3	0.2	6.79
TOC (%)		1.3	1.5	1.0	1.0	1.5	1.3	0.2	0.53
C1 naphthalenes	18	44	46	27	27	46	39	10	38
C2 naphthalenes	25	66	73	39	39	73	59	18	31
C3 naphthalenes	20	46	80	33	33	80	53	24	17
C4 naphthalenes	1.3	24	72	22	22	72	39	28	ND
C5 naphthalenes	ND(0.35)								
C1 phen,anth	74	740	3000	450	450	3000	1397	1396	100
C2 phen,anth	51	560	1800	500	500	1800	953	734	130
C3 phen,anth	23	260	1100	350	260	1100	570	461	77
C4 phen,anth	7.7	130	520	180	130	520	277	212	10
Retene	7.7								
C5 phen,anth									
C1 fluor,pyrenes									
C2 fluor,pyrenes									
C3 fluor,pyrenes									
C4 fluor,pyrenes									
C5 fluor,pyrenes									
Dibenzothiophene	NDR(14)	130	430	73	73	430	211	192	19
C1 dibenzothiophene	3.9	44	170	26	26	170	80	78	5.2
C2 dibenzothiophene	2.4	43	150	36	36	150	76	64	4.0
Dibenzofuran		160	230	99	99	230	163	66	44
Surrogate Stds. (% Recovery)									
2-Methylnaphthalene	44	34	41	38			38		83
Dibenzofuran d-8									88

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (A) . Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin Weathered Piling Site - Day0 to Day384.

Distance Interval	0.0 Metres	2.0 Metres (Upstream)	28 Metres (Upstream)			
Exposure Period/Sampling Station	384WP0.0	14WP2.0	14WP28 (BP50)			384WP28 (BP50)
Replicate No.	mixed	1	1A	1B	mean	mixed
Batch I.D.	PH-0981	PH-0827	PH-0861	PH-0861		PH-0993
Lab Sample No.	9611-80	2891-73	2891-117A	2891-117B	2891-117	9611-161
Moisture Content (%)	38	44	45	43	44	40
Sample Weight (g dry)	6.8	5.8	5.6	5.6	5.6	6.31
TOC (%)		1.2				0.82
C1 naphthalenes	47	190	22	18	20	12
C2 naphthalenes	97	120	37	34	36	23
C3 naphthalenes	110	47	26	24	25	17
C4 naphthalenes	68	13	4.8	3.3	4.1	3.0
C5 naphthalenes		ND(0.13)	ND(0.79)	ND(0.52)	ND(0.52)	
C1 phen,anth	1900	120	100	92	96	63
C2 phen,anth	2200	100	67	50	59	70
C3 phen,anth	1000	31	34	28	31	29
C4 phen,anth	35	NDR(7.7)	14	8.9	11.5	30
Retene		NDR(7.7)	14	8.9	11.5	
C5 phen,anth		ND(0.14)				
C1 fluor,pyrenes		110				
C2 fluor,pyrenes		43				
C3 fluor,pyrenes		ND(0.36)				
C4 fluor,pyrenes		ND(0.36)				
C5 fluor,pyrenes		ND(0.52)				
Dibenzothiophene	190	38	17	16	16.5	NDR(3.8)
C1 dibenzothiophene	81	7.7	5.6	4.7	5.2	2.6
C2 dibenzothiophene	88	3.0	3.3	2.5	2.9	1.8
Dibenzofuran	190	160				6.4
Surrogate Stds. (% Recovery)						
2-Methylnaphthalene	71	63	46	56	51	75
Dibenzofuran d-8	85	51				84

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX VII (B)

Raw Data and Descriptive Statistics for Surface Sediment *alkylated* PAH and Dibenzofuran Concentrations -

Day0 to Day384

BMP Piling Treatment Site (BMP)

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval	50 Metres				30 Metres		10 Metres		
Exposure Period/Sampling Station	14BP50 (WP28)			384BP50 (WP28)	384BP30	384BP20	14BP10	14BP10	14BP10
Replicate No.	1A	1B	mean	mixed	mixed	mixed	1	2	3
Batch I.D.	PH-0861	PH-0861		PH-0993	PH-0983	PH-0983	PH-0825	PH-0854	PH-0854
Lab Sample No.	2891-117A	2891-117B	2891-117	9611-161	9611-122	9611-120	2891-49	2891-98	2891-99
Moisture Content (%)	45	43	44	40	38	46	41	38	38
Sample Weight (g dry)	5.6	5.6	5.6	6.31	6.4	5.6	6.2	5.9	6.4
TOC				0.82	0.61	0.95	1.19		
C1 naphthalenes	22	18	20	12	16	23	15	11	12
C2 naphthalenes	37	34	36	23	23	34	17	34	17
C3 naphthalenes	26	24	25	17	11	18	15	13	14
C4 naphthalenes	4.8	3.3	4.1	3.0	ND	ND	4.9	ND(0.12)	ND(0.08)
C5 naphthalenes	ND(0.79)	ND(0.52)	ND(0.52)				ND(0.2)	ND(0.15)	ND(0.11)
C1 phen,anth	100	92	96	63	31	47	48	26	21
C2 phen,anth	67	50	59	70	28	57	32	18	16
C3 phen,anth	34	28	31	29	7.6	15	14	5.3	5.2
C4 phen,anth	14	8.9	11	30	6.2	14	6.6	5.6	5.1
Retene	14	8.9	11				6.6	5.6	5.1
C5 phen,anth							ND(0.24)	ND(0.24)	ND(0.27)
C1 fluor,pyrenes							41	16	15
C2 fluor,pyrenes							ND(0.2)	4.6	4.7
C3 fluor,pyrenes							ND(0.52)	ND(0.35)	ND(0.42)
C4 fluor,pyrenes							ND(0.57)	ND(0.41)	ND(0.49)
C5 fluor,pyrenes							ND(0.77)	ND(0.51)	ND(0.60)
Dibenzothiophene	17	16	17	NDR(3.8)	NDR(2.3)	4.9	5.1	2.0	1.5
C1 dibenzothiophene	5.6	4.7	5.2	2.6	1.5	2.2	2.8	1.1	0.83
C2 dibenzothiophene	3.3	2.5	2.9	1.8	ND	1.5	2.2	ND(0.07)	ND(0.06)
Dibenzofuran				6.4	5.2	15	12	4.6	3.0
Surrogate Stds. (% Recovery)									
2-Methylnaphthalene	46	56	51	75	64	66	68		
Dibenzofuran d-8				84	74	77	81		

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval						7.5 Metres	5.0 Metres		
Exposure Period/Sampling Station	14BP10				384BP10	384BP7.5	14BP5.0		
Replicate No.	Min.	Max	Mean	Std. Dev.	mixed	mixed	2	3	Min
Batch I.D.					PH-0983	PH-0983	PH-0854	PH-0854	
Lab Sample No.	2891:49, 98-99				9611-118	9611-114	2891-96	2891-97	2891:51,96-97
Moisture Content (%)	38	41	39	1.7	32	40	42	46	38
Sample Weight (g dry)	5.9	6.4	6.2	0.3	6.9	6.1	5.8	5.8	5.8
TOC			1.2		0.8	0.59			
C1 naphthalenes	11	15	13	2.1	26	27	41	29	29
C2 naphthalenes	17	34	23	9.8	160	32	28	23	23
C3 naphthalenes	13	15	14	1.0	22	20	20	19	19
C4 naphthalenes	ND(0.08)	4.9	4.9	---	ND	ND	ND(0.11)	ND(0.09)	ND(0.09)
C5 naphthalenes	ND(0.11)	ND(0.2)	ND(0.11)	---			ND(0.14)	ND(0.11)	ND(0.11)
C1 phen,anth	21	48	32	14	100	150	78	30	30
C2 phen,anth	16	32	22	8.7	90	110	43	25	25
C3 phen,anth	5.2	14	8.2	5.1	34	30	12	8.7	8.7
C4 phen,anth	5.1	6.6	5.8	0.8	19	6.6	7.8	7.5	7.5
Retene	5.1	6.6	5.8	0.8			7.8	7.5	7.5
C5 phen,anth	ND(0.24)	ND(0.27)	ND(0.24)				ND(0.27)	ND(0.25)	ND(0.25)
C1 fluor,pyrenes	15	41	24	15			76	19	19
C2 fluor,pyrenes	4.6	4.7	4.7	0.07			17	9.2	9.2
C3 fluor,pyrenes	ND(0.35)	ND(0.52)	ND(0.35)	---			13	ND(0.38)	13
C4 fluor,pyrenes	ND(0.41)	ND(0.57)	ND(0.41)	---			ND(0.44)	ND(0.45)	ND(0.44)
C5 fluor,pyrenes	ND(0.51)	ND(0.77)	ND(0.51)	---			ND(0.54)	ND(0.56)	
Dibenzothiophene	1.5	5.1	2.9	2.0	18	15	12	2.8	2.8
C1 dibenzothiophene	0.8	2.8	1.6	1.1	3.4	5.6	2.9	1.4	1.4
C2 dibenzothiophene	ND(0.06)	2.2	2.2	---	1.7	3.7	ND(0.07)	ND(0.06)	ND(0.06)
Dibenzofuran	3.0	12	6.5	4.8	47	34	23	8.8	8.8
Surrogate Stds. (% Recovery)									
2-Methylnaphthalene	68	68	68	---	65	72	41	45	41
Dibenzofuran d-8	81	81	81	---	75	83	49	50	49

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval									
Exposure Period/Sampling Station	**14BP5.0**			**180BP5.0**					
Replicate No.	**Max**	**Mean**	**Std. Dev.**	**1**	**2**	**3**	**Min**	**Max**	**Mean**
Batch I.D.				**PH-0897**	**PH-0896**	**PH-0896**			
Lab Sample No.	**2891:51,96-97**	**2891:51,96-97**		**9611-07**	**9611-08**	**9611-09**	**9611:07-09**		
Moisture Content (%)	**46**	**42**	**4.0**	**38**	**39**	**38**	**38**	**39**	**38**
Sample Weight (g dry)	**6.3**	**6.0**	**0.3**	**6.8**	**6.5**	**6.6**	**6.5**	**6.8**	**6.6**
TOC		**1.3**	**0.0**	**0.58**	**1.27**	**0.93**	**0.58**	**1.27**	**0.93**
C1 naphthalenes	**41**	**35**	**8.5**	**24**	**18**	**19**	**18**	**24**	**20**
C2 naphthalenes	**28**	**26**	**3.5**	**26**	**21**	**26**	**21**	**26**	**24**
C3 naphthalenes	**20**	**20**	**0.7**	**19**	**13**	**17**	**13**	**19**	**16**
C4 naphthalenes	**ND(0.11)**	**ND(0.09)**		**7.7**	**3.2**	**4.1**	**3.2**	**7.7**	**5.0**
C5 naphthalenes	**ND(0.14)**	**ND(0.11)**							
C1 phen,anth	**78**	**54**	**34**	**50**	**39**	**79**	**39**	**79**	**56**
C2 phen,anth	**43**	**34**	**13**	**44**	**34**	**55**	**34**	**55**	**44**
C3 phen,anth	**12**	**10**	**2.3**	**17**	**14**	**19**	**14**	**19**	**16.7**
C4 phen,anth	**7.8**	**7.7**	**0.2**	**7.3**	**9.3**	**6.0**	**6.0**	**9.3**	**7.5**
Retene	**7.8**	**7.7**	**0.2**						
C5 phen,anth	**ND(0.27)**	**ND(0.25)**							
C1 fluor,pyrenes	**76**	**48**	**40**						
C2 fluor,pyrenes	**17**	**13**	**5.5**						
C3 fluor,pyrenes	**13**	**13**							
C4 fluor,pyrenes	**ND(0.45)**	**ND(0.44)**							
C5 fluor,pyrenes		**ND(0.54)**							
Dibenzothiophene	**12**	**7.4**	**6.5**	**10**	**5.1**	**14**	**5.1**	**14**	**9.7**
C1 dibenzothiophene	**2.9**	**2.2**	**1.1**	**3.1**	**1.9**	**4.0**	**1.9**	**4.0**	**3.0**
C2 dibenzothiophene	**ND(0.07)**	**ND**		**2.2**	**1.8**	**2.6**	**1.8**	**2.6**	**2.2**
Dibenzofuran	**23**	**16**	**10**	**22**	**15**	**32**	**15**	**32**	**23**
Surrogate Stds. (% Recovery)									
2-Methylnaphthalene	**45**	**43**	**2.8**	**31**	**47**	**42**	**31**	**47**	**40**
Dibenzofuran d-8	**50**	**50**	**0.7**	**53**	**68**	**58**	**53**	**68**	**60**

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval			3.5 Metres	3.0 Metres			2.5 Metres	2.0 Metres		
Exposure Period/Sampling Station	180BP5.0	384BP5.0	384BP3.5	384BP3.0	384BP3.0	384BP3.0	384BP2.5	BBP2.0	384BP2.0	384BP1.5
Replicate No.	Std. Dev.	mixed	mixed	mixed (A)	mixed (B)	mean	mixed	1	mixed	mixed
Batch I.D.		PH-0983	PH-0983	PH-0983	PH-0983	PH-0983	PH-0981	PH-0825	PH-0981	PH-0981
Lab Sample No.		9611-112	9611-105	9611-103A	9611-103B	9611-103	9611-101	2891-25	9611-99	9611-94
Moisture Content (%)	0.6	41	34	37	36	37	34	43	34	34
Sample Weight (g dry)	0.1	6.1	6.8	6.31	6.57	6.44	7.0	5.8	7.1	6.7
TOC	0.3	0.67	0.85			0.75	0.49	0.99	0.66	0.53
C1 naphthalenes	3.2	36	40	27	34	31	32	12	31	21
C2 naphthalenes	2.9	46	39	36	45	41	62	17	36	24
C3 naphthalenes	3.1	26	20	18	21	20	25	17	27	16
C4 naphthalenes	2.4	ND	ND	ND	ND	ND	5.1	6.3	8.0	ND
C5 naphthalenes								ND(0.22)		
C1 phen,anth	21	180	120	110	160	135	190	26	360	98
C2 phen,anth	11	140	91	79	110	95	150	32	300	79
C3 phen,anth	2.5	40	31	19	44	32	53	11	170	35
C4 phen,anth	1.7	6.7	6.6	4.9	6.5	5.7	6.2	8.4	8.8	8.4
Retene								8.4		
C5 phen,anth								ND(0.3)		
C1 fluor,pyrenes								14		
C2 fluor,pyrenes								9.6		
C3 fluor,pyrenes								ND(0.97)		
C4 fluor,pyrenes								ND(1.1)		
C5 fluor,pyrenes								ND(1.4)		
Dibenzothiophene	4.5	26	19	19	23	21	30	NDR(1.3)	35	11
C1 dibenzothiophene	1.1	7.5	4.2	3.6	5.2	4.4	6.8	2.4	9.9	3.6
C2 dibenzothiophene	0.4	4.8	2.7	1.7	3.2	2.5	4.9	1.9	9.2	2.0
Dibenzofuran	8.5	62	54	51	60		70	2.4	72	25
Surrogate Stds. (% Recovery)										
2-Methylnaphthalene	8.2	68	70	76	67	72	75	67	73	75
Dibenzofuran d-8	7.6	72	78	85	77	85	84	89	82	85

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval	1.0 Metres				0.5 Metres					
Exposure Period/Sampling Station	14BP1.0	14BP1.0		384BP1.0	BBP0.5					
Replicate No.	1A	1B	mean	mixed	1	2	3	Min	Max	Mean
Batch I.D.	PH-0825	PH-0825		PH-0981	PH-0827	PH-0827	PH-0827			
Lab Sample No.	2891-57A	2891-57B	2891-57	9611-92	2891-42	2891-43	2891-44	2891:42-44	2891:42-44	2891:42-44
Moisture Content (%)	38	38	38	33	47	44	34	34	47	42
Sample Weight (g dry)	6.7	6.4	6.5	7.1	5.4	5.6	6.7	5.4	6.7	5.9
TOC			0.92	0.53	0.90	0.95	0.84	0.8	0.95	0.88
C1 naphthalenes	520	530	525	45	11	9.7	6.7	6.7	11	9.1
C2 naphthalenes	170	160	165	50	16	16	11	11	16	14
C3 naphthalenes	56	58	57	35	15	15	10	10	15	13
C4 naphthalenes	13	16	15	14	2.8	5.4	ND(0.1)	0.1	5.4	4.1
C5 naphthalenes	ND(0.17)	ND(0.17)	ND(0.17)		0.4	0.15	0.89	0.15	0.9	0.48
C1 phen,anth	230	210	220	390	33	26	16	16	33	25
C2 phen,anth	91	99	95	330	55	48	30	30	55	44
C3 phen,anth	34	40	37	170	13	10	5.8	6	13	9.6
C4 phen,anth	6.5	14	10	11	7.2	7.2	5.6	6	7	6.7
Retene	6.5	14	10		7.2	7.2	5.5	6	7	6.6
C5 phen,anth	ND(0.22)	ND(0.24)	ND(0.24)		ND(0.14)	ND(0.13)	ND(0.11)	0	0	ND(0.11)
C1 fluor,pyrenes	180	170	175		24	20	19	19	24	21
C2 fluor,pyrenes	58	54	56		24	12	10	10	24	15
C3 fluor,pyrenes	29	32	31		ND(0.34)	ND(0.32)	ND(0.26)	ND(0.26)	ND(0.34)	ND(0.26)
C4 fluor,pyrenes	ND(0.55)	ND(0.63)	ND(0.63)		ND(0.34)	ND(0.32)	ND(0.26)	ND(0.26)	ND(0.34)	ND(0.34)
C5 fluor,pyrenes	ND(0.74)	ND(0.84)	ND(0.84)		ND(0.49)	ND(0.47)	ND(0.38)	ND(0.38)	ND(0.49)	ND(0.49)
Dibenzothiophene	77	73	75	52	NDR(1.2)	NDR(0.99)	NDR(0.55)	NDR(0.55)	NDR(1.2)	NDR(1.2)
C1 dibenzothiophene	14	13	14	13	1.9	1.7	0.87	0.9	1.9	1.5
C2 dibenzothiophene	6.4	5.6	6.0	10	11	0.9	0.33	0.3	11	4.1
Dibenzofuran	310	310	310	100	2.3	2.2	1.6	1.6	2.3	2.0
Surrogate Stds. (% Recovery)										
2-Methylnaphthalene	63	74	69	89	55	51	51	51	55	52
Dibenzofuran d-8	78	90	84	78	65	63	61	61	65	63

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval										
Exposure Period/Sampling Station	**BBP0.5**	**14BP0.5**								
Replicate No.	**Std. Dev.**	**1**	**2**	**2**	**mean**	**3**	**Min**	**Max**	**Mean**	**Std. Dev.**
Batch I.D.		**PH-0825**	**PH-0854**	**PH-0854**		**PH-0854**				
Lab Sample No.		**2891-58**	**2891-94A**	**2891-94B**	**2891-94**	**2891-95**	**2891:58,94-95**	**2891:58,94-95**	**2891:58,94-95**	
Moisture Content (%)	**6.8**	**36**	**38**	**38**	**38**	**42**	**36**	**42**	**39**	**3.1**
Sample Weight (g dry)	**0.7**	**6.7**	**6.9**	**5.9**	**6.4**	**5.7**	**5.7**	**6.9**	**6.3**	**0.6**
TOC	**0.1**	**0.83**							**0.83**	
C1 naphthalenes	**2.2**	**220**	**430**	**300**	**365**	**770**	**220**	**770**	**452**	**285**
C2 naphthalenes	**2.9**	**87**	**330**	**150**	**240**	**310**	**87**	**330**	**212**	**114**
C3 naphthalenes	**2.9**	**37**	**130**	**62**	**96**	**110**	**37**	**130**	**81**	**39**
C4 naphthalenes	**1.8**	**14**	**24**	**29**	**27**	**24**	**14**	**29**	**22**	**6.6**
C5 naphthalenes	**0.4**	**ND(0.16)**	**ND(0.08)**	**6.7**	**6.7**	**ND(0.26)**	**6.7**	**6.7**	**6.7**	
C1 phen,anth	**8.5**	**180**	**740**	**230**	**485**	**570**	**180**	**740**	**412**	**205**
C2 phen,anth	**13**	**95**	**270**	**100**	**185**	**400**	**95**	**400**	**227**	**157**
C3 phen,anth	**3.6**	**27**	**54**	**24**	**39**	**55**	**24**	**55**	**40**	**14**
C4 phen,anth	**0.9**	**9.8**	**5.7**	**4.8**	**5.3**	**5.3**	**4.8**	**10**	**6.8**	**2.6**
Retene	**1.0**	**9.8**	**5.7**	**4.6**	**5.2**	**5.3**	**4.6**	**10**	**6.8**	**2.6**
C5 phen,anth		**ND(0.22)**	**ND(0.17)**	**ND(0.23)**	**ND(0.17)**	**ND(0.48)**	**ND(0.17)**	**ND(0.48)**	**ND(0.17)**	
C1 fluor,pyrenes	**2.6**	**160**	**780**	**210**	**495**	**560**	**160**	**780**	**405**	**215**
C2 fluor,pyrenes	**7.6**	**53**	**170**	**43**	**107**	**160**	**43**	**170**	**107**	**54**
C3 fluor,pyrenes		**ND(0.57)**	**72**	**21**	**47**	**56**	**21**	**72**	**51**	**6.7**
C4 fluor,pyrenes		**ND(0.63)**	**ND(0.23)**	**ND(0.37)**	**ND(0.23)**	**ND(0.92)**	**ND(0.23)**	**ND(0.92)**	**ND(0.23)**	
C5 fluor,pyrenes		**ND(0.84)**	**ND(0.28)**	**ND(0.45)**	**ND(0.28)**	**ND(1.1)**	**ND(0.28)**	**ND(1.1)**	**ND(0.28)**	
Dibenzothiophene		**51**	**270**	**67**	**169**	**220**	**51**	**270**	**147**	**87**
C1 dibenzothiophene	**0.5**	**10**	**28**	**12**	**20**	**32**	**10**	**32**	**21**	**11**
C2 dibenzothiophene	**6.0**	**5.0**	**9.2**	**4.9**	**7.1**	**11**	**4.9**	**11**	**7.7**	**3.0**
Dibenzofuran	**0.4**	**170**	**870**	**230**	**550**	**810**	**170**	**870**	**510**	**322**
Surrogate Stds. (% Recovery)										
2-Methylnaphthalene	**2.3**	**75**	**57**	**46**	**52**	**110**	**46**	**110**	**79**	**29**
Dibenzofuran d-8	**2.0**	**90**	**58**	**51**	**55**	**49**	**49**	**90**	**65**	**22**

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval										
Exposure Period/Sampling Station	180BP0.5							384BP0.5	384BP0.5	
Replicate No.	1	2	3	Min	Max	Mean	Std. Dev.	mixed	mixed	mean
Batch I.D.	PH-0897	PH-0897	PH-0897					PH-0981	PH-0981	PH-0981
Lab Sample No.	9611-18	9611-19	9611-20	9611:18-20	9611:18-20	9611:18-20	9611:18-20	9611-87A	9611-87B	9611-87
Moisture Content (%)	38	33	38	33	38	36	2.9	35	34	35
Sample Weight (g dry)	6.9	7.2	6.8	6.8	7.2	7.0	0.2	6.9	7.2	7.0
TOC	0.91	0.84	0.98	0.84	0.98	0.91	0.1			0.47
C1 naphthalenes	200	250	250	200	250	233	29	58	60	59
C2 naphthalenes	210	150	190	150	210	183	31	52	57	55
C3 naphthalenes	120	73	100	73	120	98	24	49	40	45
C4 naphthalenes	43	28	36	28	43	36	7.5	23	23	23
C5 naphthalenes										
C1 phen,anth	740	440	570	440	740	583	150	730	610	670
C2 phen,anth	410	260	330	260	410	333	75	640	560	600
C3 phen,anth	110	73	89	73	110	91	19	240	230	235
C4 phen,anth	32	23	26	23	32	27	4.6	NDR(10)	NDR(14)	NDR(14)
Retene										
C5 phen,anth										
C1 fluor,pyrenes										
C2 fluor,pyrenes										
C3 fluor,pyrenes										
C4 fluor,pyrenes										
C5 fluor,pyrenes										
Dibenzothiophene	170	100	130	100	170	133	35	77	84	81
C1 dibenzothiophene	40	24	30	24	40	31	8.1	26	18	22
C2 dibenzothiophene	23	14	18	14	23	18	4.5	22	16	19
Dibenzofuran	400	310	390	310	400	367	49	120	120	120
Surrogate Stds. (% Recovery)										
2-Methylnaphthalene	49	58	49	49	58	52	5.2	69	73	71
Dibenzofuran d-8	78	89	80	78	89	82	5.9	81	86	84

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval	0.0 Metres	2.0 Metres (Upstream)							5.0 Metres (Upstream)	
Exposure Period/Sampling Station	384BP0.0	14BP2.0 (Upstream)	14BP2.0 (Upstream)	14BP2.0 (Upstream)					14BP5.0 (Upstream)	
Replicate No.	mixed	1	2	3	Min	Max	Mean	Std. Dev.	1	2
Batch I.D.	PH-0981	PH-0860	PH-0860	PH-0860					PH-0860	PH-0860
Lab Sample No.	9611-79	2891-104	2891-105	2891-106	2891:104-106				2891-107	2891-108
Moisture Content (%)	33	41	34	34	34	41	36	4.0	38	39
Sample Weight (g dry)	7.2	5.9	6.8	6.5	5.9	6.8	6.4	0.5	5.9	6.1
TOC	0.59									
C1 naphthalenes	99	110	58	180	58	180	116	61	260	1100
C2 naphthalenes	110	52	52	54	52	54	53	1.2	130	380
C3 naphthalenes	90	29	42	200	29	200	90	95	58	120
C4 naphthalenes	130	7.3	12	0.64	0.6	12	6.6	5.7	6.6	30
C5 naphthalenes										
C1 phen,anth	1200	100	540	90	90	540	243	257	280	530
C2 phen,anth	1300	61	190	38	38	190	96	82	120	250
C3 phen,anth	460	25	54	18	18	54	32	19	36	72
C4 phen,anth	NDR(18)	11	5.7	9.3	5.7	11	8.7	2.7	24	10
Retene										
C5 phen,anth										
C1 fluor,pyrenes										
C2 fluor,pyrenes										
C3 fluor,pyrenes										
C4 fluor,pyrenes										
C5 fluor,pyrenes										
Dibenzothiophene	170	NDR(26)	140	24	24	140	82	82	79	150
C1 dibenzothiophene	51	6.1	24	4.0	4.0	24	11	11	14	28
C2 dibenzothiophene	38	2.6	9.5	1.6	1.6	10	4.6	4.3	5.9	12
Dibenzofuran	260									
Surrogate Stds. (% Recovery)										
2-Methylnaphthalene	79	58	44	44	44	58	49	8.1	42	
Dibenzofuran d-8	91									

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval	5.0 Metres (Upstream)					10 Metres (Upstream)				
Exposure Period/Sampling Station		14BP5.0 (Upstream)				14BP10 (upstream)	14BP10 (upstream)	14BP10 (upstream)		
Replicate No.	3	Min	Max	Mean	Std. Dev.	1	2	3	Min	Max
Batch I.D.	PH-0860					PH-0861	PH-0861	PH-0861		
Lab Sample No.	2891-109	2891:107 - 109				2891-110	2891-111	2891-112	2891:110-112	2891:110-112
Moisture Content (%)	40	38	40	39	1.0	42	38	38	38	42
Sample Weight (g dry)	5.9	5.9	6.1	6.0	0.1	5.4	6.1	6.0	5.4	6.1
TOC										
C1 naphthalenes	110	110	1100	490	534	39	12	60	12	60
C2 naphthalenes	62	62	380	191	167	29	17	32	17	32
C3 naphthalenes	35	35	120	71	44	18	14	19	14	19
C4 naphthalenes	4.8	4.8	30	14	14	2.0	ND(0.29)	1.8	1.8	2.0
C5 naphthalenes						ND(0.72)	ND(0.4)	ND(0.62)	ND(0.72)	ND(0.4)
C1 phen,anth	150	150	530	320	193	41	30	53	30	53
C2 phen,anth	70	70	250	147	93	26	22	37	22	37
C3 phen,anth	26	26	72	45	24	9.6	9.4	16	9.4	16
C4 phen,anth	8.5	8.5	24	14	8.5	7.6	7.2	7.8	7.2	7.8
Retene						7.6	7.2	7.8	7.2	7.8
C5 phen,anth										
C1 fluor,pyrenes								7.0	7.0	7.0
C2 fluor,pyrenes								11	11	11
C3 fluor,pyrenes								2.3	2.3	2.3
C4 fluor,pyrenes										
C5 fluor,pyrenes										
Dibenzothiophene	36	36	150	88	58	7.0	NDR(2.3)	NDR(11)	7.0	7.0
C1 dibenzothiophene	8.2	8.2	28	17	10	2.4	1.4	2.9	1.4	2.9
C2 dibenzothiophene	3.9	3.9	12	7.3	4.2	1.5	1.0	1.3	1.0	1.5
Dibenzofuran										
Surrogate Stds. (% Recovery)										
2-Methylnaphthalene	49	42	49	46		46	43	56	43	56
Dibenzofuran d-8										

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix VII (B). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin BMP Piling Site - Day0 to Day384.

Distance Interval			28 Metres (Upstream)	
Exposure Period/Sampling Station	14BP10 (upstream)		14BP28 (MC49)	384BP28 (MC49)
Replicate No.	Mean	Std Dev.		
Batch I.D.			PH-0861	PH-0993
Lab Sample No.	2891:110-112		2891-116	9611-133
Moisture Content (%)	39		40	43
Sample Weight (g dry)	5.8		6.2	5.92
TOC				
C1 naphthalenes	37	24	14	15
C2 naphthalenes	26	7.9	23	28
C3 naphthalenes	17	2.6	18	20
C4 naphthalenes	1.9	0.1	0.85	ND(2.8)
C5 naphthalenes	ND(0.4)	ND(0.4)	ND(0.41)	
C1 phen,anth	41	11.5	35	43
C2 phen,anth	28	7.8	22	64
C3 phen,anth	12	3.8	7.7	27
C4 phen,anth	7.5	0.3	6.6	9.3
Retene	7.5	0.3	6.6	
C5 phen,anth				
C1 fluor,pyrenes	7.0			
C2 fluor,pyrenes	11			
C3 fluor,pyrenes	2.3			
C4 fluor,pyrenes				
C5 fluor,pyrenes				
Dibenzothiophene	6.8	4.4	NDR(6.3)	4.4
C1 dibenzothiophene	2.2	0.8	1.6	2.6
C2 dibenzothiophene	1.3	0.3	1.1	1.5
Dibenzofuran				15
Surrogate Stds. (% Recovery)				
2-Methylnaphthalene			57	86
Dibenzofuran d-8				91

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX VII (C)

Raw Data and Descriptive Statistics for Surface Sediment *alkylated* PAH and Dibenzofuran Concentrations -

Day0 to Day384

C. Open Control Site (OC)

Appendix VII (C). Raw Data and Descriptive Statistics for Sediment *alkylated* PAH and Dibenzofuran Concentrations (ng/g, dry wt.): Sooke Basin Open Control Site - Day0 to Day384.

Distance Interval	0.0 Metres							
Exposure Period/Sampling Station	14OC0.0	14OC0.0	14OC0.0					384OC0.0
Replicate No.	1	2	3	Min	Max	Mean	Std. Dev.	mixed
Batch I.D.	PH-0825	PH-0825	PH-0825					PH-0993
Lab Sample No.	2891-64	2891-65	2891-66					9611-175
Moisture Content (%)	42	43	38	38	43	41	2.6	34
Sample Weight (g dry)	5.9	5.8	6.3	5.8	6.3	6.0	0.3	7.2
TOC	1.1	1.2	0.9	0.9	1.2	1.0	0.2	0.63
C1 naphthalenes	22	12	8.1	8.1	22	14	7.2	15
C2 naphthalenes	17	18	12	12	18	16	3.2	20
C3 naphthalenes	14	15	10	10	15	13	2.6	17
C4 naphthalenes	4.2	4.3	1.4	1.4	4.3	3.3	1.6	7.0
C5 naphthalenes	ND(0.26)	ND(0.25)	ND(0.14)	ND(0.14)	ND(0.26)	ND	---	---
C1 phen,anth	28	30	18	18	30	25	6.4	30
C2 phen,anth	30	35	30	30	35	32	2.9	43
C3 phen,anth	15	13	6.5	6.5	15	12	4.4	19
C4 phen,anth	7.4	8.0	5.0	5.0	8.0	6.8	1.6	7.2
Retene	7.4	8.0	5.0	5.0	8.0	6.8	1.6	---
C5 phen,anth	ND(0.31)	ND(0.31)	ND(0.12)	ND(0.12)	ND(0.31)	ND	na	---
C1 fluor,pyrenes	17	19	17	17	19	18	1.2	---
C2 fluor,pyrenes	ND(0.26)	ND(0.25)	9.6	10	10	9.6	---	---
C3 fluor,pyrenes	ND(0.75)	ND(0.82)	ND(0.33)	ND(0.33)	ND(0.82)	ND	---	---
C4 fluor,pyrenes	ND(0.83)	ND(0.89)	ND(0.33)	ND(0.33)	ND(0.89)	ND	---	---
C5 fluor,pyrenes	ND(1.1)	ND(1.2)	ND(0.47)	ND(0.47)	ND(1.2)	ND	---	---
Dibenzothiophene	NDR(1.7)	NDR(1.8)	NDR(0.89)	NDR(0.89)	NDR(1.8)	NDR(1.8)	---	NDR(1.8)
C1 dibenzothiophene	1.8	2.1	0.74	0.7	2.1	1.5	0.7	1.8
C2 dibenzothiophene	2.0	2.3	ND(0.05)	ND(0.05)	2.3	2.2	0.2	1.3
Dibenzofuran	4.3	3.9	2.3	2.3	4.3	3.5	1.1	5.7
Surrogate Stds.								
2-Methylnaphthalene	63	65	49	49	65	59	8.7	56
Dibenzofuran d-8	74	74	83	74	83	77	5.2	64

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blenk corrected

APPENDIX VIII

Sediment Particle Size Distribution: Sooke Basin -

Day0 to Day384

Appendix VIII. Surface Sediment (0 - 2cm) Particle Size Distribution (%, wet wt.): Sooke Basin - Day0 to Day384.

SAMPLE ID.	STATION	Fine Gravel 1/2"	Very Coarse Sand #10 2.0mm	Silt #230 0.063mm	Clay 4µ
Weathered Piling Site					
9611-154	384WP10		56.7	30.2	13.1
9611-151	384WP5.0 (1)		78.9	14.3	6.8
9611-152	384WP5.0 (2)	1.0	65.7	23.8	9.5
9611-153	384WP5.0 (3)	0.8	61.8	26.7	10.7
	mean	0.9	68.8	21.6	9.0
2891-67	14WP2.0(1)	3.5	68.5	16.4	9.6
2891-68	14WP2.0(2)	3.4	65.6	20.2	1.2
2891-69	14WP2.0(3)	6.7	66.5	17.0	9.8
	mean	4.5	66.9	17.9	6.9
9611-39	180WP2.0(1)	6.1	67.3	18.1	8.5
9611-40	180WP2.0(2)	3.6	73.2	15.9	7.3
9611-41	180WP2.0(3)	1.2	69.3	20.2	9.3
	mean	3.6	69.9	18.1	8.4
9611-147	384WP2.0(1)	0.9	69.2	18.3	11.6
9611-150	384WP2.0 (mixed)	3.8	70.6	14.0	11.6
2891-32	BWP0.5(1)		66.9	26.8	6.3
2891-33	BWP0.5(2)		69.3	24.4	6.3
2891-34	BWP0.5(3)	1.6	67.1	24.3	7.0
	mean	1.6	67.8	25.2	6.5
2891-71	14WP0.5(2)	4.9	63.0	21.6	10.3
2891-72	14WP0.5(3)	3.5	66.2	20.5	9.6
	mean	4.2	64.6	21.1	10.0
9611-43	180WP0.5(1)	6.1	69.9	16.4	7.6
9611-44	180WP0.5(2)	8.8	71.1	13.4	6.7
9611-45	180WP0.5(3)	10.5	69.6	13.6	6.3
	mean	8.5	70.2	14.5	6.9
9611-143	384WP0.5(1)	7.2	73.9	12.1	6.8
9611-146	384WP0.5(1) (mixed)	9.0	69.7	13.4	7.9
9611-80	384WP0.0	21.4	67.1	7.3	4.2
9611-162	384WP0.5 (offshore)	5.5	77.7	10.8	6.0
9611-163	384WP2.0 (offshore)	8.0	60.2	20.0	11.8
9611-164	384WP5.0 (offshore)				
9611-165	384WP10 (offshore)		24.4	50.9	24.7
2891-73	14WP2.0(1) upstream	6.3	65.6	18.0	10.1
2891-74	14WP2.0(2) upstream	2.4	73.9	15.6	8.1
2891-75	14WP2.0(3) upstream	0.5	65.8	22.7	11.0
	mean	3.1	68.4	18.8	9.7
9611-155	384WP2.0 (upstream)	7.1	66.2	16.8	9.9

Appendix VIII. Surface Sediment (0 - 2cm) Particle Size Distribution (%, wet wt.): Sooke Basin - Day0 to Day384.

SAMPLE ID.	STATION	Fine Gravel 1/2"	Very Coarse Sand #10 2.0mm	Silt #230 0.063mm	Clay 4µ
BMP Piling Site					
9611-158	384BP50/WP28	20.0	53.1	16.0	10.9
9611-161	384BP50/WP28 (mixed)	4.5	68.2	17.9	9.4
2891-28	BBP30(1)	1.6	3.8	22.7	5.9
2891-47	14BP30(1)	4.2	70.6	16.0	9.2
9611-1	180BP30(1)	6.5	69.6	16.2	7.7
9611-121	384BP30(1)	1.7	71.7	16.5	10.1
9611-122	384BP30 (mixed)	11.2	67.5	14.3	7.0
2891-48	14BP20(1)	1.7	70.0	18.8	9.5
9611-2	180BP20(1)	19.5	56.5	16.1	7.9
9611-119	384BP20(1)	2.4	66.8	19.6	11.2
9611-120	384BP20 (mixed)	1.8	64.0	23.5	10.7
2891-27	BBP10(1)	10.3	4.8	17.0	4.9
2891-49	14BP10(1)	29.4	50.0	13.2	7.4
9611-3	180BP10(1)	3.7	67.8	19.1	9.4
9611-115	384BP10(1)	16.4	65.6	11.3	6.7
9611-118	384BP10(1) (mixed)	8.5	73.0	11.0	7.5
9611-139	384BP10(1) (offshore)	3.7	39.5	36.4	20.4
2891-50	14BP7.5(1)	5.2	68.8	16.7	9.3
9611-6	180BP7.5(1)	13.8	66.7	13.1	6.4
9611-113	384BP7.5(1)	3.6	64.3	19.5	12.6
9611-114	384BP7.5 (mixed)	2.0	73.6	15.1	9.3
2891-26	BBP5.0(1)	9.8	3.4	13.1	7.0
2891-51	14BP5.0(1)	10.1	69.2	13.7	7.0
9611-7	180BP5.0(1)	4.0	75.7	14.0	6.3
9611-109	384BP5.0(1)	10.2	69.9	12.3	7.6
9611-112	384BP5.0(1) (mixed)	6.1	68.6	15.4	9.9
2891-52	14BP3.5(1)	6.1	65.4	18.3	10.2
9611-11	180BP3.5(1)	12.2	66.7	14.1	7.0
9611-104	384BP3.5(1)	14.8	68.2	10.1	6.9
9611-105	384BP3.5 (mixed)	16.5	64.4	12.4	6.7
2891-53	14BP3.0(1)	22.2	58.1	12.4	7.3
9611-12	180BP3.0(1)	21.3	58.1	13.9	6.7
9611-102	384BP3.0(1)	41.6	47.6	6.8	4.0
9611-103	384BP3.0 (mixed)	8.8	72.5	12.0	6.7
2891-54	14BP2.5(1)	3.8	74.8	14.0	7.4
2891-54 (dupl.)	14BP2.5(1)	3.8	74.2	14.3	7.7
	mean	3.8	74.5	14.2	7.6
9611-13	180BP2.5(1)	21.0	56.0	15.0	8.0
9611-100	384BP2.5(1)	21.0	61.8	10.5	6.7
9611-101	384BP2.5 (mixed)	7.9	74.9	11.1	6.1
2891-25	BBP2.0(1)	4.4	3.0	15.7	10.4
2891-55	14BP2.0(1)	10.3	70.1	12.8	6.8
9611-14	180BP2.0(1)	2.7	71.5	16.8	9.0
9611-98	384BP2.0(1)	41.5	47.5	7.2	3.8
9611-99	384BP2.0 (mixed)	11.4	72.7	10.3	5.6
2891-56	14BP1.5(1)	7.4	74.6	11.6	6.4
9611-16	180BP1.5(1)	14.7	67.7	11.8	5.8
9611-93	384BP1.5(1)	13.6	69.3	10.8	6.3
9611-94	384BP1.5 (mixed)	12.1	69.3	12.7	5.9

Appendix VIII. Surface Sediment (0 - 2cm) Particle Size Distribution (%, wet wt.): Sooke Basin - Day0 to Day384.

SAMPLE ID.	STATION	Fine Gravel 1/2"	Very Coarse Sand #10 2.0mm	Silt #230 0.063mm	Clay 4µ
2891-57	14BP1.0(1)	16.7	66.4	11.6	5.3
9611-17	180BP1.0(1)	14.3	69.7	11.0	5.0
9611-91	384BP1.0(1)	12.0	72.8	9.6	5.6
9611-92	384BP1.0 (mixed)	13.5	72.8	9.2	4.5
2891-24	BBP0.5(1) (old)	18.4	70.1	7.0	4.5
2891-42	BBP0.5(1)	4.0	68.2	21.6	6.2
2891-43	BBP0.5(2)	1.7	67.8	23.7	6.8
2891-44	BBP0.5(3)	9.8	68.0	17.6	4.6
	mean	5.2	68.0	21.0	5.9
2891-58	14BP0.5(1)	10.8	71.1	11.9	6.2
9611-18	180BP0.5(1)	39.4	47.1	9.3	4.2
9611-84	384BP0.5(1)	38.0	48.7	7.9	5.4
9611-87	384BP0.5 (mixed)	16.5	70.3	8.0	5.2
9611-79	384BP0.0	18.5	69.7	7.4	4.4
9611-136	384BP0.5(1) (offshore)	17.9	64.8	10.8	6.5
9611-137	384BP2.0(1) (offshore)	8.3	63.1	17.8	10.8
9611-138	384BP5.0(1) (offshore)	3.5	67.9	17.7	10.9
9611-123	384BP2.0 (upstream)	4.2	77.5	12.5	5.8
9611-126	384BP5.0 (upstream)	17.6	59.7	16.3	6.4
9611-130	384BP10 (upstream)	3.6	80.0	10.9	5.5
9611-133	384BP28/MC49	2.9	67.4	21	8.7
Mechanical Control					
2891-35	BMC0.5(1)	12.2	67.7	14.9	5.2
2891-36	BMC0.5(2)	1.5	75.3	16.5	6.7
2891-37	BMC0.5(3)	4.0	75.4	15.3	5.3
	mean	5.9	72.8	15.6	5.7
2891-61	14MC0.5(1)	8.1	69.8	14.7	7.4
2891-62	14MC0.5(2)	5.6	75.1	12.9	6.4
2891-63	14MC0.5(3)	21.2	64.0	9.9	4.9
	mean	11.6	69.6	12.5	6.2
9611-33	180MC0.5(1)	12.6	71.1	11.0	5.3
9611-166	384MC0.5(1)	16.1	70.1	7.9	5.9
2891-60	14MC2.0(1)	14.8	65.1	13.1	7.0
9611-32	180MC2.0(1)	4.2	79.5	11.3	5.0
9611-167	384MC2.0(1)	8.5	72.1	9.4	10.0
2891-59	14MC5.0(1)	6.2	68.9	16.4	8.5
9611-31	180MC5.0(1)	6.8	73.1	14.0	6.1
9611-168	384MC5.0(1)	3.5	76.6	12.1	7.8
Open Control					
2891-29	BOCO0.0(1)	3.9	73.9	16.8	5.4
2891-30	BOCO0.0(2)	9.8	71.4	14.5	4.3
2891-31	BOCO0.0(3)		66.9	24.8	8.3
	mean	3.0	70.7	18.7	6.0
2891-64	14OC0.0(1)	3.5	66.7	17.7	10.1

Appendix VIII. Surface Sediment (0 - 2cm) Particle Size Distribution (%, wet wt.): Sooke Basin - Day0 to Day384.

SAMPLE ID.	STATION		Fine Gravel 1/2"	Very Coarse Sand #10 2.0mm	Silt #230 0.063mm	Clay 4µ
2891-65	14OC0.0(2)		17.5	56.2	17.8	8.5
2891-66A	14OC0.0(3)		5.8	75.0	12.2	7.0
2891-66B	14OC0.0(3)		5.6	75.0	12.0	7.2
		mean	8.1	68.2	14.9	
9611-35	180OC0.0(1)		8.8	71.7	13.3	6.2
9611-36	180OC0.0(2)		19.1	63.0	11.8	6.1
9611-37	180OC0.0(3)		5.7	73.2	14.7	6.4
		mean	11.2	69.3	13.3	
9611-172	384OC0.0(1)		8.6	68.0	14.9	8.5
9611-173	384OC0.0(2)		13.0	66.9	13.6	6.5
9611-174	384OC0.0(3)		4.6	66.2	17.2	12.0
		mean	8.7	67.0	15.2	
9611-175	384OC0.0 (mixed)		9.6	67.8	14.3	8.3

APPENDIX IX

PAH and Dibenzofuran Concentrations (ng/g) in

Wood Core Samples from the Sooke Basin Weathered and BMP Pilings

October 1995

Appendix IX. PAH and Dibenzofuran Concentrations (µg/g, dry wt.) in Wood Core Samples from the Sooke Basin Weathered and and BMP Pilings - October, 1995.

Sample Site	14WP North Pile	14BP Northwest Pile	WP vs. BP Piling Sites
Sample ID	2891-78	2891-77	
Date	05-Feb-96	05-Feb-96	
Matrix	Wood	Wood	
Sample Size (g dry)	1.05	0.97	
parental PAH			
Naphthalene	15000	15000	0
Acenaphthylene	180	340	-160
Acenaphthene	12000	13000	-1000
Fluorene	11000	9100	1900
Phenanthrene	25000	26000	-1000
Anthracene	5000	4900	100
LPAH	68180	68340	-160
Fluoranthene	14000	14000	0
Pyrene	8900	9000	-100
Benz(a)anthracene	2800	2100	700
Chrysene	2700	2000	700
Benzofluoranthenes	2000	1400	600
Benzo(e)pyrene	620	360	260
Benzo(a)pyrene	680	550	130
Perylene	120	110	10
Dibenz(ah)anthracene	NDR(24)	NDR(31)	---
Indeno(1,2,3-cd)pyrene	NDR(180)	NDR(170)	---
Benzo(ghi)perylene	NDR(94)	NDR(79)	---
HPAH	31820	29520	2300
TPAH	100000	97860	2140
alkylated PAH			
C1 naphthalenes	12000	20000	-8000
C2 naphthalenes	6100	4300	1800
C3 naphthalenes	1900	870	1030
C4 naphthalenes	330	ND(2.9)	---
C5 naphthalenes	ND(5.9)	ND(4.8)	---
C1 phen,anth	5400	3700	1700
C2 phen,anth	2600	1300	1300
C3 phen,anth	390	140	250
C4 phen,anth	ND(6.1)	ND(5.1)	---
Retene	ND(6.1)	ND(5.1)	---
C5 phen,anth	ND(6.7)	ND(5.6)	---
C1 fluor,pyrenes	4500	3500	1000
C2 fluor,pyrenes	1200	880	320
C3 fluor,pyrenes	170	ND(6.0)	---
C4 fluor,pyrenes	ND(13)	ND(11)	---
C5 fluor,pyrenes	ND(13)	ND(11)	---
Dibenzothiophene	1900	1600	300
C1 dibenzothiophene	280	180	100
C2 dibenzothiophene	87	49	38
Dibenzofuran	9100	8700	400

NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Data represent minimum values

APPENDIX X

parental & alkylated PAH Concentrations in Post-installation

Surface Water Samples

Appendix X. *parental and alkylated* PAH Concentrations (µg/L) in Sooke Basin Surface Water Samples Taken in October 1995.

	Surface Grab Sample	Absorbant Surface Sample
Sample Site	BMP #1 sfc.	BMP #2 sfc.
Sample ID	2891-45	2891-46
Date	05-Feb-96	05-Feb-96
Matrix	Water	Water
Sample Size (g dry)	0.075L	5.85 g wet
Naphthalene	0.15	0.58
Acenaphthylene	0.41	0.36
Acenaphthene	0.48	3.2
Fluorene	2.9	7.9
Phenanthrene	19	60
Anthracene	6.6	3.9
LPAH	29.5	75.9
Fluoranthene	200	58
Pyrene	33	39
Benz(a)anthracene	35	7.8
Chrysene	54	6.6
Benzofluoranthenes	35	7.4
Benzo(e)pyrene	10	2.1
Benzo(a)pyrene	9.1	2.3
Perylene	1.6	0.45
Dibenz(ah)anthracene	1.0	NDR(0.17)
Indeno(1,2,3-cd)pyrene	NDR(2.9)	1.0
Benzo(ghi)perylene	2.2	0.68
HPAH	381	125
TPAH	410	201
C1 naphthalenes	170	600
C2 naphthalenes	ND(8.5)	530
C3 naphthalenes	700	780
C4 naphthalenes	660	ND(1.0)
C5 naphthalenes	ND(15)	ND(17)
C1 phen,anth	13000	13000
C2 phen,anth	12000	5900
C3 phen,anth	6500	820
C4 phen,anth	950	NDR(41)
Retene	150	NDR(41)
C5 phen,anth	ND(22)	ND(20)
C1 fluor,pyrenes	60000	14000
C2 fluor,pyrenes	16000	5100
C3 fluor,pyrenes	4100	490
C4 fluor,pyrenes	2600	ND(37)
C5 fluor,pyrenes	610	ND(38)
Dibenzothiophene	NDR(930)	3900
C1 dibenzothiophene	510	680
C2 dibenzothiophene	480	270
Dibenzofuran	600	3900
Surrogate Stds.(% recovery)		
Naph d-8	75	66
Acen d-10	78	83
Phen d-10	84	100
Pyr d-10	87	100
Cry d-12	90	130
B(a)P d-12	89	100
Perylene d-12	86	99
DiB(ah)A d-14	67	110
B(ghi)P d-12	77	95
2-Methylnaphthalene d-10	71	73
Dibenzofuran d-8	92	100

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quanticication criteria for positive identification

APPENDIX XI

Mussel *(Mytilus edulis edulis)*

Shell Length (mm) and Percent Survival

Day0 - Day384

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

OC0.0		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
1	1	20.2	21.0	36.0	56.1
	2	22.2	23.2	39.0	57.1
	3	23.0	23.2	41.5	60.2
	4	23.5	24.2	44.2	63.2
	5	24.0	24.5	45.5	64.0
	6	24.1	24.5	46.0	64.8
	7	24.1	24.5	48.0	66.2
	8	24.2	24.5	49.0	67.2
	9	24.5	25.0	49.0	67.2
	10	24.8	25.1	49.5	67.8
	11	25.2	26.0	51.2	68.0
	12	25.3	26.0	51.5	68.0
	13	25.5	27.0	52.0	68.2
	14	25.5	27.5	52.5	69.4
	15	26.0	28.0	53.5	69.8
	16	26.2	28.5	54.0	70.0
	17	27.0	29.2	54.0	70.1
	18	27.1	29.2	54.0	70.2
	19	27.2	30.0	54.0	70.9
	20	27.5	30.2	54.5	71.0
	21	29.0	31.0	55.2	71.1
	22	30.0	31.0	55.5	71.1
	23	30.0	31.0	56.0	71.2
	24	30.5	32.0	56.5	71.3
	25	30.5	32.2	56.5	71.5

OC0.0		SHELL LENGTH (mm)			
TIER	SAMPLE #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
1	26	30.8	32.9	57.0	72.0
(Cont'd)	27	32.2	33.0	57.2	72.1
	28	32.8	34.0	57.5	72.2
	29	32.8	34.2	57.5	72.9
	30	33.0	34.5	57.5	73.1
	31	33.5	34.5	58.0	73.2
	32	33.8	35.0	58.5	73.2
	33	34.0	35.2	59.0	73.5
	34	34.1	35.5	59.0	74.2
	35	34.5	36.0	60.0	74.5
	36	34.5	36.2	60.2	74.7
	37	35.0	36.5	61.0	75.0
	38	35.0	37.0	61.0	77.8
	39	35.5	37.0	62.0	79.2
	40	36.0	37.1	62.0	80.2
	41	36.4	38.0	62.0	37.5(dead)
	42	36.5	38.2	62.2	43.8(dead)
	43	37.0	38.5	62.5	47.5(dead)
	44	38.0	39.0	62.5	61.2(dead)
	45	38.4	39.0	64.0	62.2(dead)
	46	38.5	39.1	64.2	66.2(dead)
	47	39.3	40.5	64.5	66.2(dead)
	48	40.3	41.5	64.5	70.2(dead)
	49	41.5	42.2	66.0	74.1(dead)
	50	42.0	43.2	70.0	77.1(dead)
Mean		30.2	32.1	55.8	70.1
Std. Dev.		5.7	5.8	7.1	5.1
Survival (%)		100	100	100	80

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

OC0.0		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
2	1	21.6	23.0	45.0	59.8
	2	22.9	24.1	46.5	60.0
	3	23.5	24.5	48.5	61.2
	4	24.0	25.0	49.0	61.2
	5	24.5	26.2	50.0	62.0
	6	24.5	26.5	50.5	62.2
	7	25.2	28.0	50.5	63.1
	8	26.0	28.5	50.8	66.0
	9	26.5	29.0	51.2	66.0
	10	27.2	29.1	51.2	66.1
	11	27.5	29.2	51.5	66.1
	12	28.1	29.5	52.2	66.2
	13	28.1	30.0	52.9	66.5
	14	28.4	30.0	53.2	66.7
	15	28.5	30.2	54.0	67.1
	16	29.0	31.0	54.0	67.7
	17	29.1	31.0	54.0	68.0
	18	29.1	31.0	54.5	68.0
	19	29.8	31.0	55.0	68.0
	20	30.0	31.0	55.1	68.1
	21	30.0	31.2	55.5	68.2
	22	30.0	31.5	55.5	69.0
	23	30.6	32.5	55.6	70.1
	24	30.8	32.5	56.0	70.2
	25	31.0	33.0	56.2	70.5

OC0.0		SHELL LENGTH (mm)			
TIER	SAMPLE #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
2	26	31.2	33.2	56.5	71.0
(Cont'd)	27	31.2	33.5	56.5	71.0
	28	31.5	33.5	56.6	71.3
	29	31.5	33.5	56.9	71.8
	30	31.5	33.9	57.0	72.0
	31	31.5	34.0	57.0	72.0
	32	32.0	34.0	57.0	72.2
	33	32.1	34.0	57.4	72.4
	34	32.2	34.2	57.5	73.0
	35	32.5	34.2	58.0	73.1
	36	32.5	34.5	58.1	73.1
	37	33.0	35.0	58.2	74.5
	38	33.8	35.0	58.2	74.8
	39	34.0	35.2	58.3	76.0
	40	34.1	35.5	58.5	76.8
	41	34.2	36.0	58.6	77.5
	42	35.0	36.5	59.2	45.8(dead)
	43	36.2	37.5	59.3	63.0(dead)
	44	36.8	38.0	60.0	65.0(dead)
	45	37.1	38.0	60.1	65.0(dead)
	46	37.5	39.1	60.5	65.3(dead)
	47	38.2	39.2	61.2	67.2(dead)
	48	38.5	40.0	62.4	70.0(dead)
	49	41.5	41.0	68.2	72.0(dead)
	50	41.9	43.1		
Mean		29.2	32.6	55.5	68.8
Std. Dev.		4.6	4.4	4.3	4.6
Survival (%)		100	100	98	84

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

OC0.0		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/11/96
TIER	SAMPLE #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
3	1	20.1	23.2	26.2	56.1
	2	22.0	23.5	40.8	58.1
	3	22.0	23.5	43.5	61.2
	4	22.3	24.0	45.2	63.0
	5	22.6	24.5	46.0	63.0
	6	23.6	24.5	48.2	63.5
	7	25.0	25.0	48.5	64.0
	8	25.0	26.0	49.2	65.0
	9	25.5	27.0	49.5	65.0
	10	25.5	27.0	49.8	66.0
	11	25.5	28.0	50.0	68.0
	12	26.5	28.0	50.5	68.5
	13	26.8	28.5	51.2	69.2
	14	27.0	29.2	52.2	69.8
	15	27.0	30.1	53.5	70.0
	16	27.6	30.5	54.2	70.2
	17	28.0	30.5	54.2	70.3
	18	29.2	31.0	55.0	71.0
	19	29.2	32.1	55.0	71.0
	20	31.0	32.2	55.1	71.2
	21	31.2	33.0	55.2	72.0
	22	31.5	33.0	55.3	72.0
	23	31.9	33.5	55.8	72.0
	24	32.0	33.5	56.2	72.0
	25	32.0	34.0	56.3	72.1

OC0.0		SHELL LENGTH (mm)			
TIER	SAMPLE #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
3	26	32.2	34.0	56.5	72.3
(Cont'd)	27	32.5	34.2	57.0	72.5
	28	33.0	34.2	57.0	73.0
	29	33.2	34.5	57.0	73.2
	30	33.2	35.0	57.5	73.4
	31	33.5	35.0	57.5	73.6
	32	33.5	35.1	57.8	74.0
	33	33.5	35.5	58.0	75.0
	34	33.6	36.0	58.2	75.1
	35	33.8	36.0	58.8	77.0
	36	34.0	36.0	59.2	79.1
	37	34.0	36.0	59.5	79.8
	38	35.0	36.0	60.0	84.2
	39	35.0	36.5	60.0	27.4(dead)
	40	35.5	36.5	60.3	40.2(dead)
	41	36.0	37.0	60.4	59.5(dead)
	42	36.0	37.5	60.5	60.0(dead)
	43	36.2	38.2	60.5	61.2(dead)
	44	37.2	38.2	61.5	64.1(dead)
	45	40.0	42.0	63.4	65.3(dead)
	46	41.3	42.5	63.5	66.1(dead)
	47	42.5	43.2	64.5	68.2(dead)
	48	43.0	43.5	65.0	72.0(dead)
	49	44.0	44.5	66.2	73.2(dead)
	50	44.5	45.0	70.5	75.0(dead)
Mean		29.7	33.1	55.3	70.1
Std. Dev.		6.0	5.8	7.3	5.8
Survival (%)		100	100	100	76

OC0.0					
Overall Mean	n = 150	31.1	32.6	55.5	69.7
Std. Dev.		5.5	5.4	6.3	5.2

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP0.5		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BBP0.5	14BP0.5	180BP0.5	384BP0.5
1	1	19.8	19.0	35.0	43.8
	2	20.3	21.0	39.9	45.5
	3	21.2	21.5	40.2	53.4
	4	22.5	23.0	44.2	54.2
	5	22.6	25.0	44.2	54.5
	6	25.0	27.2	45.0	54.9
	7	25.5	28.0	45.5	55.4
	8	27.0	28.0	46.0	55.5
	9	27.0	28.5	46.2	55.8
	10	27.1	29.8	47.0	56.5
	11	29.0	30.0	47.2	57.5
	12	29.0	30.9	48.5	57.8
	13	29.0	31.0	49.0	59.0
	14	29.1	31.0	49.2	59.3
	15	29.6	31.2	49.5	59.5
	16	30.0	31.2	49.5	59.9
	17	30.0	31.5	49.9	59.9
	18	30.1	31.5	49.9	60.0
	19	30.8	32.0	50.0	60.2
	20	31.0	32.2	50.0	60.4
	21	31.2	33.0	50.2	61.0
	22	31.2	33.5	50.2	62.2
	23	31.2	33.5	50.9	62.5
	24	32.0	33.5	51.0	62.7
	25	32.0	33.5	51.0	63.3

BP0.5		SHELL LENGTH (mm)			
TIER	SAMPLE #	BBP0.5	14BP0.5	180BP0.5	384BP0.5
1	26	32.2	34.0	51.2	64.2
(Cont'd)	27	32.3	34.0	52.1	64.2
	28	32.4	34.1	52.2	65.0
	29	32.6	34.2	52.5	65.8
	30	32.8	34.2	52.5	66.3
	31	33.2	34.5	53.0	66.5
	32	33.2	35.0	54.0	66.9
	33	33.5	35.0	54.0	67.5
	34	33.6	35.1	54.2	68.2
	35	33.6	36.0	54.5	69.0
	36	34.0	36.0	54.5	69.5
	37	34.2	36.5	55.0	69.5
	38	34.5	37.0	55.1	70.0
	39	35.0	37.2	55.2	70.4
	40	35.2	37.5	55.2	70.5
	41	35.5	38.0	55.2	33.5(dead)
	42	36.5	38.0	55.5	45.7(dead)
	43	36.5	38.0	55.5	46.0(dead)
	44	37.3	38.2	56.2	50.0(dead)
	45	37.3	38.5	56.2	53.8(dead)
	46	37.5	39.0	56.9	55.8(dead)
	47	38.0	40.0	57.2	57.0(dead)
	48	38.5	40.0	58.9	58.5(dead)
	49	39.1	42.2	61.0	61.0 (dead)
	50	40.5	43.1	61.2	61.2(dead)
Mean		29.7	33.1	47.2	57.4
Std. Dev.		4.9	5.2	4.0	4.8
Survival (%)		100	100	100	80

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP0.5		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/11/96
TIER	SAMPLE #	BBP0.5	14BP0.5	180BP0.5	384BP0.5
2	1	17.6	17.5	25.5	50.0
	2	18.8	19.0	33.0	51.6
	3	19.2	21.5	35.5	52.0
	4	20.0	23.0	36.5	52.2
	5	20.1	23.0	39.2	52.4
	6	20.5	23.1	39.2	53.6
	7	20.9	23.5	39.5	57.2
	8	20.9	23.5	40.0	57.4
	9	21.1	25.2	42.1	58.0
	10	24.0	26.2	43.0	58.5
	11	24.1	27.0	44.5	58.5
	12	24.3	27.5	45.0	59.0
	13	24.5	28.1	45.0	60.0
	14	25.1	28.5	45.0	60.5
	15	25.2	29.0	47.2	60.5
	16	27.1	29.1	47.2	61.2
	17	27.1	29.9	47.2	61.2
	18	27.5	30.1	47.3	61.8
	19	27.5	30.1	47.3	62.0
	20	27.5	31.0	48.2	62.5
	21	28.0	31.5	48.2	62.5
	22	28.6	31.5	48.3	62.5
	23	29.0	32.0	48.5	63.0
	24	29.1	32.0	49.2	63.2
	25	29.1	32.1	49.5	63.8

BP0.5		SHELL LENGTH (mm)			
TIER	SAMPLE #	BBP0.5	14BP0.5	180BP0.5	384BP0.5
2	26	29.2	32.2	50.2	64.9
(Cont'd)	27	29.2	32.5	50.5	65.0
	28	29.5	32.5	51.1	65.5
	29	30.0	33.0	51.2	65.8
	30	30.8	33.2	51.3	67.0
	31	31.0	34.0	52.3	68.0
	32	32.0	35.0	53.4	69.0
	33	32.2	35.5	53.5	69.5
	34	32.9	35.5	53.5	70.0
	35	33.0	36.2	54.2	71.5
	36	33.1	36.5	56.0	72.0
	37	34.0	37.2	56.2	75.6
	38	34.0	37.2	56.5	76.5
	39	34.0	37.5	56.5	34.5(dead)
	40	35.0	38.0	56.6	36.0(dead)
	41	35.0	38.0	57.2	37.0(dead)
	42	36.0	39.0	57.5	46.0 (dead)
	43	36.6	39.0	59.5	54.2(dead)
	44	36.8	40.0	60.5	56.0(dead)
	45	38.2	41.0	61.2	59.9(dead)
	46	38.2	41.0	61.5	60.0(dead)
	47	39.0	41.0	62.2	61.2(dead)
	48	39.2	41.0	68.2	65.3(dead)
	49	39.5	42.1	17.2 (dead)	
	50	43.1	45.5	38.0 (dead)	
Mean		27.7	32.2	43.2	58.6
Std. Dev.		6.3	6.5	6.0	4.2
Survival (%)		100	100	96	79

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP0.5		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/11/96
TIER	SAMPLE #	BBP0.5	14BP0.5	180BP0.5	384BP0.5
3	1	20.0	22.0	28.0	48.0
	2	20.1	23.5	35.0	51.5
	3	21.3	23.5	37.0	54.0
	4	21.5	23.5	38.0	54.5
	5	21.8	24.0	39.0	56.5
	6	22.0	24.0	39.2	57.5
	7	22.0	24.5	40.0	58.5
	8	22.1	25.0	41.1	59.1
	9	22.2	25.0	41.2	59.3
	10	22.5	26.0	42.5	59.5
	11	22.8	26.2	43.2	59.8
	12	24.0	26.2	44.5	59.8
	13	24.0	27.0	45.1	60.2
	14	24.0	27.2	46.0	61.0
	15	25.0	27.5	46.0	61.2
	16	25.5	28.5	46.0	61.2
	17	26.0	28.5	47.0	61.2
	18	26.1	29.0	47.0	61.5
	19	26.1	29.0	47.0	62.5
	20	26.1	29.0	47.1	62.5
	21	26.2	29.9	48.2	64.0
	22	26.4	30.0	49.0	64.2
	23	26.8	30.0	49.2	64.2
	24	27.0	30.1	49.9	64.2
	25	27.0	30.1	50.0	64.8

BP0.5					
TIER	SAMPLE #	BBP0.5	14BP0.5	180BP0.5	384BP0.5
3	26	27.1	30.2	50.1	65.0
(Cont'd)	27	27.6	30.2	51.0	65.0
	28	28.1	31.0	51.1	65.0
	29	28.5	31.0	51.5	66.2
	30	30.0	32.0	51.9	67.2
	31	30.6	32.0	52.0	68.2
	32	30.8	33.5	53.0	68.5
	33	30.9	33.5	54.0	70.0
	34	30.9	34.0	54.0	70.5
	35	31.8	34.1	54.2	72.1
	36	31.9	34.1	54.5	73.2
	37	32.0	34.2	54.5	75.3
	38	32.2	34.9	55.0	40.5(dead)
	39	32.5	35.0	55.2	41.0(dead)
	40	33.0	35.0	56.0	46.2(dead)
	41	33.0	35.0	56.0	52.0(dead)
	42	33.3	36.0	56.1	56.0(dead)
	43	34.1	37.0	56.5	58.0(dead)
	44	34.8	37.1	57.9	59.0(dead)
	45	34.9	37.2	58.0	59.2(dead)
	46	37.0	38.1	59.0	61.0(dead)
	47	37.2	40.0	59.2	63.2(dead)
	48	37.5	40.0	60.0	
	49	37.8	40.2	33.0 (dead)	
	50	38.0	40.2	34.0 (dead)	
Mean		26.7	30.9	43.4	59.6
Std. Dev.		5.2	5.0	5.4	4.2
Survival (%)		100	100	96	79

BP0.5					
Overall Mean	n = 150	29.7	32.1	49.8	62.0
Std. Dev.		5.6	5.7	7.0	6.3

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP2.0		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BBP2.0	14BP2.0	180BP2.0	384BP2.0
1	1	20.0	20.5	36.2	47.5
	2	20.4	22.0	40.0	51.2
	3	22.0	22.0	40.5	53.2
	4	22.0	22.5	44.9	59.2
	5	22.0	24.0	45.0	59.9
	6	22.2	24.1	45.0	60.5
	7	22.4	24.5	45.1	61.1
	8	22.5	25.0	45.2	61.3
	9	22.5	25.0	46.0	62.3
	10	22.5	25.2	46.2	62.6
	11	22.7	26.0	48.1	63.4
	12	23.1	26.0	49.0	63.5
	13	23.9	26.0	50.0	64.5
	14	24.0	26.5	50.0	64.7
	15	24.2	27.0	50.0	65.0
	16	24.5	27.5	50.1	65.0
	17	24.8	27.5	50.1	65.0
	18	25.0	27.5	51.0	65.3
	19	25.3	28.0	51.0	65.5
	20	25.8	28.0	51.1	65.8
	21	26.9	29.1	51.2	66.3
	22	27.0	30.0	51.2	67.2
	23	27.0	30.1	51.5	68.2
	24	27.5	30.2	52.0	68.2
	25	27.6	30.2	52.1	68.2

BP2.0					
TIER	SAMPLE #	BBP2.0	14BP2.0	180BP2.0	384BP2.0
1	26	27.8	31.0	52.2	68.3
(Cont'd)	27	28.0	31.5	53.0	68.5
	28	28.2	31.5	53.0	68.7
	29	28.3	31.5	53.0	69.0
	30	28.9	31.5	53.0	69.0
	31	28.9	32.0	53.2	69.2
	32	29.0	32.0	53.2	69.5
	33	29.1	32.2	54.1	70.0
	34	30.1	32.5	54.2	70.1
	35	30.1	33.2	54.5	70.2
	36	30.2	34.0	54.5	70.2
	37	30.4	34.0	55.1	70.5
	38	30.8	34.0	56.0	71.2
	39	32.1	34.2	56.0	71.5
	40	32.2	35.1	57.0	72.4
	41	32.8	35.2	57.0	73.5
	42	33.1	35.2	57.0	73.5
	43	34.1	35.5	57.1	74.8
	44	34.8	36.1	58.0	75.0
	45	36.5	37.0	59.1	75.6
	46	36.6	39.0	60.1	76.2
	47	37.0	39.0	60.1	44.0(dead)
	48	37.2	39.9	62.0	45.0(dead)
	49	39.5	43.5	63.0	47.5(dead)
	50	41.1	44.5	64.5	48.2(dead)
Mean		27.5	30.6	47.7	66.5
Std. Dev.		5.2	5.5	4.2	6.1
Survival (%)		100	100	100	92

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP2.0		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BBP2.0	14BP2.0	180BP2.0	384BP2.0
2	1	23.8	26.5	41.2	56.0
	2	23.8	27.2	45.1	57.8
	3	24.9	27.5	45.5	60.0
	4	25.0	28.5	46.0	60.1
	5	26.4	28.5	47.0	61.5
	6	26.5	28.9	48.0	62.0
	7	26.7	29.9	48.2	63.2
	8	27.3	30.0	48.5	63.3
	9	27.5	30.0	49.2	63.4
	10	28.0	30.0	49.5	64.2
	11	28.6	30.0	50.0	64.2
	12	28.9	30.5	50.0	64.5
	13	28.9	31.0	50.1	64.8
	14	29.0	31.5	51.0	64.9
	15	29.1	32.0	51.5	65.5
	16	29.1	32.0	52.0	66.0
	17	29.2	32.0	52.0	66.0
	18	29.2	32.0	52.1	66.1
	19	29.4	32.5	52.5	66.4
	20	30.0	32.5	53.0	66.8
	21	30.0	32.5	54.5	67.0
	22	30.5	33.2	54.5	67.3
	23	30.8	33.5	54.5	67.5
	24	31.0	33.5	54.5	67.5
	25	31.5	34.0	54.5	67.8

BP2.0		SHELL LENGTH (mm)			
TIER	SAMPLE #	BBP2.0	14BP2.0	180BP2.0	384BP2.0
2	26	32.2	34.2	54.9	68.0
(Cont'd)	27	32.6	35.5	55.0	68.3
	28	33.0	36.0	55.1	68.4
	29	33.4	36.0	55.1	68.7
	30	33.5	36.2	55.2	69.9
	31	33.7	36.5	55.2	70.0
	32	33.8	36.9	56.0	70.5
	33	34.0	37.0	56.1	71.0
	34	34.0	37.0	56.5	71.5
	35	34.5	37.5	56.5	71.5
	36	34.6	37.5	56.9	72.2
	37	34.6	38.0	57.0	72.3
	38	35.0	38.2	57.5	72.4
	39	36.0	38.2	57.5	73.8
	40	36.2	38.5	58.0	74.2
	41	36.5	39.0	58.0	74.8
	42	36.5	39.0	58.1	75.0
	43	37.9	39.2	59.0	77.0
	44	37.9	39.5	59.1	77.2
	45	38.0	39.9	59.5	78.2
	46	38.0	40.0	59.5	50.0(dead)
	47	38.1	40.2	59.5	55.2(dead)
	48	38.2	41.0	60.0	59.0(dead)
	49	38.8	43.2	61.0	69.5(dead)
	50	41.1	44.5	65.1	80.5(dead)
Mean		30.1	34.6	53.9	67.7
Std. Dev.		4.4	4.4	5.8	5.0
Survival (%)		100	100	100	90

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP2.0		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/11/96
TIER	SAMPLE #	BBP2.0	14BP2.0	180BP2.0	384BP2.0
3	1	23.5	25.0	36.1	77.0
	2	23.6	25.0	43.0	76.0
	3	24.0	27.0	44.1	67.8
	4	25.8	27.2	46.3	60.3
	5	26.7	28.0	46.9	68.9
	6	26.8	28.0	47.2	68.5
	7	27.5	28.5	47.2	65.5
	8	27.8	29.0	47.2	87.5
	9	28.2	29.2	47.5	69.0
	10	28.4	29.2	48.2	65.0
	11	28.5	30.0	49.3	62.2
	12	28.9	30.0	49.5	61.5
	13	29.1	30.0	49.9	66.4
	14	29.1	30.1	50.5	70.0
	15	29.5	30.1	50.8	69.9
	16	29.9	30.2	51.0	59.2
	17	30.5	30.5	51.2	64.0
	18	31.0	31.0	51.2	69.3
	19	31.1	31.5	51.2	78.9
	20	31.2	31.5	51.4	61.5
	21	31.3	32.5	52.5	63.0
	22	31.4	33.0	52.5	69.5
	23	31.5	33.0	53.2	64.6
	24	32.2	33.0	53.3	67.8
	25	32.5	33.2	53.4	69.8

BP2.0					
TIER	SAMPLE #	BBP2.0	14BP2.0	180BP2.0	384BP2.0
3	26	33.0	34.2	53.5	71.5
(Cont'd)	27	33.5	34.5	53.6	71.4
	28	33.8	35.0	54.0	71.0
	29	33.9	35.0	54.2	59.2
	30	34.1	35.0	54.2	66.0
	31	34.2	35.0	54.3	65.2
	32	34.3	35.2	55.0	75.0
	33	34.4	36.0	55.1	73.2
	34	34.5	36.0	55.1	66.1
	35	35.0	36.0	55.2	65.0
	36	35.0	36.0	55.5	73.2
	37	35.3	36.5	55.5	63.5
	38	35.3	37.0	56.0	63.5
	39	35.5	37.0	56.3	63.0
	40	36.1	37.2	56.5	69.1
	41	36.2	37.5	57.2	70.0
	42	37.0	37.5	57.6	63.0(dead)
	43	37.1	37.5	58.1	62.8(dead)
	44	37.2	38.5	58.5	68.1(dead)
	45	38.1	38.5	60.0	71.3(dead)
	46	39.2	39.1	60.2	59.0(dead)
	47	39.6	39.1	61.5	60.2(dead)
	48	41.2	41.5	65.8	66.8(dead)
	49	43.1	45.0	68.0	49.5(dead)
	50	49.2	50.0	73.5	36.2(dead)
Mean		30.9	33.7	53.4	68.0
Std. Dev.		5	4.9	6.2	5.7
Survival (%)		100	100	100	82

BP2.0					
Overall Mean	n = 150	30.9	33.0	53.1	67.4
Std. Dev.		5.3	5.2	5.7	5.6

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP10		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BBP10	14BP10	180BP10	384BP10
1	1	20.6	19.9	39.2	47.2
	2	23.2	23.0	44.0	54.5
	3	23.5	23.5	46.1	56.2
	4	23.5	24.9	47.0	57.2
	5	23.8	25.0	49.0	57.3
	6	24.0	25.2	50.1	58.0
	7	24.2	26.0	51.0	59.1
	8	24.8	26.0	51.0	59.3
	9	25.5	27.5	51.1	60.4
	10	25.7	28.0	51.9	64.2
	11	26.1	28.0	52.0	64.3
	12	26.8	28.0	52.0	64.4
	13	28.2	29.9	52.1	64.5
	14	28.5	30.2	52.2	64.8
	15	28.7	30.5	53.0	66.2
	16	29.2	31.0	53.5	66.5
	17	30.2	32.0	54.1	66.5
	18	31.0	33.0	54.5	67.0
	19	31.6	33.0	55.0	68.1
	20	31.8	33.5	55.0	69.1
	21	31.9	34.0	55.5	70.1
	22	32.0	34.0	56.2	70.1
	23	32.2	34.0	57.0	71.2
	24	32.6	34.0	57.0	71.2
	25	32.6	34.0	57.0	71.2

BP10		SHELL LENGTH (mm)			
TIER	SAMPLE #	BBP10	14BP10	180BP10	384BP10
1	26	33.1	34.2	57.0	72.3
(Cont'd)	27	33.1	34.5	58.5	72.6
	28	34.0	35.2	58.9	73.0
	29	34.1	36.0	59.2	73.1
	30	34.2	36.0	59.5	73.1
	31	34.5	36.0	60.0	73.2
	32	35.0	36.0	60.0	73.5
	33	35.0	36.0	60.1	75.5
	34	35.1	37.0	60.5	77.1
	35	35.2	37.0	60.5	78.7
	36	35.3	37.0	61.0	53.8(dead)
	37	35.5	37.0	61.0	54.1(dead)
	38	35.6	37.5	61.0	57.3(dead)
	39	36.1	37.5	62.2	59.5(dead)
	40	36.4	37.5	62.2	60.2(dead)
	41	37.0	38.1	63.0	63.2(dead)
	42	37.0	38.2	63.2	64.0(dead)
	43	38.0	38.5	64.0	64.3(dead)
	44	38.0	38.5	64.0	70.2(dead)
	45	38.1	39.0	64.5	70.6(dead)
	46	39.2	41.0	65.0	72.1(dead)
	47	40.1	41.0	65.1	75.0(dead)
	48	41.8	43.0	65.5	75.2(dead)
	49	42.2	43.1	41.1 (dead)	
	50	44.3	45.0	53.0 (dead)	
Mean		31.6	33.6	56.5	66.6
Std. Dev.		5.6	5.7	6.0	7.2
Survival (%)		100	100	96	73

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP10		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BBP10	14BP10	180BP10	384BP10
2	1	22.1	23.2	36.0	52.5
	2	23.9	24.5	47.5	56.3
	3	24.0	27.0	48.0	59.0
	4	25.5	27.0	49.0	60.8
	5	26.1	27.5	50.5	61.2
	6	26.3	28.0	51.0	61.3
	7	26.7	28.0	51.1	62.5
	8	26.9	28.0	51.5	64.0
	9	27.0	28.2	52.0	65.0
	10	27.5	28.5	52.1	65.2
	11	27.5	28.5	53.0	65.3
	12	27.8	28.9	53.0	65.5
	13	27.8	29.0	53.2	66.0
	14	28.0	29.0	53.2	66.5
	15	28.2	29.0	54.2	66.8
	16	28.5	29.5	55.0	69.2
	17	28.6	30.0	55.0	70.0
	18	29.2	30.0	55.0	70.2
	19	29.5	30.5	56.0	71.0
	20	30.1	31.0	56.0	71.2
	21	30.6	32.0	56.0	71.3
	22	31.2	32.0	56.0	71.8
	23	31.3	33.0	56.0	72.2
	24	32.0	33.2	57.0	72.5
	25	32.4	34.0	57.0	73.2

BP10		SHELL LENGTH (mm)			
TIER	SAMPLE #	BBP10	14BP10	180BP10	384BP10
2	26	32.5	34.0	57.1	73.3
(Cont'd)	27	32.5	34.0	57.1	73.4
	28	32.5	34.2	57.2	74.0
	29	32.6	34.2	57.2	74.2
	30	33.4	34.5	58.5	74.3
	31	33.8	34.5	59.1	75.1
	32	34.0	34.9	59.1	75.5
	33	34.2	35.0	60.0	76.1
	34	34.2	35.5	60.0	76.7
	35	34.2	36.0	60.0	77.0
	36	34.4	36.0	60.5	77.1
	37	34.5	36.0	60.5	78.1
	38	35.1	36.5	61.0	78.9
	39	36.5	37.0	61.0	80.0
	40	36.5	38.0	61.5	80.2
	41	37.1	38.0	62.0	80.2
	42	37.1	39.0	62.0	47.0(dead)
	43	37.9	39.0	62.5	63.0(dead)
	44	38.0	39.0	63.0	64.5(dead)
	45	38.2	40.0	63.0	66.0(dead)
	46	38.5	40.0	64.9	66.2(dead)
	47	39.0	40.0	65.0	69.9(dead)
	48	39.3	40.5	65.5	71.2(dead)
	49	41.1	40.5	67.9	71.2(dead)
	50	42.0	41.0	Broken shell	
Mean		30.1	33.1	56.7	70.1
Std. Dev.		4.8	4.7	5.7	6.8
Survival (%)		100	100	98	84

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

BP10		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/11/96
TIER	SAMPLE #	BBP10	14BP10	180BP10	384BP10
3	1	20.8	20.2	38.0	52.3
	2	22.0	22.0	41.0	55.5
	3	25.0	26.4	43.4	57.2
	4	25.0	27.0	45.5	62.4
	5	25.8	27.0	47.2	64.0
	6	26.2	28.0	52.0	64.2
	7	26.2	28.0	52.2	66.1
	8	26.5	28.0	52.8	66.2
	9	27.0	28.0	53.0	66.2
	10	27.0	28.2	53.2	66.3
	11	27.0	28.5	53.5	67.2
	12	27.3	28.5	54.0	68.2
	13	27.8	29.0	54.0	68.4
	14	28.0	29.0	54.0	69.2
	15	28.1	29.9	54.2	70.0
	16	28.1	30.0	55.0	70.0
	17	28.1	30.0	56.1	70.0
	18	28.6	30.5	56.5	70.2
	19	29.5	31.0	56.8	70.2
	20	29.9	31.2	56.9	71.2
	21	30.0	31.5	57.0	71.2
	22	31.1	32.0	57.0	71.3
	23	31.2	32.8	57.0	72.7
	24	31.2	33.0	57.1	73.1
	25	31.3	33.0	57.5	73.4

BP10		SHELL LENGTH (mm)			
TIER	SAMPLE #	BBP10	14BP10	180BP10	384BP10
3	26	31.3	33.0	57.9	74.0
(Cont'd)	27	31.5	33.0	58.4	74.2
	28	31.8	33.0	58.5	74.2
	29	32.0	33.1	59.3	75.0
	30	32.2	34.0	60.0	75.5
	31	32.5	34.0	60.0	76.0
	32	33.1	34.5	60.0	77.2
	33	33.5	34.5	60.0	77.2
	34	33.5	35.0	60.0	77.5
	35	34.0	35.0	60.1	77.5
	36	34.2	35.5	60.1	77.8
	37	34.6	37.0	60.1	78.6
	38	35.1	37.0	60.1	78.8
	39	36.0	37.0	60.8	79.0
	40	37.2	37.0	61.1	80.0
	41	37.5	38.0	62.0	80.0
	42	38.0	38.5	62.2	81.2
	43	38.1	39.0	62.5	50.0(dead)
	44	38.1	39.0	63.2	65.0(dead)
	45	38.2	39.9	63.2	66.0(dead)
	46	38.5	40.1	64.1	69.2(dead)
	47	38.8	40.5	64.2	70.0(dead)
	48	39.1	42.0	64.6	71.0(dead)
	49	43.0	46.0	67.7	72.0(dead)
	50	45.0	32.0 (dead)		
Mean		29.9	32.8	56.8	71.1
Std. Dev.		5.2	5.1	6.0	6.8
Survival (%)		100	98	100	86

BP10					
Overall Mean	n = 150	32.0	33.2	56.7	69.4
Std. Dev.		5.2	5.1	5.9	7.1

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

WP0.5		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BWP0.5	14WP0.5	180WP0.5	384WP0.5
1	1	21.7	22.0	40.0	48.5
	2	22.5	22.0	41.0	52.2
	3	23.0	22.0	41.1	52.8
	4	23.5	22.1	41.2	55.5
	5	24.5	23.0	41.2	56.5
	6	25.0	25.1	42.2	57.2
	7	25.1	25.5	44.5	58.2
	8	25.2	25.5	45.0	58.3
	9	26.1	26.1	45.0	58.5
	10	27.1	27.1	45.1	60.8
	11	27.1	27.2	45.2	62.3
	12	27.5	27.8	46.0	62.3
	13	27.5	28.0	46.1	63.0
	14	27.5	28.0	46.5	63.3
	15	27.8	28.1	47.0	63.4
	16	28.0	28.9	47.0	63.5
	17	28.0	29.1	47.0	64.0
	18	28.0	29.9	47.2	64.3
	19	28.2	30.0	47.2	65.2
	20	29.7	30.1	47.2	65.4
	21	29.9	30.1	47.5	65.4
	22	30.1	30.1	49.0	65.4
	23	30.2	30.8	49.0	65.4
	24	31.0	31.0	49.2	65.5
	25	31.1	31.0	49.2	66.1

WP0.5		SHELL LENGTH (mm)			
TIER	SAMPLE #	BWP0.5	14WP0.5	180WP0.5	384WP0.5
1	26	31.1	31.1	49.5	66.2
(Cont'd)	27	31.2	31.2	50.0	66.4
	28	31.2	31.5	50.0	67.2
	29	31.2	31.5	50.1	67.3
	30	31.2	32.9	52.0	68.6
	31	31.7	33.0	53.0	69.5
	32	32.1	33.1	53.0	70.0
	33	32.2	33.2	53.2	70.2
	34	32.8	33.9	53.2	70.4
	35	33.1	34.0	54.0	70.5
	36	33.1	34.0	54.0	71.3
	37	33.2	34.5	54.5	71.3
	38	33.2	35.0	54.5	72.2
	39	33.2	35.0	54.5	72.6
	40	33.5	35.0	55.0	76.1
	41	33.8	35.1	55.1	49.9(dead)
	42	34.1	35.2	56.0	53.9(dead)
	43	37.5	37.9	56.0	57.9(dead)
	44	37.5	38.2	57.2	61.2(dead)
	45	38.1	39.1	58.0	62.0(dead)
	46	38.1	40.1	58.0	63.0(dead)
	47	40.1	41.0	61.0	66.1(dead)
	48	41.3	41.9	64.5	69.2(dead)
	49	42.2	42.1	45.5 (dead)	
	50	43.0	40.2 (dead)		
Mean		30.3	31.2	49.9	64.3
Std. Dev.		5.1	5.2	5.6	6.1
Survival (%)		100	98	98	83

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

WP0.5		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/10/96
TIER	SAMPLE #	BWP0.5	14WP0.5	180WP0.5	384WP0.5
2	1	18.5	19.2	36.0	52.4
	2	21.5	21.9	36.3	53.8
	3	22.0	22.2	37.3	54.2
	4	22.5	23.1	39.0	54.2
	5	23.0	23.1	39.0	54.9
	6	23.0	23.5	39.0	55.0
	7	24.0	23.5	40.8	55.5
	8	24.1	24.0	42.2	56.1
	9	24.1	25.0	42.3	57.1
	10	24.5	25.0	42.5	57.3
	11	24.9	25.1	43.0	57.5
	12	25.5	25.2	44.0	58.2
	13	25.5	27.0	44.0	58.8
	14	25.8	27.1	44.2	61.0
	15	25.9	28.0	44.5	61.2
	16	26.4	28.5	45.5	61.2
	17	26.5	29.2	46.0	61.7
	18	27.1	29.9	46.2	62.4
	19	27.5	29.9	46.5	63.1
	20	28.1	30.0	47.0	63.2
	21	29.0	30.0	47.0	63.5
	22	29.9	30.0	47.9	63.8
	23	30.0	31.0	48.0	64.1
	24	30.0	31.5	48.2	64.5
	25	30.0	32.0	49.4	65.0

WP0.5		SHELL LENGTH (mm)			
TIER	SAMPLE #	BWP0.5	14WP0.5	180WP0.5	384WP0.5
2	26	31.0	32.1	50.0	65.2
(Cont'd)	27	31.1	32.5	50.6	65.2
	28	31.2	32.5	51.1	65.4
	29	31.5	33.0	52.4	65.8
	30	31.9	33.0	52.5	66.1
	31	32.2	33.5	53.0	66.2
	32	32.3	33.5	53.0	66.4
	33	32.5	33.9	53.1	66.5
	34	32.6	34.0	53.1	67.6
	35	33.0	34.0	53.2	68.2
	36	33.0	34.5	54.2	69.0
	37	33.2	34.8	54.8	69.1
	38	33.5	35.0	55.1	69.2
	39	35.0	36.0	55.1	70.0
	40	35.0	36.0	55.2	70.8
	41	36.0	36.9	55.4	71.5
	42	36.1	36.9	56.0	72.2
	43	36.2	37.2	56.3	73.0
	44	37.5	39.0	58.1	73.1
	45	38.0	39.0	58.5	73.2
	46	38.9	39.0	60.2	42.0(dead)
	47	39.9	40.1	62.1	55.0(dead)
	48	40.0	42.0	62.4	62.3(dead)
	49	43.1	43.2	65.7	77.2(dead)
	50	44.1	45.1	19.2 (dead)	
Mean		28.6	31.4	49.3	63.4
Std. Dev.		5.9	6.0	7.2	5.9
Survival (%)		100	100	98	92

Appendix XI. Mussel (*Mytilus edulis edulis)* Shell Length (mm) and Percent Survival Field Measurements - Day0 to Day384.

WP0.5		SHELL LENGTH (mm)			
		02/10/95	17/10/95	04/04/96	21/11/96
TIER	SAMPLE #	BWP0.5	14WP0.5	180WP0.5	384WP0.5
3	1	22.4	22.5	30.0	54.5
	2	23.1	23.2	34.0	55.3
	3	23.2	24.0	35.2	55.5
	4	24.0	24.1	36.5	56.5
	5	24.0	24.2	37.0	56.5
	6	24.5	24.5	37.0	57.3
	7	24.5	25.5	40.0	57.5
	8	24.5	26.1	41.5	58.2
	9	24.8	26.5	42.1	59.0
	10	25.2	26.5	43.0	60.0
	11	25.6	27.0	43.2	60.8
	12	26.1	27.1	44.0	61.0
	13	26.1	28.0	44.0	62.2
	14	26.2	28.2	44.0	62.3
	15	26.5	28.5	44.5	63.0
	16	26.5	29.0	45.0	63.1
	17	26.5	29.0	45.0	64.0
	18	27.0	29.0	45.2	64.0
	19	27.2	29.2	45.2	64.4
	20	27.2	29.9	45.2	64.5
	21	27.8	30.0	46.0	64.7
	22	28.9	30.1	47.2	65.1
	23	28.9	30.2	48.0	65.2
	24	29.2	30.5	48.0	65.3
	25	29.6	31.0	48.1	65.8

WP0.5		SHELL LENGTH (mm)			
TIER	SAMPLE #	BWP0.5	14WP0.5	180WP0.5	384WP0.5
3	26	29.9	32.0	48.2	66.2
(Cont'd)	27	30.9	32.0	50.0	66.4
	28	31.0	32.0	50.0	66.5
	29	31.1	32.0	51.0	67.4
	30	31.1	32.5	51.5	67.5
	31	31.3	32.5	51.5	69.0
	32	31.8	33.0	51.5	69.2
	33	32.0	33.2	52.0	69.2
	34	32.0	34.2	52.0	69.3
	35	32.1	34.5	52.0	69.3
	36	32.9	34.5	52.5	69.5
	37	32.9	34.9	53.0	69.5
	38	33.4	35.0	53.0	70.0
	39	33.8	35.1	53.2	70.0
	40	34.5	35.2	55.0	70.2
	41	34.5	35.2	55.1	71.2
	42	35.0	36.0	55.1	72.5
	43	35.5	36.5	56.0	73.0
	44	36.0	37.0	56.0	74.2
	45	36.0	37.9	56.0	75.4
	46	37.5	38.5	57.0	36.8(dead)
	47	38.0	41.0	57.0	44.2(dead)
	48	40.0	41.0	59.5	58.2(dead)
	49	40.2	42.2	59.9	64.5(dead)
	50	40.9	46.9	62.5	
Mean		28.4	31.6	48.2	64.9
Std. Dev.		4.9	5.3	7.2	5.4
Survival (%)		100	100	100	91

WP0.5					
Overall Mean	n = 150	30.4	31.4	49.1	64.2
Std. Dev.		5.3	5.5	6.7	5.8

APPENDIX XII

Mussel *(Mytilus edulis edulis)*

Whole Body Tissue PAH Concentrations (ng/g, wet weight)

Day0 - Day384

A. parental PAH

B. alkylated PAH and dibenzofuran

C. Tissue Sample Shell Length (mm)

APPENDIX XII (A)

Mussel *(Mytilus edulis edulis)*

Whole Body Tissue PAH Concentrations (ng/g, wet weight)

Sooke Basin - Day0 - Day384

***parental* PAH**

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	14OC0.0		14OC0.0			14OC0.0		14OC0.0		140C0.0	
Composite #	1A		1B		mean	2		3		Mean	Std. Dev.
Batch I.D.	PH-0835		PH-0835			PH-0835		PH-0835			
Lab. No.	2891-91A		2891-91B		2891-91	2891-92		2891-93		2891:91-93	
Sample Weight (gm):	4.2		4.0		4.1	5.2		5.1		4.8	0.6
% Moisture	77		77		77	78		79		78	1.0
Lipid Content (%)	2.9				2.9	2.9		2.5		2.8	0.2
	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*	Conc.	*SDL*		
Naphthalene	2.9	*0.03*	2.7	*0.03*	2.8	3.0	*0.02*	3.2	*0.03*	3.0	0.2
Acenaphthylene	NDR(0.39)	*0.06*	NDR(0.37)	*0.6*	NDR(0.39)	NDR(0.3)	*0.04*	NDR(0.2)	*0.5*	NDR	---
Acenaphthene	1.2	*0.04*	1.4	*0.04*	1.3	1.3	*0.03*	1.2	*0.3*	1.3	0.1
Fluorene	2.0	*0.02*	2.2	*0.03*	2.1	2.0	*0.02*	1.8	*0.2*	2.0	0.2
Phenanthrene	5.1	*0.09*	4.9	*0.1*	5.0	4.6	*0.06*	4.2	*0.07*	4.6	0.4
Anthracene	0.87	*0.09*	0.82	*0.1*	0.85	0.72	*0.06*	0.69	*0.08*	0.8	0.1
LPAH	12.1		12.0		12.0	11.6		11.1		11.6	0.5
Fluoranthene	30	*0.008*	30	*0.009*	30	28	*0.005*	20	*0.006*	26	5.3
Pyrene	10	*0.008*	9.9	*0.009*	10.0	8.0	*0.005*	6.4	*0.006*	8.1	1.8
Benz(a)anthracene	0.4	*0.01*	0.5	*0.01*	0.4	0.3	*0.007*	0.5	*0.009*	0.4	0.1
Chrysene	2.9	*0.01*	2.8	*0.01*	2.9	3.1	*0.007*	2.0	*0.009*	2.7	0.6
Benzofluoranthenes	NDR(0.88)	*0.03*	NDR(0.67)	*0.04*	NDR(0.88)	NDR(0.88)	*0.02*	NDR(0.68)	*0.03*	NDR	---
Benzo(e)pyrene	NDR(0.88)	*0.03*	NDR(0.46)	*0.04*	NDR(0.88)	NDR(0.45)	*0.02*	NDR(0.51)	*0.03*	NDR	---
Benzo(a)pyrene	ND(0.04)	*0.04*	ND(0.05)	*0.05*	NDR(0.88)	ND(0.03)	*0.03*	ND(0.03)	*0.03*	NDR	---
Dibenz(ah)anthracene	ND(0.09)	*0.09*	ND(0.12)	*0.12*	ND(0.09)	ND(0.07)	*0.07*	ND(0.08)	*0.08*	ND	---
Indeno(1,2,3-cd)pyrene	ND(0.12)	*0.12*	ND(0.17)	*0.17*	ND(0.12)	ND(0.1)	*0.1*	ND(0.12)	*0.12*	ND	---
Benzo(ghi)perylene	ND(0.11)	*0.11*	ND(0.15)	*0.15*	ND(0.11)	ND(0.09)	*0.09*	ND(0.1)	*0.1*	ND	---
HPAH	43.3		43.2		43.2	39.4		28.9		37.2	7.4
TPAH	55.4		55.2		55.3	51.1		40.0		48.8	7.9
TPAH (µg/g, wet weight)	0.06		0.05		0.06	0.05		0.04		0.05	0.01
Perylene	ND(0.03)	*0.03*	ND(0.04)	*0.04*	ND(0.03)	ND(0.03)	*0.03*	ND(0.03)	*0.03*	NDR	---
Surrogate Standards (% recovery)											
Napththalene d-8	77		73		75	70		68		71	3.6
Acenaphthene d-10	80		76		78	74		71		74	3.5
Phenanthrene d-10	83		77		80	73		72		75	4.4
Pyrene d-10	81		72		77	71		71		73	3.2
Chrysene d-12	72		61		67	60		62		63	3.3
Benzo(a)pyrene d-12	70		66		68	61		52		60	8.0
Perylene d-12	72		67		70	61		56		62	6.8
Dibenz(ah)anthracene d-14	44		44		44	38		35		39	4.6
Benzo(ghi)perylene d-12	66		62		64	55		50		56	7.1

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180OC0.0		180OC0.0		180OC0.0		180OC0.0		384OC0.0		384OC0.0		384OC0.0		384OC0.0	
Composite #	1		2		3		Mean	Std. Dev.	1		2		3		Mean	Std. Dev.
Batch I.D.	PH-0901		PH-0901		PH-0901				PH-1008		PH-1008		PH-1022			
Lab. No.	9611-66		9611-67		9611-68		9611:66-68		9611-192		9611-193		9611-194			
Sample Weight (gm):	10.3		10.4		10.2		10.3	0.1	6.0		5.9		10.2			
% Moisture	86		86		87		86	0.6					91			
Lipid Content (%)	1.1		1.2		1.0		1.1	0.1	0.6		0.7		0.6			
	Conc.	SDL	Conc.	SDL	Conc.	SDL			Conc.	SDL	Conc.	SDL	Conc.	SDL		
Naphthalene	0.92	0.01	1.2	0.02	1.3	0.02	1.1	0.2	4.3	0.01	2.9	0.01	1.0	0.03	3.6	1.0
Acenaphthylene	0.2	0.02	0.23	0.02	0.22	0.02	0.22	0.02	NDR(0.1)	0.03	NDR(0.1)	0.03	NDR(0.07)	0.02	NDR	---
Acenaphthene	0.44	0.01	0.54	0.01	0.54	0.01	0.51	0.1	0.22	0.1	0.31	0.11	0.13	0.03	0.3	---
Fluorene	0.7	0.01	0.9	0.01	0.9	0.01	0.81	0.1	0.4	0.02	0.4	0.02	0.34	0.02	0.4	0.0
Phenanthrene	3.3	0.01	3.7	0.01	3.8	0.01	3.6	0.3	1.0	0.03	1.3	0.04	0.85	0.02	1.2	0.2
Anthracene	0.4	0.01	0.48	0.01	0.42	0.01	0.43	0.04	0.2	0.04	0.23	0.04	0.13	0.02	0.2	---
LPAH	6.0		7.0		7.2		6.7	0.7	5.7		4.6		2.5		5.1	0.7
Fluoranthene	6.9	0.008	7.6	0.009	8.2	0.01	7.6	0.7	3.1	0.01	5.0	0.02	4.4	0.01	4.1	1.3
Pyrene	3.1	0.008	3.4	0.009	4.0	0.01	3.5	0.5	1.8	0.01	2.2	0.02	1.7	0.01	2.0	0.3
Benz(a)anthracene	0.6	0.005	0.6	0.005	0.73	0.006	0.64	0.1	0.22	0.05	0.27	0.08	0.18	0.02	0.2	0.0
Chrysene	1.6	0.005	1.7	0.008	1.9	0.006	1.7	0.2	0.74	0.05	1.0	0.08	0.74	0.02	0.9	0.2
Benzofluoranthenes	0.74	0.006	0.8	0.006	1.1	0.008	0.88	0.2	0.23	0.1	0.21	0.14	0.14	0.07	0.2	---
Benzo(e)pyrene	0.63	0.006	0.65	0.006	0.76	0.007	0.68	0.1	0.19	0.09	0.21	0.14	0.14	0.07	0.2	---
Benzo(a)pyrene	NDR(0.11)	0.008	NDR(0.1)	0.007	NDR(0.14)	0.009	NDR	---	ND	0.11	ND	0.17	ND	0.09	ND	---
Dibenz(ah)anthracene	ND	0.03	ND	0.04	ND	0.04	ND	---	ND	0.22	ND	0.04	ND	0.09	ND	---
Indeno(1,2,3-cd)pyrene	NDR(0.14)	0.01	NDR(0.11)	0.01	NDR(0.17)	0.01	NDR	---	ND	0.16	ND	0.23	ND	0.11	ND	---
Benzo(ghi)perylene	NDR(0.18)	0.008	NDR(.021)	0.007	NDR(0.24)	0.009	NDR	---	ND	0.12	ND	0.18	ND	0.1	ND	---
HPAH	13.6		14.8		16.7		15.0	1.6	5.9		8.5		7.3		7.2	1.8
TPAH	19.5		21.8		23.8		21.7	2.2	11.5		13.1		9.8		12.3	1.1
TPAH (µg/g, wet weight)	0.02		0.02		0.02		0.02	0.00	0.01		0.01		0.01		0.01	0.0
Perylene	0.2	0.007	0.21	0.007	0.26	0.009	0.22	0.03	ND	0.11	ND	0.16	ND	0.09	ND	ND
Surrogate Standards (% recovery)																
Napththalene d-8	44		50		57		50	6.5	69		100		51		85	25
Acenaphthene d-10	50		63		61		58	7.0	74		110		53		92	29
Phenanthrene d-10	65		80		74		73	7.5	80		100		62		90	19
Pyrene d-10	75		84		80		80	4.5	82		81		72		82	5.7
Chrysene d-12	70		86		78		78	8.0	59		55		74		57	10
Benzo(a)pyrene d-12	78		91		85		85	6.5	83		80		90		82	5.0
Perylene d-12	69		84		79		77	7.6	76		76		79		76	1.6
Dibenz(ah)anthracene d-14	67		65		68		67	1.5	66		56		85		61	15
Benzo(ghi)perylene d-12	74		94		82		83	10	66		65		74		66	4.7

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	BBP0.5		BBP0.5		BBP0.5		BBP0.5		14BP0.5		14BP0.5		14BP0.5		14BP0.5	
Composite #	1		2		3		Mean	Std. Dev.	1		2		3		Mean	Std. Dev.
Batch I.D.	PH-0828		PH-0828		PH-0828				PH-0828		PH-0828		PH-0828			
Lab. No.	2891-39		2891-40		2891-41		2891:39-41		2891-79		2891-80		2891-81		2891:79-81	
Sample Weight (gm):	5.2		5.2		6.0		5.4	0.4	7.2		7.2		6.1		6.9	0.6
% Moisture	79		80		78		79	1.0	76		76		76		76	0.0
Lipid Content (%)	2.8		2.7		3.0		2.8	0.2	3.0		3.3		3.3		3.2	0.2
	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*			Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*		
Naphthalene	2.6	*0.005*	3.4	*0.01*	4.9	*0.01*	3.6	1.2	1.2	*0.005*	1.5	*0.005*	1.7	*0.008*	1.5	0.3
Acenaphthylene	0.29	*0.01*	0.28	*0.04*	0.43	*0.03*	0.3	0.1	0.38	*0.01*	0.45	*0.01*	0.33	*0.02*	0.4	0.1
Acenaphthene	0.41	*0.008*	0.44	*0.02*	0.61	*0.02*	0.5	0.1	5.9	*0.009*	5.2	*0.01*	6.5	*0.01*	5.9	0.7
Fluorene	1.3	*0.009*	1.3	*0.03*	1.6	*0.02*	1.4	0.2	4.6	*0.009*	2.8	*0.01*	4.1	*0.01*	3.8	0.9
Phenanthrene	3.3	*0.008*	3.0	*0.02*	4.0	*0.02*	3.4	0.5	15	*0.009*	9.1	*0.01*	9.1	*0.01*	11	3.4
Anthracene	0.42	*0.009*	0.26	*0.02*	0.43	*0.02*	0.4	0.1	2.0	*0.009*	1.7	*0.01*	1.6	*0.01*	1.8	0.2
LPAH	7.0		8.7		12.0		9.2	2.5	29.1		20.8		23.0		24.3	4.3
Fluoranthene	4.1	*0.005*	3.3	*0.01*	4.9	*0.01*	4.1	0.8	34	*0.005*	30	*0.006*	35	*0.007*	33	2.6
Pyrene	2.1	*0.005*	1.3	*0.01*	1.8	*0.01*	1.7	0.4	13	*0.008*	13	*0.006*	9.6	*0.007*	12	2.0
Benz(a)anthracene	0.66	*0.004*	0.33	*0.02*	0.3	*0.009*	0.4	0.2	1.8	*0.006*	1.8	*0.006*	0.8	*0.008*	1.8	0.6
Chrysene	2.3	*0.005*	1.9	*0.02*	1.5	*0.009*	1.9	0.4	5.3	*0.006*	4.3	*0.006*	4.9	*0.008*	4.8	0.5
Benzofluoranthenes	0.46	*0.04*	0.48	*0.17*	0.44	*0.08*	0.5	0.02	2.1	*0.06*	1.1	*0.06*	0.91	*0.07*	2.1	0.6
Benzo(e)pyrene	0.28	*0.04*	0.16	*0.16*	0.1	*0.08*	0.2	0.09	NDR(0.36)	*0.08*	NDR(0.37)	*0.06*	NDR(0.25)	*0.07*	NDR	---
Benzo(a)pyrene	NDR(0.17)	*0.05*	ND(0.2)	*0.2*	ND(0.1)	*0.1*	NDR	---	NDR(0.16)	*0.07*	ND(0.07)	*0.07*	ND(0.09)	*0.09*	ND	---
Dibenz(ah)anthracene	0.1	*0.04*	0.1	*0.1*	0.05	*0.05*	0.1	0.03	ND(0.03)	*0.03*	ND(0.03)	*0.03*	ND(0.05)	*0.05*	ND	---
Indeno(1,2,3-cd)pyrene	NDR(0.16)	*0.04*	ND(0.17)	*0.17*	ND(0.12)	*0.12*	NDR	---	ND(0.07)	*0.07*	ND(0.06)	*0.06*	ND(0.08)	*0.08*	ND	---
Benzo(ghi)perylene	NDR(0.22)	*0.03*	NDR(0.18)	*0.14*	NDR(0.13)	*0.08*	NDR	---	NDR(0.19)	*0.05*	NDR(0.14)	*0.05*	ND(0.07)	*0.07*	NDR	---
HPAH	10.0		7.6		8.4		8.6	1.2	56.2		47.3		49.5		51.0	4.6
TPAH	17.0		16.3		20.3		17.9	2.2	85.3		68.1		72.5		75.3	8.9
TPAH (µg/g, wet weight)	0.02		0.02		0.02		0.02	0.00	0.08		0.07		0.07		0.07	0.0
Perylene	NDR(0.16)	*0.04*	ND(0.18)	*0.18*	ND(0.09)	*0.09*	ND	---	ND(0.09)	*0.09*	ND(0.08)	*0.08*	ND(0.08)	*0.08*	ND(0.08)	---
Surrogate Standards (% recovery)																
Napththalene d-8	53		33		27		38	14	46		48		63		52	9.3
Acenaphthene d-10	58		36		39		44	12	56		54		75		62	12
Phenanthrene d-10	62		43		46		50	10	59		57		82		66	14
Pyrene d-10	64		42		46		51	12	58		57		80		65	13
Chrysene d-12	69		36		51		52	17	52		54		75		60	13
Benzo(a)pyrene d-12	88		69		76		78	10	83		77		79		80	3.1
Perylene d-12	92		73		77		81	10	86		78		80		81	4.2
Dibenz(ah)anthracene d-14	86		63		62		70	14	76		73		64		71	6.2
Benzo(ghi)perylene d-12	97		77		69		81	14	89		83		79		84	5.0

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180BP0.5		180BP0.5		180BP0.5		180BP0.5		384BP0.5		384BP0.5		384BP0.5	
Composite #	1		2		3		Mean	Std. Dev.	1		2A		2B	
Batch I.D.	PH-0904		PH-0904		PH-0904				PH-0997		PH-0997		PH-0997	
Lab. No.	9611-54		9611-55		9611-56		9611:54-56		9611-180		9611-181A		9611-181B	
Sample Weight (gm):	10.0		9.8		9.3		9.7	0.4	5.6		5.3		5.5	
% Moisture	86		88		87		87	1.0	88		89		89	
Lipid Content (%)	1.1		1.0				1.1	0.1						
	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*			Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*
Naphthalene	0.94	*0.02*	1.0	*0.01*	0.82	*0.03*	0.9	0.1	ND	*5.4*	ND	*3.1*	ND	*3.3*
Acenaphthylene	0.24	*0.02*	0.19	*0.02*	0.29	*0.03*	0.2	0.1	0.11	*0.02*	0.09	*0.06*	0.1	*0.05*
Acenaphthene	0.6	*0.02*	0.66	*0.02*	0.53	*0.03*	0.6	0.1	0.29	*0.01*	0.21	*0.02*	0.22	*0.03*
Fluorene	0.8	*0.005*	0.8	*0.004*	0.8	*0.007*	0.8	0.02	0.2	*0.03*	0.3	*0.04*	0.2	*0.06*
Phenanthrene	3.4	*0.007*	3.6	*0.006*	3.1	*0.009*	3.4	0.3	1.3	*0.02*	1.2	*0.02*	1.2	*0.02*
Anthracene	0.51	*0.007*	0.51	*0.007*	0.57	*0.01*	0.5	0.0	NDR(0.25)	*0.02*	NDR(0.24)	*0.02*	NDR(0.24)	*0.02*
LPAH	6.5		6.6		6.2		6.4	0.2	1.9		1.8		1.7	
Fluoranthene	7.5	*0.008*	7.5	*0.008*	8.0	*0.01*	7.7	0.3	4.8	*0.02*	4.0	*0.02*	3.8	*0.02*
Pyrene	3.4	*0.008*	3.4	*0.008*	3.5	*0.01*	3.4	0.1	2.3	*0.02*	2.0	*0.02*	1.8	*0.02*
Benz(a)anthracene	0.69	*0.004*	0.68	*0.003*	0.92	*0.005*	0.8	0.1	NDR(0.25)	*0.007*	0.27	*0.02*	0.27	*0.009*
Chrysene	1.7	*0.004*	2.1	*0.004*	1.7	*0.005*	1.8	0.2	0.89	*0.008*	0.68	*0.008*	0.68	*0.01*
Benzofluoranthenes	0.96	*0.02*	0.86	*0.02*	1.0	*0.02*	0.9	0.1	NDR(0.35)	*0.02*	NDR(0.21)	*0.008*	NDR(0.2)	*0.03*
Benzo(e)pyrene	0.79	*0.02*	0.8	*0.02*	0.83	*0.02*	0.8	0.02	0.24	*0.02*	0.17	*0.02*	0.16	*0.03*
Benzo(a)pyrene	NDR(0.19)	*0.02*	NDR(0.16)	*0.02*	NDR(0.2)	*0.03*	NDR	---	NDR(0.03)	*0.02*	ND	*0.02*	ND	*0.03*
Dibenz(ah)anthracene	NDR(0.06)	*0.02*	NDR(0.04)	*0.01*	NDR(0.03)	*0.01*	NDR	---	ND	*0.05*	ND	*0.02*	ND	*0.03*
Indeno(1,2,3-cd)pyrene	NDR(0.18)	*0.008*	NDR(0.15)	*0.008*	NDR(0.17)	*0.009*	NDR	---	NDR(0.05)	*0.03*	ND	*0.03*	ND	*0.04*
Benzo(ghi)perylene	NDR(0.23)	*0.007*	NDR(0.2)	*0.008*	NDR(0.25)	*0.007*	NDR	---	NDR(0.06)	*0.03*	NDR(0.04)	*0.03*	NDR(0.05)	*0.04*
HPAH	15.0		15.3		16.0		15.4	0.5	8.2		7.1		6.7	
TPAH	21.5		21.9		22.1		21.9	0.3	10.1		8.9		8.5	
TPAH (µg/g, wet weight)	0.02		0.02		0.02		0.02	0.0	0.01		0.01		0.01	
Perylene	0.27	*0.02*	0.26	*0.02*	0.28	*0.03*	0.3	0.01	NDR(0.1)	*0.03*	NDR(0.06)	*0.03*	NDR(0.07)	*0.04*
Surrogate Standards (% recovery)														
Napththalene d-8	64		67		43		58	13	79		60		35	
Acenaphthene d-10	78		82		71		77	5.6	86		66		55	
Phenanthrene d-10	90		89		96		92	3.8	98		91		84	
Pyrene d-10	95		96		100		97	2.6	97		99		100	
Chrysene d-12	84		85		92		87	4.4	85		89		86	
Benzo(a)pyrene d-12	87		82		93		87	5.5	120		130		120	
Perylene d-12	79		75		87		80	6.1	110		110		110	
Dibenz(ah)anthracene d-14	67		71		94		77	15	120		130		120	
Benzo(ghi)perylene d-12	73		76		94		81	11	110		120		110	

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	384BP0.5			384BP0.5		14BP2.0		14BP2.0		14BP2.0		14BP2.0	
Composite #	mean	3		Mean	Std. Dev.	1		2		3		Mean	Std. Dev.
Batch I.D.		PH-0997				PH-0822		PH-0822		PH-0822			
Lab. No.	9611-181	9611-182		9611:180-182		2891-82		2891-83		2891-84		2891:82-84	
Sample Weight (gm):	5.4	5.5				10.1		9.0		10.1		9.7	0.6
% Moisture	89	88				76		78		77		77	1.0
Lipid Content (%)						3.1		2.8		2.8		2.9	0.2
	Conc.	Conc.	*SDL*			Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*		
Naphthalene	ND	ND	*3.6*	ND	---	1.1	*0.19*	0.87	*0.15*	0.69	*0.15*	0.89	0.2
Acenaphthylene	0.095	0.09	*0.03*	0.1	0.01	NDR(0.34)	*0.11*	NDR(0.22)	*0.08*	NDR(0.27)	*0.08*	NDR	---
Acenaphthene	0.215	0.23	*0.02*	0.2	0.04	3.2	*0.7*	2.6	*0.08*	2.7	*0.06*	2.8	0.3
Fluorene	0.2	0.2	*0.05*	0.2	0.03	1.9	*0.2*	1.1	*0.15*	1.0	*0.16*	1.3	0.5
Phenanthrene	1.2	1.0	*0.02*	1.2	0.2	5.6	*0.17*	4.5	*0.15*	3.8	*0.16*	4.6	0.9
Anthracene	NDR	NDR(0.2)	*0.02*	NDR	---	NDR(1.2)	*0.19*	NDR(0.81)	*0.17*	NDR(0.67)	*0.17*	NDR	---
LPAH	1.7	1.5		1.7	0.2	11.8		9.1		8.2		9.7	1.9
Fluoranthene	3.9	4.0	*0.02*	4.2	0.5	30	*0.07*	32	*0.07*	30	*0.06*	31	1.2
Pyrene	1.9	2.0	*0.02*	2.1	0.2	10	*0.7*	8.4	*0.07*	8.4	*0.07*	8.9	0.9
Benz(a)anthracene	0.27	0.23	*0.01*	0.3	0.03	0.82	*0.21*	0.55	*0.2*	ND	*0.31*	0.69	0.2
Chrysene	0.68	0.66	*0.01*	0.7	0.1	2.7	*0.22*	2.4	*0.21*	2.0	*0.2*	2.4	0.4
Benzofluoranthenes	NDR	NDR(0.24)	*0.03*	NDR	---	ND	*0.53*	ND	*0.4*	ND	*0.38*	ND	---
Benzo(e)pyrene	0.165	0.18	*0.03*	0.2	0.04	ND	*0.69*	ND	*0.41*	ND	*0.38*	ND	---
Benzo(a)pyrene	ND	ND	*0.04*	ND	---	ND	*0.53*	ND	*0.56*	ND	*0.53*	ND	---
Dibenz(ah)anthracene	ND	ND	*0.04*	ND	---	ND	*2.0*	ND	*0.8*	ND	*1.0*	ND	---
Indeno(1,2,3-cd)pyrene	ND	ND	*0.05*	ND	---	ND	*0.64*	ND	*1.3*	ND	*0.37*	ND	---
Benzo(ghi)perylene	NDR	ND	*0.05*	NDR	---	ND	*0.5*	ND	*1.0*	ND	*0.29*	ND	---
HPAH	6.9	7.1		7.4	0.7	43.5		43.4		40.4		42.4	1.8
TPAH	8.7	8.6		9.1	0.9	55.3		52.4		48.6		52.1	3.4
TPAH (µg/g, wet weight)	0.01	0.01		0.01	0.00	0.06		0.05		0.05		0.05	0.0
Perylene	NDR	NDR(0.06)	*0.04*	NDR	---	ND	*0.61*	ND	*0.66*	ND	*0.64*	ND	---
Surrogate Standards (% recovery)													
Napththalene d-8	48	59		62	15.9	58		70		52		60	9.2
Acenaphthene d-10	61	78		75	13.0	59		70		55		61	7.8
Phenanthrene d-10	88	100		95	6.7	70		74		57		67	8.9
Pyrene d-10	100	99		99	1.3	100		99		81		93	11
Chrysene d-12	88	79		84	4.4	83		80		66		76	9.1
Benzo(a)pyrene d-12	125	120		122	2.9	99		110		100		103	6.1
Perylene d-12	110	110		110	0.0	100		110		97		102	6.8
Dibenz(ah)anthracene d-14	125	120		122	2.9	60		77		64		67	8.9
Benzo(ghi)perylene d-12	115	110		112	2.9	80		89		76		82	6.7

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180BP2.0		180BP2.0		180BP2.0		180BP2.0		384BP2.0		384BP2.0		384BP2.0	
Composite #	1		2		3		Mean	Std. Dev.	1		2		3	
Batch I.D.	PH-0885		PH-0885		PH-0885				PH-0997		PH-0997		PH-0997	
Lab. No.	9611-57		9611-58		9611-59		9611:57-59		9611-183		9611-184		9611-185	
Sample Weight (gm):	10.4		10.4		10.4		10.4	0.0	5.5		5.5		5.5	
% Moisture	87		86		87		87	0.6	88		86		89	
Lipid Content (%)	1.0				1.1		1.1	0.1						
	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*			Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*
Naphthalene	2.0	*0.01*	5.5	*0.009*	1.7	*0.007*	3.1	2.1	ND	*5.8*	ND	*4.7*	ND	*3.3*
Acenaphthylene	NDR(0.27)	*0.02*	0.42	*0.02*	0.27	*0.02*	0.3	0.1	NDR(0.09)	*0.02*	NDR(0.11)	*0.02*	NDR(0.09)	*0.01*
Acenaphthene	0.58	*0.01*	0.63	*0.01*	0.56	*0.009*	0.6	0.04	0.27	*0.02*	0.25	*0.01*	0.2	*0.01*
Fluorene	1.0	*0.02*	1.1	*0.02*	0.8	*0.01*	1.0	0.1	0.3	*0.03*	0.3	*0.03*	0.3	*0.03*
Phenanthrene	3.4	*0.008*	6.0	*0.009*	3.7	*0.008*	4.4	1.4	1.3	*0.02*	1.3	*0.02*	1.2	*0.02*
Anthracene	0.42	*0.008*	0.89	*0.009*	0.47	*0.008*	0.6	0.3	NDR(0.19)	*0.02*	NDR(0.22)	*0.02*	NDR(0.2)	*0.02*
LPAH	7.4		14.5		7.5		9.8	4.1	1.8		1.9		1.7	
Fluoranthene	7.0	*0.004*	24	*0.005*	9.8	*0.004*	13.6	9.1	3.1	*0.02*	4.6	*0.02*	4.0	*0.02*
Pyrene	3.1	*0.004*	13	*0.005*	4.4	*0.004*	6.8	5.4	1.8	*0.02*	2.2	*0.02*	1.8	*0.02*
Benz(a)anthracene	0.61	*0.004*	1.2	*0.004*	0.84	*0.004*	0.9	0.3	0.23	*0.01*	0.21	*0.008*	0.19	*0.01*
Chrysene	1.5	*0.004*	3.4	*0.005*	1.9	*0.004*	2.3	1.0	0.58	*0.01*	0.84	*0.008*	0.8	*0.008*
Benzofluoranthenes	0.86	*0.006*	1.7	*0.007*	1.2	*0.006*	1.3	0.4	NDR(0.24)	*0.02*	NDR(0.22)	*0.02*	NDR(0.23)	*0.02*
Benzo(e)pyrene	0.54	*0.006*	1.8	*0.007*	0.89	*0.006*	1.1	0.7	0.14	*0.03*	0.16	*0.02*	0.17	*0.02*
Benzo(a)pyrene	NDR(0.08)	*0.006*	0.15	*0.008*	0.16	*0.007*	0.2	0.01	ND	*0.03*	ND	*0.02*	ND	*0.02*
Dibenz(ah)anthracene	NDR(0.08)	*0.02*	NDR(0.03)	*0.02*	ND	*0.02*	NDR	---	ND	*0.04*	ND	*0.02*	ND	*0.03*
Indeno(1,2,3-cd)pyrene	NDR(0.14)	*0.03*	NDR(0.24)	*0.03*	NDR(0.19)	*0.03*	NDR	---	ND		ND	*0.04*	ND	*0.03*
Benzo(ghi)perylene	NDR(0.2)	*0.02*	NDR(0.3)	*0.02*	NDR(0.24)	*0.02*	NDR	---	NDR(0.07)	*0.04*	NDR(0.06)	*0.04*	NDR(0.05)	*0.03*
HPAH	13.6		45.3		19.2		26.0	16.9	5.9		8.0		7.0	
TPAH	21.0		59.8		26.7		35.8	20.9	7.7		9.9		8.6	
TPAH (µg/g, wet weight)	0.02		0.06		0.03		0.04	0.02	0.01		0.01		0.01	
Perylene	0.25	*0.007*	0.56	*0.008*	0.35	*0.007*	0.4	0.2	NDR(0.06)	*0.03*	NDR(0.06)	*0.03*	NDR(0.06)	*0.02*
Surrogate Standards (% recovery)														
Napththalene d-8	20		27		29		25	4.7	100		75		100	
Acenaphthene d-10	30		37		38		35	4.4	110		85		100	
Phenanthrene d-10	62		70		66		66	4.0	110		95		110	
Pyrene d-10	80		83		80		81	1.7	99		93		97	
Chrysene d-12	77		80		76		78	2.1	82		82		84	
Benzo(a)pyrene d-12	91		96		90		92	3.2	120		120		120	
Perylene d-12	83		89		83		85	3.5	110		110		110	
Dibenz(ah)anthracene d-14	88		100		90		93	6.4	120		120		120	
Benzo(ghi)perylene d-12	83		90		87		87	3.5	120		110		120	

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	384BP2.0		14BP10		14BP10		14BP10	14BP10		14BP10		14BP10	
Composite #	Mean	Std. Dev.	1A		1B		mean	2		3		Mean	Std. Dev.
Batch I.D.			PH-0822		PH-0822			PH-0822		PH-0822			
Lab. No.	9611:183-185		2891-85A		2891-85B		2891-85	2891-86		2891-87		2891:85-87	
Sample Weight (gm):	5.5	0.0	8.2		7.6		7.9	10.0		10.4		9.4	1.3
% Moisture	88	1.5	76		76		76	77		77		77	0.6
Lipid Content (%)							3.1	3.0		2.9		3.0	0.1
			Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*	Conc.	*SDL*		
Naphthalene	ND	---	NDR(1.4)	*0.19*	NDR(1.1)	*0.21*	NDR	NDR(1.0)	*0.16*	NDR(1.0)	*0.15*	NDR	---
Acenaphthylene	NDR	---	NDR(0.4)	*0.1*	NDR(0.36)	*0.19*	NDR	NDR(0.3)	*0.09*	NDR(0.29)	*0.09*	NDR	---
Acenaphthene	0.2	0.04	2.3	*0.07*	2.4	*0.09*	2.4	2.2	*0.06*	2.1	*0.09*	2.2	0.1
Fluorene	0.3	0.05	NDR(1.7)	*0.2*	NDR(1.8)	*0.23*	NDR	NDR(1.8)	*0.17*	NDR(1.7)	*0.16*	NDR	---
Phenanthrene	1.3	0.06	6.8	*0.19*	6.8	*0.23*	6.8	5.9	*0.16*	5.5	*0.15*	6.1	0.7
Anthracene	NDR	---	0.89	*0.22*	0.96	*0.27*	0.925	0.83	*0.18*	0.85	*0.17*	0.87	0.1
LPAH	1.8	0.1	10.0		10.2		10.1	8.9		8.5		9.2	0.8
Fluoranthene	3.9	0.75	34	*0.1*	34	*0.09*	34	30	*0.07*	26	*0.08*	30	4.0
Pyrene	1.9	0.23	11	*0.1*	11	*0.1*	11	10	*0.07*	7.3	*0.09*	9.4	1.9
Benz(a)anthracene	0.2	0.02	0.91	*0.27*	0.67	*0.26*	0.79	0.71	*0.2*	1.1	*0.23*	0.87	0.2
Chrysene	0.7	0.14	3.5	*0.28*	3.0	*0.27*	3.25	2.5	*0.21*	2	*0.24*	2.6	0.6
Benzofluoranthenes	NDR	---	ND	*0.43*	ND	*0.45*	ND	ND	*0.46*	ND	*0.27*	ND	---
Benzo(e)pyrene	0.2	0.02	ND	*0.39*	ND	*0.46*	ND	ND	*0.52*	ND	*0.27*	ND	---
Benzo(a)pyrene	ND	---	ND	*0.54*	ND	*0.64*	ND	ND	*0.42*	ND	*0.38*	ND	---
Dibenz(ah)anthracene	ND	---	ND	*1.1*	ND	*0.47*	ND	ND	*0.36*	ND	*2.6*	ND	---
Indeno(1,2,3-cd)pyrene	ND	---	ND	*0.73*	ND	*0.56*		ND	*0.27*	ND	*0.75*	ND	---
Benzo(ghi)perylene	NDR	---	ND	*0.57*	ND	*0.43*	ND	ND	*0.21*	ND	*0.58*	ND	---
HPAH	6.9	1.1	49.4		48.7		49.0	43.2		36.4		42.9	6.3
TPAH	8.7	1.1	59.4		58.8		59.1	52.1		44.9		52.0	7.1
TPAH (µg/g, wet weight)	0.01	0.001	0.06		0.06		0.06	0.05		0.05		0.05	0.01
Perylene	NDR	---	ND	*0.62*	ND	*0.73*	ND	ND	*0.52*	ND	*0.43*	ND	---
Surrogate Standards (% recovery)													
Napththalene d-8	92	14	65		55		60	51		65		59	7.1
Acenaphthene d-10	98	13	69		54		62	55		70		62	7.5
Phenanthrene d-10	105	8.7	70		55		63	59		75		66	8.4
Pyrene d-10	96	3.1	80		80		80	80		81		80	0.6
Chrysene d-12	83	1.2	73		72		73	66		69		69	3.3
Benzo(a)pyrene d-12	120	0.0	100		100		100	100		100		100	0.0
Perylene d-12	110	0.0	100		110		105	96		100		100	4.5
Dibenz(ah)anthracene d-14	120	0.0	66		72		69	69		63		67	3.5
Benzo(ghi)perylene d-12	117	5.8	76		82		79	82		80		80	1.5

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180BP10		180BP10		180BP10	180BP10		180BP10		180BP10	
Composite #	1A		1B		mean	2		3		Mean	Std. Dev.
Batch I.D.	PH-0903		PH-0903			PH-0903		PH-0903			
Lab. No.	9611-60A		9611-60B		9611-60	9611-61		9611-62		9611:60-62	
Sample Weight (gm):	10.1		10.9		10.5	12.6		10.6		11.2	1.2
% Moisture	86		86		86	87		86		86	0.6
Lipid Content (%)								1.0		1.0	
	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*	Conc.	*SDL*		
Naphthalene	0.72	*0.01*	0.72	*0.02*	0.72	0.81	*0.01*	0.74	*0.009*	0.8	0.05
Acenaphthylene	0.22	*0.01*	0.2	*0.01*	0.21	0.18	*0.01*	0.16	*0.009*	0.2	0.03
Acenaphthene	0.43	*0.01*	0.47	*0.01*	0.45	0.5	*0.008*	0.44	*0.008*	0.5	0.03
Fluorene	0.8	*0.006*	0.7	*0.009*	0.7	0.7	*0.007*	0.6	*0.007*	0.7	0.07
Phenanthrene	3.0	*0.009*	3.0	*0.009*	3.0	3.2	*0.007*	3.0	*0.007*	3.1	0.12
Anthracene	0.46	*0.009*	0.43	*0.01*	0.445	0.38	*0.007*	0.38	*0.007*	0.4	0.04
LPAH	5.6		5.5		5.6	5.8		5.3		5.6	0.22
Fluoranthene	6.2	*0.008*	6.1	*0.008*	6.15	5.9	*0.006*	5.7	*0.006*	5.9	0.23
Pyrene	3.0	*0.008*	2.9	*0.008*	2.95	2.8	*0.006*	2.6	*0.006*	2.8	0.18
Benz(a)anthracene	0.61	*0.005*	0.55	*0.005*	0.58	0.62	*0.005*	0.62	*0.004*	0.6	0.02
Chrysene	1.4	*0.004*	1.4	*0.004*	1.4	1.4	*0.005*	1.5	*0.004*	1.4	0.06
Benzofluoranthenes	0.82	*0.005*	0.77	*0.005*	0.795	0.7	*0.008*	0.71	*0.004*	0.7	0.05
Benzo(e)pyrene	NDR(0.68)	*0.005*	NDR(0.62)	*0.004*	NDR	NDR(0.58)	*0.005*	NDR(0.58)	*0.004*	NDR	---
Benzo(a)pyrene	NDR(0.15)	*0.008*	NDR(0.12)	*0.006*	NDR	NDR(0.14)	*0.007*	NDR(0.14)	*0.005*	NDR	---
Dibenz(ah)anthracene	NDR(0.12)	*0.03*	NDR(0.06)	*0.02*	NDR	NDR(0.04)	*0.03*	NDR(0.04)	*0.02*	NDR	---
Indeno(1,2,3-cd)pyrene	NDR(0.21)	*0.008*	NDR(0.18)	*0.006*	NDR	NDR(0.15)	*0.008*	NDR(0.18)	*0.007*	NDR	---
Benzo(ghi)perylene	NDR(0.23)	*0.005*	NDR(0.22)	*0.004*	NDR	NDR(0.2)	*0.005*	NDR(0.2)	*0.005*	NDR	---
HPAH	12.0		11.7		11.9	11.4		11.1		11.5	0.38
TPAH	17.6		17.3		17.4	17.2		16.5		17.0	0.51
TPAH (µg/g, wet weight)	0.02		0.02		0.02	0.02		0.02		0.02	0.00
Perylene	NDR(0.27)	*0.008*	NDR(0.24)	*0.006*	NDR	NDR(0.23)	*0.007*	NDR(.24)	*0.005*	NDR	---
Surrogate Standards (% recovery)											
Napththalene d-8	50		45		48	46		57		50	6.0
Acenaphthene d-10	77		75		76	74		80		77	3.1
Phenanthrene d-10	97		91		94	95		91		93	2.1
Pyrene d-10	100		99		100	99		97		99	1.3
Chrysene d-12	100		110		105	75		91		90	15
Benzo(a)pyrene d-12	98		97		98	67		80		82	15
Perylene d-12	87		86		87	56		65		69	16
Dibenz(ah)anthracene d-14	83		98		91	62		70		74	15
Benzo(ghi)perylene d-12	79		85		82	58		59		66	14

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	384BP10		384BP10		384BP10			384BP10		384BP10	
Composite #	1		2A		2B		mean	3		Mean	Std. Dev.
Batch I.D.	PH-1008		PH-1008		PH-1008			PH-1008			
Lab. No.	9611-186		9611-187A		9611-187B			9611-188		9611:186-188	
Sample Weight (gm):	5.8		5.7		5.7		5.7	5.6		5.7	0.1
% Moisture											
Lipid Content (%)	0.9		0.7		0.7		0.7	0.8		0.78	0.09
	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*		
Naphthalene	2.8	*0.01*	4.6	*0.01*	5.3	*0.2*	5.0	3.3	*0.01*	3.7	1.1
Acenaphthylene	NDR(0.11)	*0.03*	NDR(0.13)	*0.03*	NDR(0.14)	*0.04*	NDR	NDR(0.13)	*0.03*	NDR	---
Acenaphthene	0.37	*0.11*	0.42	*0.1*	0.42	*0.14*	0.42	0.41	*0.11*	0.40	0.03
Fluorene	NDR(0.4)	*0.02*	0.3	*0.02*	0.3	*0.02*	0.3	0.5	*0.02*	0.41	0.14
Phenanthrene	1.7	*0.04*	1.4	*0.03*	1.4	*0.05*	1.4	1.6	*0.04*	1.6	0.15
Anthracene	0.27	*0.04*	0.28	*0.03*	0.28	*0.05*	0.28	0.26	*0.04*	0.27	0.01
LPAH	5.1		7.0		7.7		7.4	6.1		6.19	1.11
Fluoranthene	5.8	*0.01*	5.4	*0.01*	5.2	*0.02*	5.3	5.1	*0.01*	5.4	0.36
Pyrene	2.9	*0.01*	2.5	*0.01*	2.4	*0.02*	2.5	2.4	*0.01*	2.6	0.28
Benz(a)anthracene	0.27	*0.06*	0.3	*0.05*	0.24	*0.07*	0.27	0.28	*0.06*	0.27	0.01
Chrysene	1.1	*0.05*	1.0	*0.05*	0.98	*0.07*	0.99	1.1	*0.06*	1.1	0.1
Benzofluoranthenes	NDR(0.3)	*0.08*	NDR(0.29)	*0.08*	NDR(0.33)	*0.12*	NDR	NDR(0.23)	*0.11*	NDR	---
Benzo(e)pyrene	NDR(0.26)	*0.07*	NDR(0.24)	*0.08*	NDR(0.23)	*0.12*	NDR	NDR(0.19)	*0.11*	NDR	---
Benzo(a)pyrene	ND	*0.09*	ND	*0.1*	ND	*0.14*	ND	ND	*0.13*	ND	---
Dibenz(ah)anthracene	ND	*0.15*	ND	*0.21*	ND	*0.21*	ND	ND	*0.26*	ND	---
Indeno(1,2,3-cd)pyrene	ND	*0.14*	ND	*0.12*	ND	*0.17*	ND	ND	*0.17*	ND	---
Benzo(ghi)perylene	ND	*0.1*	ND	*0.09*	ND	*0.13*	ND	ND	*0.13*	ND	---
HPAH	10.1		9.2		8.8		9.0	8.9		9.3	0.7
TPAH	15.2		16.2		16.5		16.4	15.0		15.5	0.8
TPAH (µg/g, wet weight)	0.01		0.02		0.02		0.02	0.01		0.02	0.001
Perylene	NDR(0.09)	*0.09*	NDR(0.05)	*0.09*	ND	*0.13*	NDR	ND	*0.13*	NDR	---
Surrogate Standards (% recovery)											
Napththalene d-8	77		73		70		72	67		72	5.0
Acenaphthene d-10	78		76		70		73	68		73	5.0
Phenanthrene d-10	84		85		76		81	78		81	3.0
Pyrene d-10	84		84		84		84	82		83	1.2
Chrysene d-12	60		82		58		70	55		62	7.6
Benzo(a)pyrene d-12	90		85		88		87	80		86	5.1
Perylene d-12	84		79		83		81	74		80	5.1
Dibenz(ah)anthracene d-14	76		75		79		77	63		72	7.8
Benzo(ghi)perylene d-12	79		75		80		78	67		75	6.5

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	14WP0.5		14WP0.5		14WP0.5		14WP0.5	14WP0.5		14WP0.5	
Composite #	1		2A		2B		mean	3		Mean	Std. Dev.
Batch I.D.	PH-0828		PH-0828		PH-0828			PH-0835			
Lab. No.	2891-88		2891-89A		2891-89B		2891-89	2891-90		2891:88-90	
Sample Weight (gm):	6.0		5.3		6.2		5.7	5.0		5.6	0.5
% Moisture	75		75		75		75	76		75	1
Lipid Content (%)	3.2						3.2	2.8		3.1	0.2
	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*		
Naphthalene	1.3	*0.01*	1.2	*0.006*	1.3	*0.008*	1.3	2.2	*0.03*	1.6	0.5
Acenaphthylene	0.26	*0.03*	0.19	*0.02*	0.25	*0.02*	0.22	0.26	*0.06*	0.25	0.02
Acenaphthene	2.0	*0.02*	2.0	*0.01*	2.0	*0.01*	2.0	2.2	*0.04*	2.1	0.1
Fluorene	2.2	*0.02*	1.6	*0.01*	1.6	*0.02*	1.6	2.2	*0.02*	2.0	0.3
Phenanthrene	7.1	*0.02*	6.3	*0.01*	6.4	*0.01*	6.35	6.8	*0.09*	6.8	0.4
Anthracene	1.0	*0.02*	1.1	*0.01*	0.91	*0.01*	1.005	1.0	*0.09*	1.0	0.0
LPAH	13.9		12.4		12.5		12.4	14.7		13.6	1.1
Fluoranthene	34	*0.01*	26	*0.007*	25	*0.007*	26	49	*0.008*	36	12
Pyrene	9.8	*0.01*	9.6	*0.008*	9.5	*0.008*	9.55	11	*0.008*	10	0.8
Benz(a)anthracene	0.76	*0.01*	0.66	*0.009*	NDR(0.72)	*0.009*	0.66	0.89	*0.01*	0.77	0.1
Chrysene	3.6	*0.01*	3.4	*0.009*	3.3	*0.009*	3.4	4.5	*0.01*	3.8	0.6
Benzofluoranthenes	NDR(1.1)	*0.12*	NDR(0.8)	*0.09*	NDR(0.63)	*0.1*	NDR(0.8)	NDR(1.6)	*0.03*	NDR	---
Benzo(e)pyrene	0.47	*0.11*	0.5	*0.09*	0.5	*0.1*	0.5	1.2	*0.04*	0.72	0.4
Benzo(a)pyrene	ND(0.14)	*0.14*	ND(0.11)	*0.11*	ND(0.12)	*0.12*	ND(0.11)	ND(0.04)	*0.04*	ND	---
Dibenz(ah)anthracene	ND(0.07)	*0.07*	ND(0.06)	*0.06*	ND(0.07)	*0.07*	ND(0.06)	ND(0.11)	*0.11*	ND	---
Indeno(1,2,3-cd)pyrene	ND(0.12)	*0.12*	ND(0.1)	*0.1*	ND(0.12)	*0.12*	ND(0.1)	ND(0.15)	*0.15*	ND	---
Benzo(ghi)perylene	ND(0.1)	*0.1*	NDR(0.13)	*0.09*	NDR(0.18)	*0.1*	NDR(0.18)	NDR(0.25)	*0.14*	NDR	---
HPAH	48.2		40.2		38.3		39.2	65.4		50.9	13.3
TPAH	62.0		52.6		50.8		51.7	80.1		64.6	14.4
TPAH (µg/g, wet weight)	0.06		0.05		0.05		0.05	0.08		0.06	0.01
Perylene	ND(0.13)	*0.13*	ND(0.1)	*0.1*	ND(0.14)	*0.14*	ND(0.1)	ND(0.04)	*0.04*	ND	---
Surrogate Standards (% recovery)											
Napththalene d-8	48		64		50		57	61		55	6.7
Acenaphthene d-10	60		70		54		62	62		61	1.2
Phenanthrene d-10	81		72		64		68	63		71	9.3
Pyrene d-10	85		70		67		69	62		72	12
Chrysene d-12	77		58		57		58	54		63	12
Benzo(a)pyrene d-12	82		78		64		71	53		69	15
Perylene d-12	84		80		64		72	55		70	15
Dibenz(ah)anthracene d-14	66		65		48		57	33		52	17
Benzo(ghi)perylene d-12	82		78		59		69	49		67	17

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180WP0.5		180WP0.5		180WP0.5	180WP0.5		180WP0.5		180WP0.5		180WP0.5	180WP0.5	
Composite #	1A		1B		mean	2		3A		3B		mean	Mean	Std. Dev.
Batch I.D.	PH-0904		PH-0904			PH-0901		PH-0901		PH-0901				
Lab. No.	9611-63A		9611-63B		9611-63	9611-64		9611-65A		9611-65B		9611-65	9611:63-65	
Sample Weight (gm):	10.0		9.1		9.5	10.8		9.7		10.7			10.2	
% Moisture	88		87		88	88		87		87			88	
Lipid Content (%)	0.9				0.9	1.0		0.9					1.0	0.1
	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*	Conc.		
Naphthalene	1.0	*0.02*	1.2	*0.01*	1.1	0.66	*0.02*	0.76	*0.02*	0.76	*0.01*	0.76	0.84	0.23
Acenaphthylene	0.16	*0.02*	0.18	*0.02*	0.17	0.24	*0.02*	0.23	*0.02*	0.21	*0.02*	0.22	0.21	0.04
Acenaphthene	0.34	*0.02*	0.38	*0.02*	0.36	0.46	*0.02*	0.38	*0.02*	0.4	*0.01*	0.39	0.40	0.05
Fluorene	0.6	*0.006*	0.7	*0.005*	0.6	1.0	*0.01*	0.9	*0.01*	0.7	*0.009*	0.8	0.80	0.17
Phenanthrene	3.0	*0.007*	3.6	*0.007*	3.3	3.6	*0.01*	3.0	*0.01*	3	*0.009*	3	3.3	0.3
Anthracene	0.38	*0.008*	0.43	*0.008*	0.405	0.6	*0.01*	0.47	*0.01*	0.59	*0.01*	0.53	0.51	0.1
LPAH	5.4		6.5		6.0	6.5		5.7		5.7		5.7	6.1	0.4
Fluoranthene	6.8	*0.009*	7.9	*0.009*	7.4	8.1	*0.01*	7.1	*0.01*	6.8	*0.009*	6.95	7.5	0.58
Pyrene	3.4	*0.009*	4	*0.009*	3.7	4	*0.01*	3.1	*0.01*	3.1	*0.009*	3.1	3.6	0.46
Benz(a)anthracene	0.89	*0.004*	1.2	*0.004*	1.045	0.9	*0.006*	0.82	*0.006*	0.94	*0.005*	0.88	0.94	0.09
Chrysene	2.4	*0.004*	2.7	*0.004*	2.55	2.1	*0.006*	2	*0.006*	2.3	*0.005*	2.15	2.3	0.25
Benzofluoranthenes	1.3	*0.02*	1.6	*0.02*	1.45	1.4	*0.008*	1.1	*0.008*	1.1	*0.006*	1.1	1.3	0.19
Benzo(e)pyrene	0.86	*0.02*	1.0	*0.02*	0.93	1.0	*0.008*	0.76	*0.01*	0.73	*0.006*	0.745	0.89	0.13
Benzo(a)pyrene	0.27	*0.02*	0.33	*0.02*	0.33	0.18	*0.01*	0.08	*0.01*	0.16	*0.007*	0.12	0.21	0.11
Dibenz(ah)anthracene	NDR(0.03)	*0.01*	NDR(0.05)	*0.02*	NDR	ND	*0.05*	ND	*0.01*	ND	*0.05*	ND	NDR	---
Indeno(1,2,3-cd)pyrene	NDR(0.18)	*0.008*	NDR(0.22)	*0.009*	NDR	NDR(0.18)	*0.01*	NDR(0.17)	*0.01*	NDR(0.14)	*0.01*	NDR(0.17)	NDR	---
Benzo(ghi)perylene	NDR(0.21)	*0.006*	NDR(0.26)	*0.007*	NDR	NDR(0.23)	*0.01*	NDR(0.22)	*0.01*	NDR(0.21)	*0.007*	NDR(0.23)	NDR	---
HPAH	15.9		18.7		17.3	17.7		15.0		15.1		15.0	16.7	1.4
TPAH	21.4		25.2		23.3	24.2		20.7		20.8		20.7	22.7	1.8
TPAH (µg/g, wet weight)	0.02		0.02		0.02	0.02		0.02		0.02		0.02	0.02	0.00
Perylene	0.22	*0.02*	0.26	*0.02*	0.26	0.29	*0.01*	0.2	*0.05*	0.21	*0.007*	0.205	0.25	0.04
Surrogate Standards (% recovery)														
Napththalene d-8	67		68		68	50		48		60		54	57	9.2
Acenaphthene d-10	81		83		82	60		57		63		60	67	13
Phenanthrene d-10	87		84		86	76		74		81		78	80	5.1
Pyrene d-10	92		88		90	80		79		85		82	84	5.3
Chrysene d-12	83		74		79	74		73		80		77	76	2.3
Benzo(a)pyrene d-12	81		73		77	85		86		90		88	83	5.7
Perylene d-12	74		65		70	78		81		83		82	77	6.4
Dibenz(ah)anthracene d-14	75		63		69	73		75		73		74	72	2.6
Benzo(ghi)perylene d-12	76		66		71	84		86		90		88	81	8.9

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (A). Whole Body Tissue *parental* PAH Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	384WP0.5		384WP0.5		384WP0.5		384WP0.5	
Composite #	1		2		3		Mean	Std. Dev.
Batch I.D.	PH-1008		PH-1008		PH-1008			
Lab. No.	9611-189		9611-190		9611-191		9611:189-191	
Sample Weight (gm):	5.8		5.7		5.9		5.8	0.1
% Moisture								
Lipid Content (%)	0.8		0.7		1.1		0.88	0.19
	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*		
Naphthalene	5.9	*0.01*	4.2	*0.02*	3.0	*0.01*	4.4	1.5
Acenaphthylene	NDR(1.1)	*0.03*	NDR(0.09)	*0.03*	NDR(0.13)	*0.03*	NDR	---
Acenaphthene	0.54	*0.09*	0.28	*0.13*	0.3	*0.09*	0.37	0.14
Fluorene	0.4	*0.01*	0.5	*0.02*	0.4	*0.01*	0.4	0.05
Phenanthrene	1.5	*0.03*	1.4	*0.04*	2.0	*0.03*	1.6	0.3
Anthracene	NDR(0.25)	*0.03*	NDR(0.26)	*0.04*	NDR(0.31)	*0.03*	NDR	---
LPAH	8.3		6.3		5.7		6.8	1.4
Fluoranthene	5.8	*0.01*	5.2	*0.02*	6.8	*0.01*	5.9	0.8
Pyrene	2.3	*0.01*	2.6	*0.02*	2.6	*0.01*	2.5	0.2
Benz(a)anthracene	0.33	*0.05*	0.27	*0.06*	0.29	*0.04*	0.3	0.03
Chrysene	1.3	*0.05*	1.2	*0.06*	1.3	*0.04*	1.3	0.06
Benzofluoranthenes	NDR(0.28)	*0.09*	NDR(0.4)	*0.11*	NDR(0.28)	*0.09*	NDR	---
Benzo(e)pyrene	NDR(0.29)	*0.09*	NDR(0.34)	*0.1*	NDR(0.29)	*0.08*	NDR	---
Benzo(a)pyrene	ND	*0.11*	ND	*0.12*	ND	*0.1*	ND	---
Dibenz(ah)anthracene	ND	*0.08*	ND	*0.2*	ND	*0.18*	ND	---
Indeno(1,2,3-cd)pyrene	ND	*0.15*	ND	*0.16*	ND	*0.15*	ND	---
Benzo(ghi)perylene	ND	*0.11*	ND	*0.01*	ND	*0.11*	ND	---
HPAH	9.7		9.3		11.0		10.0	0.9
TPAH	18.0		15.6		16.7		16.8	1.2
TPAH (µg/g, wet weight)	0.02		0.02		0.02		0.02	0.001
Perylene	ND	*0.11*	ND	*0.12*	ND	*0.1*	ND	---
Surrogate Standards (% recovery)								
Napththalene d-8	70		62		66		66	4.0
Acenaphthene d-10	75		66		68		70	4.7
Phenanthrene d-10	83		78		74		78	4.5
Pyrene d-10	83		84		82		83	1.0
Chrysene d-12	56		57		57		57	0.6
Benzo(a)pyrene d-12	81		87		77		82	5.0
Perylene d-12	75		80		70		75	5.0
Dibenz(ah)anthracene d-14	62		65		59		62	3.0
Benzo(ghi)perylene d-12	65		67		58		63	4.7

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identificaion
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX XII (B)

Mussel *(Mytilus edulis edulis)*

Whole Body Tissue PAH Concentrations (ng/g, wet weight)

Sooke Basin - Day0 - Day384

***alkylated* PAH and dibenzofuran**

Appendix XII (B). Whole Body Tissue *alkylated* PAH and Dibenzofuran Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	14OC0.5		14OC0.5			14OC0.5		14OC0.5		140C0.5		180OC0.5		180OC0.5
Composite #	1A		1B		mean	2		3		Mean	Std. Dev.	1		2
Batch I.D.	PH-0835		PH-0835			PH-0835		PH-0835				PH-0901		PH-0901
Lab. No.	2891-91A		2891-91B		2891-91	2891-92		2891-93		2891:91-93		9611-66		9611-67
Sample Weight (gm):	4.2		4.0		4.1	5.2		5.1		4.8	0.6	10.3		10.4
% Moisture	77		77		77	78		79		78	1.0	86		86
Lipid Content (%)	2.9				2.9	2.9		2.5		2.8	0.2	1.1		1.2
	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*	Conc.	*SDL*			Conc.	*SDL*	Conc.
C1 naphthalenes	4.0	*0.02*	3.6	*0.02*	3.8	3.6	*0.02*	3.6	*0.02*	3.7	0.1	1.0	*0.009*	1.2
C2 naphthalenes	2.3	*0.02*	2.9	*0.02*	2.6	2.3	*0.01*	2.1	*0.02*	2.3	0.3	3.5	*0.006*	4.6
C3 naphthalenes	3.7	*0.03*	3.3	*0.03*	3.5	3.5	*0.02*	3.7	*0.02*	3.6	0.1	1.8	*0.01*	2.1
C4 naphthalenes	5.5	*0.05*	5.1	*0.05*	5.3	5.0	*0.03*	4.8	*0.04*	5.0	0.3	0.84	*0.01*	1.2
C5 naphthalenes	1.6	*0.06*	2.4	*0.07*	2.0	1.7	*0.04*	2.3	*0.05*	2.0	0.3	---		---
C1 phen,anth	6.7	*0.12*	5.8	*0.13*	6.3	5.5	*0.08*	4.9	*0.1*	5.6	0.7	3.5	*0.008*	3.8
C2 phen,anth	10	*0.05*	9.2	*0.07*	9.6	9.9	*0.04*	7.2	*0.05*	8.9	1.5	5.6	*0.02*	5.6
C3 phen,anth	8.4	*0.07*	7.0	*0.08*	7.7	5.6	*0.05*	5.4	*0.06*	6.2	1.3	4.2	*0.006*	9.3
C4 phen,anth	0.7	*0.03*	1.3	*0.03*	0.98	1.4	*0.02*	1.5	*0.02*	1.3	0.3	1.4	*0.02*	1.5
Retene	0.7	*0.03*	0.51	*0.03*	0.58	0.4	*0.02*	0.46	*0.03*	0.5	0.1	---		---
C5 phen,anth	ND(0.02)	*0.02*	ND(0.03)	*0.03*	ND(0.02)	ND(0.02)	*0.02*	ND(0.02)	*0.02*	ND		---		---
C1 fluor,pyrenes	4.0	*0.01*	4.9	*0.01*	4.5	4.2	*0.007*	3.1	*0.009*	3.9	0.7	---		---
C2 fluor,pyrenes	ND(0.02)	*0.02*	ND(0.02)	*0.02*	ND(0.02)	ND(0.02)	*0.02*	ND(0.02)	*0.02*	ND		---		---
C3 fluor,pyrenes	ND(0.09)	*0.09*	ND(0.11)	*0.11*	ND(0.09)	ND(0.07)	*0.07*	ND(0.08)	*0.08*	ND		---		---
C4 fluor,pyrenes	ND(0.08)	*0.08*	ND(0.1)	*0.1*	ND(0.08)	ND(0.06)	*0.06*	ND(0.07)	*0.07*	ND		---		---
C5 fluor,pyrenes	ND(0.05)	*0.05*	ND(0.06)	*0.06*	ND(0.05)	ND(0.04)	*0.04*	ND(0.05)	*0.05*	ND		---		---
Dibenzothiophene	NDR(0.43)	*0.08*	NDR(0.43)	*0.09*	NDR(0.43)	NDR(0.38)	*0.06*	NDR(0.43)	*0.07*	ND		NDR(0.26)	*0.006*	NDR(0.3)
C1 dibenzothiophene	1.0	*0.09*	1.0	*0.1*	1.0	1.0	*0.06*	0.8	*0.08*	0.9	0.1	0.7	*0.01*	1.0
C2 dibenzothiophene	1.5	*0.03*	1.7	*0.04*	1.6	1.4	*0.02*	1.3	*0.03*	1.4	0.2	0.8	*0.01*	0.76
Dibenzofuran	1.2	*0.02*	1.1	*0.02*	1.2	1.1	*0.01*	0.93	*0.02*	1.1	0.1	0.58	*0.03*	0.66
Surrogate Standards														
2-Methylnaphthalene d-10	78		75		77	72		68		72	4.3	43		51
Dibenzofuran d-5	97		91		94	88		84		89	5.0	46		60

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (B). Whole Body Tissue *alkylated* PAH and Dibenzofuran Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180OC0.5		180OC0.5		BBP0.5		BBP0.5		BBP0.5		BBP0.5	
Composite #	3		Mean	Std. Dev.	1		2		3		Mean	Std. Dev.
Batch I.D.	PH-0901				PH-0828		PH-0828		PH-0828			
Lab. No.	9611-68		9611:66-68		2891-39		2891-40		2891-41		2891:39-41	
Sample Weight (gm):	10.2		10.3	0.1	5.2		5.2		6.0		5.4	0.4
% Moisture	87		86	0.6	79		80		78		79	1.0
Lipid Content (%)	1.0		1.1	0.1	2.8		2.7		3.0		2.8	0.2
	SDL	Conc.	*SDL*		Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*		
C1 naphthalenes	*0.01*	1.4	*0.01*	1.2	0.2	2.8	*0.007*	3.3	*0.02*	5.1	*0.02*	3.7	1.2
C2 naphthalenes	*0.007*	3.7	*0.007*	3.9	0.6	3.2	*0.01*	2.3	*0.03*	3.1	*0.03*	2.9	0.5
C3 naphthalenes	*0.02*	2.1	*0.02*	2.0	0.2	3.3	*0.01*	5.0	*0.04*	5.1	*0.03*	4.5	1.0
C4 naphthalenes	*0.01*	0.94	*0.02*	0.99	0.2	2.0	*0.01*	ND(0.04)	*0.04*	2.5	*0.03*	2.3	0.4
C5 naphthalenes		---		---		1.7	*0.01*	ND(0.04)	*0.04*	ND(0.03)	*0.03*	1.7	
C1 phen,anth	*0.008*	4.1	*0.01*	3.8	0.3	3.7	*0.02*	4.5	*0.06*	5.4	*0.04*	4.5	0.9
C2 phen,anth	*0.02*	6.4	*0.02*	5.9	0.5	5.4	*0.02*	5.3	*0.05*	8.0	*0.04*	6.2	1.5
C3 phen,anth	*0.009*	11	*0.01*	8.2	3.5	1.3	*0.02*	8.8	*0.07*	10	*0.05*	6.7	4.7
C4 phen,anth	*0.02*	2.1	*0.03*	1.7	0.4	2.9	*0.01*	ND(0.03)	*0.03*	ND(0.02)	*0.02*	2.9	---
Retene		---		---		NDR(4.0)	*0.01*	NDR(0.74)	*0.03*	NDR(1.2)	*0.02*	NDR(4.0)	---
C5 phen,anth		---		---		ND(0.02)	*0.02*	ND(0.04)	*0.04*	ND(0.03)	*0.03*	ND	---
C1 fluor,pyrenes		---		---		2.7	*0.004*	ND(0.01)	*0.01*	ND(0.008)	*0.008*	2.7	---
C2 fluor,pyrenes		---		---		ND	*0.02*	ND(0.05)	*0.05*	ND(0.04)	*0.04*	ND	---
C3 fluor,pyrenes		---		---		ND	*0.02*	ND(0.09)	*0.09*	ND(0.05)	*0.05*	ND	---
C4 fluor,pyrenes		---		---		ND	*0.03*	ND(0.12)	*0.12*	ND(0.07)	*0.07*	ND	---
C5 fluor,pyrenes		---		---		ND	*0.01*	ND(0.05)	*0.05*	ND(0.03)	*0.03*	ND	---
Dibenzothiophene	*0.06*	NDR(0.28)	*0.007*	NDR(0.3)		NDR(0.29)	*0.009*	NDR(0.29)	*0.02*	NDR(0.35)	*0.02*	NDR(0.35)	---
C1 dibenzothiophene	*0.01*	0.9	*0.02*	0.85	0.1	1.2	*0.009*	ND(0.02)	*0.02*	ND(0.02)	*0.02*	1.2	---
C2 dibenzothiophene	*0.01*	0.9	*0.01*	0.82	0.1	0.86	*0.005*	0.96	*0.01*	1.2	*0.01*	1.0	0.2
Dibenzofuran	*0.03*	0.63	*0.03*	0.62	0.04	NDR(0.57)	*0.007*	0.55	*0.02*	0.79	*0.02*	0.7	0.2
Surrogate Standards													
2-Methylnaphthalene d-10		55		47	6.1	55		34		30		40	13.4
Dibenzofuran d-5		57		53	7.4	59		41		44		48	9.6

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (B). Whole Body Tissue *alkylated* PAH and Dibenzofuran Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	14BP0.5		14BP0.5		14BP0.5		14BP0.5		180BP0.5		180BP0.5		180BP0.5	
Composite #	1		2		3		Mean	Std. Dev.	1		2		3	
Batch I.D.	PH-0828		PH-0828		PH-0828				PH-0904		PH-0904		PH-0904	
Lab. No.	2891-79		2891-80		2891-81		2891:79-81		9611-54		9611-55		9611-56	
Sample Weight (gm):	7.2		7.2		6.1		6.9	0.6	10.0		9.8		9.3	
% Moisture	76		76		76		76	0.0	86		88		87	
Lipid Content (%)	3.0		3.3		3.3		3.2	0.2	1.1		1.0			
	Conc.	SDL	Conc.	SDL	Conc.	SDL			Conc.	SDL	Conc.	SDL	Conc.	SDL
C1 naphthalenes	1.4	0.007	1.4	0.008	1.7	0.01	1.5	0.8	0.9	0.007	1.1	0.006	0.8	0.01
C2 naphthalenes	4.0	0.01	4.4	0.01	4.8	0.02	4.4	2.4	2.1	0.01	2.0	0.01	3.4	0.02
C3 naphthalenes	4.3	0.01	4.1	0.01	4.4	0.02	4.3	2.3	2.1	0.03	2.1	0.02	2.2	0.04
C4 naphthalenes	12	0.01	5.2	0.02	4.6	0.02	7.3	4.9	1.1	0.02	1.2	0.02	1.0	0.03
C5 naphthalenes	2.5	0.01	2.2	0.02	2.3	0.02	2.3	1.3	---		---		---	
C1 phen,anth	10	0.02	9.0	0.02	7.4	0.03	8.8	4.9	3.3	0.004	3.3	0.004	3.3	0.006
C2 phen,anth	13	0.02	14	0.02	11	0.03	13	7.0	6.4	0.01	7.2	0.009	6.2	0.01
C3 phen,anth	11	0.03	4.3	0.03	9.3	0.04	8.2	5.1	5.0	0.01	5.4	0.01	6.2	0.02
C4 phen,anth	9.7	0.01	3.6	0.01	1.6	0.02	5.0	4.0	1.4	0.01	2.2	0.01	1.4	0.02
Retene	0.32	0.01	0.4	0.01	NDR(0.28)	0.01	0.4	0.2	---		---		---	
C5 phen,anth	ND(0.02)	0.02	ND(0.02)	0.02	ND(0.02)	0.02	ND(0.02)	---	---		---		---	
C1 fluor,pyrenes	9.2	0.004	6.1	0.005	5.3	0.006	6.9	4.0	---		---		---	
C2 fluor,pyrenes	ND(0.02)	0.02	ND(0.02)	0.02	ND(0.03)	0.03	ND(0.02)	---	---		---		---	
C3 fluor,pyrenes	ND(0.03)	0.03	ND(0.03)	0.03	ND(0.04)	0.04	ND(0.03)	---	---		---		---	
C4 fluor,pyrenes	ND(0.04)	0.04	ND(0.05)	0.05	ND(0.06)	0.06	ND(0.04)	---	---		---		---	
C5 fluor,pyrenes	ND(0.02)	0.02	ND(0.02)	0.02	ND(0.02)	0.02	ND(0.02)	---	---		---		---	
Dibenzothiophene	1.4	0.01	NDR(0.93)	0.01	NDR(0.89)	0.01	1.4	0.8	NDR(0.26)	0.008	NDR(0.28)	0.008	NDR(0.26)	0.01
C1 dibenzothiophene	2.0	0.01	2.1	0.01	1.5	0.01	1.9	1.0	0.7	0.008	0.7	0.009	0.7	0.01
C2 dibenzothiophene	2.0	0.005	2.3	0.006	2.1	0.007	2.1	1.2	0.78	0.006	0.84	0.006	0.77	0.009
Dibenzofuran	2.4	0.007	1.7	0.008	2.6	0.01	2.2	1.3	---		---		---	
Surrogate Standards														
2-Methylnaphthalene d-10	52		50		69		57	10	66		69		49	
Dibenzofuran d-5	62		60		84		69	13						

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (B). Whole Body Tissue *alkylated* PAH and Dibenzofuran Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180BP0.5		14WP0.5		14WP0.5		14WP0.5		14WP0.5		14WP0.5	
Composite #	Mean	Std. Dev.	1		2A		2B		mean	3		Mean	Std. Dev.
Batch I.D.			PH-0828		PH-0828		PH-0828			PH-0835			
Lab. No.	9611:54-56		2891-88		2891-89A		2891-89B		2891-89	2891-90		2891:88-90	
Sample Weight (gm):	9.7	0.4	6.0		5.3		6.2		5.7	5.0		5.6	0.5
% Moisture	87	1.0	75		75		75		75	76		75	1
Lipid Content (%)	1.1	0.1	3.2						3.2	2.8		3.1	0.2
			Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*		
C1 naphthalenes	1.0	0.1	1.3	*0.02*	1.4	*0.01*	1.4	*0.01*	1.4	1.6	*0.02*	1.4	0.2
C2 naphthalenes	2.5	0.8	4.7	*0.03*	2.7	*0.01*	2.6	*0.02*	2.7	3.0	*0.02*	3.5	1.1
C3 naphthalenes	2.1	0.1	4.2	*0.03*	3.9	*0.02*	3.6	*0.02*	3.8	3.7	*0.03*	3.9	0.3
C4 naphthalenes	1.1	0.1	5.2	*0.04*	4.5	*0.02*	4.3	*0.02*	4.4	4.4	*0.05*	4.7	0.5
C5 naphthalenes	---	---	1.9	*0.04*	2.1	*0.02*	2.0	*0.02*	2.1	ND(0.06)	*0.06*	2.0	0.1
C1 phen,anth	3.3	0.0	7.4	*0.05*	7.1	*0.03*	7.0	*0.03*	7.1	7.1	*0.12*	7.2	0.2
C2 phen,anth	6.6	0.5	9.9	*0.04*	9.5	*0.03*	9.6	*0.03*	9.6	11	*0.06*	10	0.8
C3 phen,anth	5.5	0.6	8.6	*0.05*	1.9	*0.04*	1.8	*0.04*	1.9	9.1	*0.07*	6.5	4.0
C4 phen,anth	1.7	0.5	2.6	*0.02*	1.5	*0.02*	1.3	*0.01*	1.4	ND(0.03)	*0.03*	2.0	0.8
Retene	---	---	0.32	*0.02*	NDR(1.3)	*0.01*	NDR(1.9)	*0.02*	NDR(1.9)	ND(0.03)	*0.03*	0.32	
C5 phen,anth	---	---	ND(0.03)	*0.03*	ND(0.02)	*0.02*	ND(0.02)	*0.02*	ND(0.02)	ND(0.02)	*0.02*	ND	
C1 fluor,pyrenes	---	---	4.9	*0.008*	5.0	*0.006*	5.2	*0.006*	5.1	5.3	*0.01*	5.1	0.2
C2 fluor,pyrenes	---	---	ND(0.04)	*0.04*	1.6	*0.03*	1.6	*0.03*	1.6	ND(0.02)	*0.02*	1.6	0.0
C3 fluor,pyrenes	---	---	ND(0.06)	*0.06*	ND(0.05)	*0.05*	ND(0.05)	*0.05*	ND(0.05)	ND(0.1)	*0.1*	ND	
C4 fluor,pyrenes	---	---	ND(0.08)	*0.08*	ND(0.07)	*0.07*	ND(0.07)	*0.07*	ND(0.07)	ND(0.08)	*0.08*	ND	
C5 fluor,pyrenes	---	---	ND(0.04)	*0.04*	ND(0.03)	*0.03*	ND(0.03)	*0.03*	ND(0.03)	ND(0.06)	*0.08*	ND	
Dibenzothiophene	NDR(0.28)		NDR(0.63)	*0.02*	NDR(0.57)	*0.01*	NDR(0.58)	*0.01*	NDR(0.58)	NDR(0.61)	*0.08*	NDR	
C1 dibenzothiophene	0.7	0.05	1.5	*0.02*	1.6	*0.01*	1.4	*0.02*	1.5	1.1	*0.09*	1.4	0.2
C2 dibenzothiophene	0.8	0.04	1.6	*0.01*	1.4	*0.007*	1.6	*0.008*	1.5	1.5	*0.03*	1.5	0.1

Dibenzofuran	---	---	0.99	*0.02*	1.1	*0.01*	0.91	*0.012*	1.0	1.2	*0.02*	1.1	0.1
Surrogate Standards													
2-Methylnaphthalene d-10	61	11	51		66		51		59	62		57	5.6
Dibenzofuran d-5			68		75		60		68	77		71	5.3

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

Appendix XII (B). Whole Body Tissue *alkylated* PAH and Dibenzofuran Concentrations (ng/g, wet wt.): *Mytilus edulis edulis* : Sooke Basin - Day0 to Day384.

Station	180WP0.5		180WP0.5		180WP0.5	180WP0.5		180WP0.5		180WP0.5		180WP0.5	180WP0.5	
Composite #	1A		1B		mean	2		3A		3B		mean	Mean	Std. Dev.
Batch I.D.	PH-0904		PH-0904			PH-0901		PH-0901		PH-0901				
Lab. No.	9611-63A		9611-63B		9611-63	9611-64		9611-65A		9611-65B		9611-65	9611:63-65	
Sample Weight (gm):	10.0		9.1		9.5	10.8		9.7		10.7			10.2	
% Moisture	88		87		88	88		87		87			88	
Lipid Content (%)	0.9				0.9	1.0		0.9					1.0	0.1
	Conc.	*SDL*	Conc.	*SDL*	Conc.	Conc.	*SDL*	Conc.	*SDL*	Conc.	*SDL*	Conc.		
C1 naphthalenes	1.0	*0.007*	1.2	*0.006*	1.1	0.7	*0.01*	0.7	*0.01*	0.8	*0.008*	0.8	0.86	0.2
C2 naphthalenes	1.3	*0.01*	1.3	*0.01*	1.3	1.7	*0.008*	3.5	*0.008*	4.5	*0.006*	4.0	2.3	1.5
C3 naphthalenes	1.8	*0.03*	2.0	*0.02*	1.9	1.8	*0.02*	1.7	*0.02*	1.7	*0.01*	1.7	1.8	0.1
C4 naphthalenes	0.9	*0.02*	1.2	*0.02*	1.0	1.4	*0.02*	0.8	*0.02*	1.0	*0.01*	0.9	1.1	0.3
C5 naphthalenes	---		---		---	---		---		---		---	---	---
C1 phen,anth	2.9	*0.005*	3.4	*0.005*	3.2	3.8	*0.009*	3.3	*0.009*	3.3	*0.007*	3.3	3.4	0.3
C2 phen,anth	5.0	*0.01*	5.9	*0.01*	5.5	6.0	*0.02*	4.9	*0.02*	4.9	*0.02*	4.9	5.5	0.5
C3 phen,anth	4.6	*0.01*	4.4	*0.01*	4.5	4.8	*0.01*	3.7	*0.01*	5.6	*0.008*	4.7	4.7	0.1
C4 phen,anth	1.3	*0.01*	1.3	*0.01*	1.3	2.1	*0.03*	1.3	*0.03*	1.1	*0.02*	1.2	1.5	0.5
Retene	---		---		---	---		---		---		---	---	---
C5 phen,anth	---		---		---	---		---		---		---	---	---
C1 fluor,pyrenes	---		---		---	---		---		---		---	---	---
C2 fluor,pyrenes	---		---		---	---		---		---		---	---	---
C3 fluor,pyrenes	---		---		---	---		---		---		---	---	---
C4 fluor,pyrenes	---		---		---	---		---		---		---	---	---
C5 fluor,pyrenes	---		---		---	---		---		---		---	---	---
Dibenzothiophene	NDR(0.25)	*0.009*	NDR(0.31)	*0.009*	NDR(0.31)	NDR(0.28)	*0.007*	NDR(0.24)	*0.007*	NDR(0.24)	*0.06*	NDR(0.28)	NDR(0.31)	
C1 dibenzothiophene	0.62	*0.01*	0.66	*0.01*	0.64	0.76	*0.02*	0.64	*0.02*	0.78	*0.01*	0.71	0.70	0.06
C2 dibenzothiophene	0.64	*0.007*	0.93	*0.007*	0.79	0.96	*0.01*	0.78	*0.01*	0.69	*0.01*	0.74	0.83	0.12
Dibenzofuran	---		---		---	0.58	*0.03*	0.51	*0.03*	0.51	*0.03*	0.51	0.55	0.05
Surrogate Standards														
2-Methylnaphthalene d-10	68		69		69	50		48		57		53	57	10.0
Dibenzofuran d-5						60		55		61		58	59	1.4

ND = Less than detection limit
NDR = Peak detected (value) but did not meet quantification criteria for positive identification
Concentrations are recovery corrected
Data have not been blank corrected

APPENDIX XII (C)

Mussel *(Mytilus edulis edulis)*

Shell Lengths (mm) used for Whole Body Tissue PAH Analysis

Sooke Basin - Day0 - Day384

Appendix XII (C). Mussel (*Mytilus edulis edulis)* Shell Lengths Used for Whole Body Tissue PAH Analysis: Sooke Basin - Day0 to Day384.

STATION BP0.05

Comp. #1 Sample #	SHELL LENGTH (mm) BBP0.5	14BP0.5	180BP0.5	384BP0.5
1	28.0	34.0	43.0	57.0
2	28.0	35.5	45.0	53.0
3	30.2	36.5	46.0	60.2
4	31.0	36.5	46.5	52.0
5	31.5	37.2	48.5	57.2
6	34.0	37.2	49.0	56.5
7	36.0	39.0	50.0	65.0
8	38.0	39.5	50.5	69.5
9	38.0	42.0	57.0	54.0
10	38.0	44.0	65.5	64.0
Mean	33.3	38.1	50.1	58.8
Std. Dev.	4.1	3.0	6.6	5.7

Comp. #2 Sample #	SHELL LENGTH (mm) BBP0.5	14BP0.5	180BP0.5	384BP0.5
1	28.0	29.0	42.0	53.0
2	28.5	31.0	45.0	55.5
3	30.0	31.2	47.0	63.5
4	31.0	33.0	49.0	53.1
5	35.0	33.0	50.0	56.0
6	35.0	35.0	51.5	60.0
7	36.5	36.0	52.0	64.0
8	38.0	36.5	54.0	57.0
9	39.5	40.0	55.0	69.0
10	40.2	46.5	56.0	60.0
Mean	34.2	35.1	50.2	59.1
Std. Dev.	4.5	5.1	4.5	5.2

Comp. #3 Sample #	SHELL LENGTH (mm) BBP0.5	14BP0.5	180BP0.5	384BP0.5
1	31.0	28.0	41.0	67.0
2	31.0	29.0	45.5	59.5
3	31.5	30.1	46.0	58.5
4	32.2	31.0	46.5	52.0
5	32.2	31.0	48.0	54.2
6	33.5	33.0	51.0	63.5
7	34.0	33.2	54.0	55.1
8	34.0	33.5	54.0	70.0
9	36.0	34.0	56.0	54.0
10	38.0	39.5	62.0	66.0
Mean	33.3	32.2	50.4	60.0
Std. Dev.	2.3	3.2	6.2	6.3

BP0.5				
Overall Mean	33.6	35.2	50.2	59.3
Std. Dev.	3.6	4.5	5.6	5.6

STATION BP2.0

Comp. #1 Sample #	SHELL LENGTH (mm) BBP2.0	14BP2.0	180BP2.0	384BP2.0
1	---	23.5	54.0	65.0
2	---	26.5	55.0	70.1
3	---	31.5	56.0	70.0
4	---	32.0	56.0	65.5
5	---	35.0	57.5	70.2
6	---	35.5	57.5	72.0
7	---	36.5	58.0	58.0
8	---	37.0	59.0	69.1
9	---	37.0	59.2	38.0
10	---	39.5	61.0	69.1
Mean	---	33.4	57.3	64.7
Std. Dev.	---	5.1	2.1	10.2

Comp. #2 Sample #	SHELL LENGTH (mm) BBP2.0	14BP2.0	180BP2.0	384BP2.0
1	---	28.0	46.0	66.0
2	---	28.5	48.0	65.1
3	---	30.1	50.5	68.2
4	---	31.0	53.0	65.0
5	---	32.0	53.5	64.5
6	---	33.0	54.5	64.1
7	---	33.0	55.0	68.0
8	---	34.0	58.0	66.5
9	---	36.0	60.0	68.5
10	---	42.5	60.0	73.5
Mean	---	32.8	53.9	66.9
Std. Dev.	---	4.2	4.7	2.8

Comp. #3 Sample #	SHELL LENGTH (mm) BBP2.0	14BP2.0	180BP2.0	384BP2.0
1	---	29.0	45.5	68.0
2	---	30.0	51.0	68.0
3	---	31.0	53.0	65.0
4	---	32.0	53.0	68.0
5	---	33.0	54.0	59.2
6	---	35.0	54.0	56.2
7	---	35.2	55.0	54.5
8	---	36.0	57.0	67.0
9	---	36.5	59.0	60.5
10	---	42.0	60.0	64.5
Mean	---	34.0	54.2	63.1
Std. Dev.	---	3.8	4.1	5.1

BP2.0				
Overall Mean	---	33.4	55.1	64.9
Std. Dev.	---	4.3	4.0	6.7

Appendix XII (C). Mussel (*Mytilus edulis edulis)* Shell Lengths Used for Whole Body Tissue PAH Analysis: Sooke Basin - Day0 to Day384.

STATION BP10

Comp. #1 Sample #	SHELL LENGTH (mm) BBP10	14BP10	180BP10	384BP10
1	---	28.0	51.5	65.0
2	---	28.0	53.0	65.1
3	---	28.5	55.0	66.0
4	---	31.0	56.0	67.0
5	---	32.0	57.0	68.0
6	---	34.5	57.0	69.0
7	---	39.2	57.5	70.0
8	---	40.0	59.0	70.1
9	---	43.0	59.5	71.0
10	---	47.0	60.5	71.2
Mean	---	35.1	56.6	68.2
Std. Dev.	---	6.8	2.8	2.4

Comp. #2 Sample #	SHELL LENGTH (mm) BBP10	14BP10	180BP10	384BP10
1	---	28.0	51.0	64.2
2	---	28.5	54.0	66.1
3	---	30.0	54.5	66.1
4	---	32.0	56.0	68.0
5	---	32.0	56.0	69.5
6	---	33.5	57.5	70.2
7	---	34.0	60.0	71.0
8	---	36.0	60.0	72.2
9	---	37.0	61.5	74.5
10	---	40.2	64.5	76.0
Mean	---	33.1	57.5	69.8
Std. Dev.	---	3.9	4.0	3.8

Comp. #3 Sample #	SHELL LENGTH (mm) BBP10	14BP10	180BP10	384BP10
1	---	27.0	51.0	79.0
2	---	27.5	52.5	70.0
3	---	29.0	54.0	73.2
4	---	33.0	54.5	68.1
5	---	34.0	54.5	75.0
6	---	36.0	56.0	68.0
7	---	38.0	56.5	72.5
8	---	38.0	57.0	61.5
9	---	39.5	60.0	68.0
10	---	46.0	61.0	74.0
Mean	---	34.8	55.7	70.9
Std. Dev.	---	6.0	3.1	4.9

BP10			
Overall Mean	34.3	56.6	69.7
Std. Dev.	5.6	3.3	3.9

STATON WP0.5

Comp #1 Sample #	SHELL LENGTH (mm) BWP0.5	14WP0.5	180WP0.5	384WP0.5
1	---	31.1	45.5	68.2
2	---	31.5	45.5	65.0
3	---	32.0	46.0	63.2
4	---	33.0	51.0	62.0
5	---	35.0	54.0	61.5
6	---	35.2	54.0	74.0
7	---	36.0	55.0	70.0
8	---	36.5	56.0	65.2
9	---	37.9	60.0	71.0
10		38.2	64.0	66.1
Mean	---	34.6	53.1	66.6
Std. Dev.	---	2.6	6.2	4.1

Comp. #2 Sample #	SHELL LENGTH (mm) BWP0.5	14WP0.5	180WP0.5	384WP0.5
1	---	30.0	43.5	71.0
2	---	32.5	45.5	66.5
3	---	33.1	47.0	68.2
4	---	33.1	48.0	66.5
5	---	34.1	52.0	67.0
6	---	36.0	53.5	62.0
7	---	36.5	55.0	67.5
8	---	38.2	56.0	62.0
9	---	39.0	60.0	67.0
10	---	40.0	60.5	68.2
Mean	---	35.3	52.1	66.6
Std. Dev.	---	3.2	6.0	2.7

Comp. #3 Sample #	SHELL LENGTH (mm) BWP0.5	14WP0.5	180WP0.5	384WP0.5
1	---	28.2	41.0	71.0
2	---	28.2	46.0	74.0
3	---	29.5	47.0	71.0
4	---	29.5	49.0	67.0
5	---	29.9	51.0	67.0
6	---	30.0	54.5	61.0
7	---	32.0	55.5	71.5
8	---	32.1	59.5	64.0
9	---	32.2	60.0	63.0
10	---	34.5	63.0	70.5
Mean	---	30.6	52.7	68.0
Std. Dev.	---	2.0	7.1	4.3

WP0.5			
Overall Mean	---	33.5	52.6	67.1
Std. Dev.	---	3.3	6.2	3.7

Appendix XII (C). Mussel (*Mytilus edulis edulis)* Shell Lengths Used for Whole Body Tissue PAH Analysis: Sooke Basin - Day0 to Day384.

STATION OC0.0

SHELL LENGTH (mm)				
Comp. #1 Sample #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
1	---	30.2	51.0	65.5
2	---	31.0	51.5	71.5
3	---	31.2	54.0	61.0
4	---	32.5	54.5	65.5
5	---	32.5	57.0	60.2
6	---	34.2	59.0	70.1
7	---	36.0	60.0	71.0
8	---	36.5	62.0	68.0
9	---	37.0	62.0	75.0
10	---	43.0	63.5	54.0
Mean	---	34.4	57.5	66.2
Std. Dev.	---	3.9	4.5	6.3

SHELL LENGTH (mm)				
Comp. #2 Sample #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
1	---	24.5	51.0	69.0
2	---	26.5	51.0	68.5
3	---	29.0	51.0	61.0
4	---	29.0	53.0	64.0
5	---	29.5	53.0	74.0
6	---	31.0	53.0	57.0
7	---	32.2	54.5	69.5
8	---	33.9	57.0	64.5
9	---	34.5	57.0	72.0
10	---	35.2	60.5	
Mean	---	30.5	54.1	66.6
Std. Dev.	---	3.5	3.2	5.4

Comp. #3 Sample #	BOC0.0	14OC0.0	180OC0.0	384OC0.0
1	---	24.9	39.0	76.0
2	---	26.2	46.0	55.0
3	---	28.0	47.0	60.0
4	---	29.5	47.0	65.0
5	---	29.5	51.5	70.0
6	---	31.1	52.0	61.5
7	---	34.0	52.0	74.0
8	---	34.5	53.0	60.5
9	---	35.0	58.0	60.2
10	---	42.2	66.0	66.0
Mean	---	31.5	51.2	64.8
Std. Dev.	---	5.1	7.3	6.7

OC0.0				
Overall Mean	---	32.1	54.2	65.8
Std. Dev.	---	4.4	5.7	6.0

APPENDIX XIII

Mussel *(Mytilus edulis edulis)*

Whole Body and Gonadal Tissue PAH Concentrations (ng/g, wet weight)

Sooke Basin - Day180

Appendix XIII. Whole Body and Gonadal Tissue parental PAH Concentrations (ng/g, wet wt.): Sooke Basin - Day180.

Station	180OC0.5 Whole Body		180OC0.5 Gonad	180BP0.5 Whole Body		180BP0.5 Gonad	180BP2.0 Whole Body		180BP2.0 Gonad	180BP10 Whole Body		180BP10 Gonad	180WP0.5 Whole Body		180WP0.5 Gonad
	Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.	
Sample # (9611)	9611-66-68		69	9611-54-56		70	9611-57-59		71	9611-60-62		72	9611-63-65		73
Sample Weight (gm):	10.3		2.4	9.7		2.4	10.4		4.0	11.2	1.2	3.2	10.2		2.3
% Moisture	86		80	87		81	87		77	86.33	0.58	79	88		78
Lipid Content (%)	1.1			1.1			1.1			1.0			1.0		
Naphthalene	1.1	0.20	3.8	0.92	0.09	3.9	3.1	2.1	3.3	0.76	0.05	3.1	0.84	0.23	4.3
Acenaphthylene	0.22	0.02	0.35	0.27	0.04	0.24	0.35	0.11	0.54	0.18	0.03	0.28	0.21	0.04	0.48
Acenaphthene	0.51	0.06	1.0	0.60	0.07	1.1	0.59	0.04	1.5	0.46	0.03	0.67	0.40	0.05	1.4
Fluorene	0.81	0.10	2.5	0.82	0.02	2.1	0.97	0.15	2.3	0.68	0.07	1.3	0.80	0.17	1.9
Phenanthrene	3.6	0.26	6.4	3.37	0.25	6.8	4.4	1.4	9.3	3.1	0.12	4.1	3.3	0.30	7.4
Anthracene	0.43	0.04	0.7	0.53	0.03	1.0	0.59	0.26	1.3	0.40	0.04	0.5	0.51	0.10	0.9
LPAH	6.7	0.65	14.8	6.4	0.23	15.1	9.8	4.1	18.2	5.6	0.22	10.0	6.1	0.44	16.4
Fluoranthene	7.6	0.65	13	7.7	0.29	17	13.6	9.1	18	5.9	0.23	9.1	7.5	0.58	18
Pyrene	3.5	0.46	5.5	3.4	0.06	6.7	6.8	5.4	8.7	2.8	0.18	3.8	3.6	0.46	8
Benz(a)anthracene	0.64	0.08	0.74	0.76	0.14	1.1	0.88	0.30	1.1	0.61	0.02	0.51	0.94	0.09	1.4
Chrysene	1.7	0.15	2.0	1.8	0.23	3.4	2.3	1.0	3.5	1.43	0.06	1.5	2.3	0.25	3.6
Benzofluoranthenes	0.88	0.19	0.72	0.94	0.07	0.97	1.3	0.42	1.1	0.74	0.05	0.66	1.3	0.19	1.4
Benzo(e)pyrene	0.68	0.07	NDR(0.9)	0.81	0.02	NDR(0.98)	1.1	0.65	NDR(1.9)	NDR		NDR(0.59)	0.89	0.13	NDR(1.2)
Benzo(a)pyrene	----		ND(0.04)	NDR(0.2)		ND(0.03)	0.16	0.01	ND(0.01)	NDR		ND(0.03)	0.21	0.11	NDR(0.1)
Dibenz(ah)anthracene	ND		ND(0.05)	NDR(0.06)		ND(0.09)	NDR(0.08)		ND(0.06)	NDR		ND(0.06)	NDR(0.05)		ND(0.16)
Indeno(1,2,3-cd)pyrene	NDR(0.17)		NDR(0.09)	NDR(0.18)		NDR(0.08)	NDR(0.24)		NDR(0.06)	NDR		NDR(0.06)	NDR(0.22)		NDR(0.13)
Benzo(ghi)perylene	NDR(0.24)		NDR(0.12)	NDR(0.25)		NDR(0.08)	NDR(0.024)		NDR(0.13)	NDR		NDR(0.06)	NDR(0.26)		NDR(0.11)
HPAH	15.0	1.6	22.0	15.4	0.46	29.2	26.0	16.9	32.4	11.5	0.4	15.6	16.7	1.4	32.4
TPAH	21.7	2.2	36.7	21.9	0.29	44.3	35.8	20.9	50.6	17.0	0.5	25.5	22.7	1.8	48.8
TPAH (µg/g, wet weight)	0.02	0.00	0.04	0.02	0.00	0.04	0.04	0.02	0.05	0.02	0.00	0.03	0.02	0.00	0.05
Perylene	0.22	0.03	NDR(0.25)	0.27		NDR(0.23)	0.39	0.16	NDR(0.52)	NDR		NDR(0.18)	0.25	0.04	NDR(0.34)
Surrogate Standards (% recovery)															
Napththalene d-8	50		55	58		48	25		63	50		28	57		43
Acenaphthene d-10	58		70	77		68	35		81	77		45	67		57
Phenanthrene d-10	73		84	92		87	66		93	93		75	80		74
Pyrene d-10	80		92	97		92	81		99	99		83	84		86
Chrysene d-12	78		89	87		98	78		110	90		85	76		82
Benzo(a)pyrene d-12	85		100	87		100	92		100	82		88	83		81
Perylene d-12	77		84	80		83	85		83	69		74	77		67
Dibenz(ah)anthracene d-14	67		120	77		120	93		130	74		99	72		71
Benzo(ghi)perylene d-12	83		98	81		95	87		100	66		80	81		67

APPENDIX XIV

Benthic Infaunal Community Structuure - Sooke Basin

a) **Summary Statistics and Taxa Codes**

b) **Raw Data**

Appendix XIVa. Benthic Infauna Summary Statistics and Taxa Codes - Sooke Basin Creosote Evaluation Study.

Dominant species	Code	Variable	Total Number	Occurrences	Mean	Median	Variance/Mean
Nephtys ferruginea	PNF	37	390	113	2.85	2	2.02
Paraprionospio pinnata	PPP	46	724	135	5.28	5	1.76
Spiophanes berkeleyorum	PSPIB	65	390	99	2.85	2	3.29
Alvania compacta	MAC	69	1703	128	12.43	6	17.99
Mysella tumida	MMT	81	8722	134	63.66	59	32.82
Nassarius mendicus	MNM	83	480	115	3.5	3	4.84
Odostomia sp.	MOS	86	367	96	2.68	2	4.24
Parvilucina tenuisculpta	MPT	87	876	130	6.44	5	4.44
Ophiuroidea (Amphiodia urtica and/or periercta)	EAU & EOPH	106 & 107	2762	133	20.16	19	14.6
Moderately dominant species							
Aphelochaeta multifilis\	PAMU	8	474	41	3.46	0	21.15
Glycinde polygnatha	PGP	25	111	59	0.81	0	2.02
Lumbrinderidae sp. Ident.	PLS	31	168	75	1.23	1	2.67
Mediomastus sp.	PMS	34	352	45	2.57	0	13.75
Pholoe minuta	PPM	48	218	84	1.59	1	2.41
Podarkeopsis glabrus	PPODG	54	154	70	1.12	1	2.74
Scoletoma luti	PSL	61	98	42	0.72	0	2.63
Macoma nasuta	MMN	78	336	72	2.45	1	8.15
Macoma species juvenile	MMS	79	140	48	1.02	0	5.4
Nitidella gouldi	MNG	85	97	61	0.71	0	1.33
Protothaca staminea juveniles	MPSJ	89	181	55	1.32	0	6.28
Psephidia lordi	MPL	90	99	37	0.72	0	4.02
Tellina modesta	MTM	91	449	89	3.28	1	8.54
Nematodes	MNEM	109	52	37	0.38	0	1.36
Pinnixa schmitti and Pinnixa sp.	CPS	105	14	12	0.1	0	1.19

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PAML	PAS	PAMO	PAMU	PAPHS	PAB	PCAPC	PCAPS	PCHAS	PCIRS	PDORR	PDORS	PDORDS	PEB
1	-2	BP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2	-2	BP	1.0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
3	-2	BP	1.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	-2	BP	2.0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
5	-2	BP	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	-2	BP	3.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	-2	BP	3.5	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
8	-2	BP	5.0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1
9	-2	BP	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	-2	BP	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	-2	BP	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	-2	BP	30	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
13	-2	MC	0.5	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
14	-2	MC	1.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-2	MC	1.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	-2	MC	2.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	-2	MC	2.5	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1
18	-2	MC	3.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	-2	MC	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
20	-2	MC	5.0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0
21	-2	MC	7.5	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1
22	-2	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	-2	MC	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
24	-2	MC	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	-2	OC	0.0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1
26	-2	OC	0.0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	-2	OC	0.0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0
28	-2	WP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	-2	WP	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	-2	WP	0.5	3	0	0	0	0	0	0	0	0	0	2	0	0	0	0
31	14	BP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	14	BP	1.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
33	14	BP	1.5	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0
34	14	BP	2.0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
35	14	BP	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	14	BP	3.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	14	BP	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	14	BP	5.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	14	BP	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	14	BP	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	14	BP	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	14	BP	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	14	MC	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	14	MC	0.5	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0
45	14	MC	0.5	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0
46	14	MC	1.0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
47	14	MC	1.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	14	MC	2.0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0
49	14	MC	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	14	MC	3.0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
51	14	MC	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	14	MC	5.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	14	MC	7.5	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PETL	PETS	PEL	PES	PEXOL	PGA	PGP	PGS	PGONS	PHF	PHS	PLP	PLS	PLC	PLL	PMS	PMD	PNC
1	-2	BP	0.5	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
2	-2	BP	1.0	1	0	0	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	0
3	-2	BP	1.5	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
4	-2	BP	2.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	-2	BP	2.5	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
6	-2	BP	3.0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
7	-2	BP	3.5	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
8	-2	BP	5.0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
9	-2	BP	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
10	-2	BP	10	1	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0
11	-2	BP	20	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0
12	-2	BP	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	-2	MC	0.5	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
14	-2	MC	1.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-2	MC	1.5	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0
16	-2	MC	2.0	1	0	0	0	0	0	0	0	0	0	0	0	0	6	3	0	2	0	0
17	-2	MC	2.5	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
18	-2	MC	3.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
19	-2	MC	3.5	1	0	0	0	0	0	0	3	0	0	0	0	0	4	2	0	0	0	0
20	-2	MC	5.0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
21	-2	MC	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	-2	MC	10	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
23	-2	MC	20	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0
24	-2	MC	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	-2	OC	0.0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0
26	-2	OC	0.0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
27	-2	OC	0.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	-2	WP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
29	-2	WP	0.5	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
30	-2	WP	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
31	14	BP	0.5	1	0	0	0	0	0	0	2	0	0	0	0	0	1	6	0	0	0	0
32	14	BP	1.0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0
33	14	BP	1.5	1	0	0	0	0	0	0	1	0	0	0	1	0	0	2	0	0	0	0
34	14	BP	2.0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
35	14	BP	2.5	1	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0
36	14	BP	3.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	14	BP	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	14	BP	5.0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
39	14	BP	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
40	14	BP	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	14	BP	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
42	14	BP	30	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
43	14	MC	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	14	MC	0.5	2	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
45	14	MC	0.5	3	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
46	14	MC	1.0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
47	14	MC	1.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	14	MC	2.0	1	0	0	0	0	0	0	1	0	0	0	0	0	2	3	0	0	0	0
49	14	MC	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
50	14	MC	3.0	1	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0
51	14	MC	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0
52	14	MC	5.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	14	MC	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PNF	PNS	PNERS	PNERP	PNERSP	PORBS	PORBS	POF	PPARAS	PPP	PPECG	PPM	PPA	PPCAS	PPHYJ	PPHYS	PPB
1	-2	BP	0.5	1	8	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0
2	-2	BP	1.0	1	3	0	0	0	0	0	0	1	0	3	0	2	0	0	0	0	0
3	-2	BP	1.5	1	1	0	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0
4	-2	BP	2.0	1	11	0	0	0	0	0	0	0	0	11	0	3	0	0	0	0	0
5	-2	BP	2.5	1	4	0	0	0	0	0	0	0	0	5	1	2	0	0	0	0	0
6	-2	BP	3.0	1	2	0	0	0	0	0	0	0	0	6	0	2	0	0	0	0	1
7	-2	BP	3.5	1	5	0	0	0	0	0	0	0	0	10	0	2	0	0	0	0	0
8	-2	BP	5.0	1	5	0	0	0	1	0	0	0	0	8	0	8	0	0	0	0	0
9	-2	BP	7.5	1	3	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0
10	-2	BP	10	1	8	0	0	0	0	0	0	0	0	7	0	1	0	0	0	0	0
11	-2	BP	20	1	0	1	0	0	0	0	0	0	0	6	0	5	0	0	0	0	0
12	-2	BP	30	1	3	0	0	0	1	0	0	0	0	4	0	4	0	0	0	0	0
13	-2	MC	0.5	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
14	-2	MC	1.0	1	3	0	0	0	0	0	0	0	0	4	0	2	0	0	0	0	0
15	-2	MC	1.5	1	2	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0
16	-2	MC	2.0	1	1	3	0	0	0	0	0	0	0	13	0	0	0	0	1	0	0
17	-2	MC	2.5	1	0	3	0	0	0	0	0	0	0	6	0	3	0	0	2	0	0
18	-2	MC	3.0	1	5	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0
19	-2	MC	3.5	1	4	0	0	0	0	0	0	1	0	6	0	1	0	0	0	0	0
20	-2	MC	5.0	1	1	0	0	0	0	0	0	2	0	6	0	1	0	0	0	0	0
21	-2	MC	7.5	1	7	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
22	-2	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	-2	MC	20	1	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0
24	-2	MC	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	-2	OC	0.0	1	2	0	0	0	0	0	0	0	0	4	0	5	0	0	0	0	0
26	-2	OC	0.0	2	4	0	0	0	0	0	0	0	0	4	0	2	0	0	0	0	0
27	-2	OC	0.0	3	5	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
28	-2	WP	0.5	1	2	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0
29	-2	WP	0.5	2	4	0	0	0	0	0	0	0	0	11	0	1	0	0	0	0	0
30	-2	WP	0.5	3	8	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
31	14	BP	0.5	1	2	0	0	0	0	0	0	1	0	10	0	2	0	0	0	0	0
32	14	BP	1.0	1	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
33	14	BP	1.5	1	3	0	0	0	0	0	0	0	0	10	0	3	0	0	0	0	0
34	14	BP	2.0	1	4	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
35	14	BP	2.5	1	3	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
36	14	BP	3.0	1	5	0	0	0	0	0	0	0	0	4	0	6	0	0	0	0	0
37	14	BP	3.5	1	4	0	0	0	0	0	0	0	0	4	0	3	0	0	0	0	0
38	14	BP	5.0	1	4	0	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0
39	14	BP	7.5	1	9	0	0	0	0	0	0	0	0	10	0	7	0	0	0	0	0
40	14	BP	10	1	1	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
41	14	BP	20	1	2	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
42	14	BP	30	1	5	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
43	14	MC	0.5	1	4	0	0	0	0	0	0	0	0	9	0	1	0	0	0	0	0
44	14	MC	0.5	2	1	0	0	0	0	0	0	0	0	10	0	2	0	0	0	0	0
45	14	MC	0.5	3	4	0	0	0	0	0	0	1	0	2	1	2	1	0	0	0	0
46	14	MC	1.0	1	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0
47	14	MC	1.5	1	6	0	0	0	0	0	0	0	0	10	0	2	0	0	0	0	0
48	14	MC	2.0	1	6	0	0	0	0	0	0	1	0	11	0	1	0	0	0	0	0
49	14	MC	2.5	1	0	0	0	0	0	0	0	1	0	6	0	1	0	0	0	0	0
50	14	MC	3.0	1	1	1	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0
51	14	MC	3.5	1	2	0	0	0	0	0	0	7	0	10	0	4	0	0	0	0	1
52	14	MC	5.0	1	1	0	0	0	0	0	0	1	0	7	1	3	0	0	0	0	0
53	14	MC	7.5	1	5	0	0	0	0	0	0	0	0	8	0	6	0	0	0	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PPODG	PPOLS	PPOLYSP	PPS	PPRIS	PPRIM	PPRIST	PSL	PSERS	PSPHS	PSPC	PSPIB	PSPIS	PSYLS	POP
1	-2	BP	0.5	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
2	-2	BP	1.0	1	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0
3	-2	BP	1.5	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
4	-2	BP	2.0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
5	-2	BP	2.5	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
6	-2	BP	3.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	-2	BP	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	-2	BP	5.0	1	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0
9	-2	BP	7.5	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
10	-2	BP	10	1	0	1	0	0	0	0	0	3	0	0	0	1	0	0	0
11	-2	BP	20	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
12	-2	BP	30	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0
13	-2	MC	0.5	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
14	-2	MC	1.0	1	0	0	0	0	0	0	0	3	0	0	0	9	0	0	0
15	-2	MC	1.5	1	0	0	0	0	0	0	0	1	0	0	0	8	0	0	0
16	-2	MC	2.0	1	1	1	0	0	0	0	0	3	0	0	0	7	0	0	0
17	-2	MC	2.5	1	1	0	0	0	0	0	1	2	0	0	0	4	0	0	0
18	-2	MC	3.0	1	1	0	0	0	0	0	0	1	0	0	0	6	0	0	0
19	-2	MC	3.5	1	0	1	0	0	0	0	0	3	0	0	1	9	0	0	0
20	-2	MC	5.0	1	0	0	0	0	0	0	0	5	0	0	0	5	0	0	0
21	-2	MC	7.5	1	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
22	-2	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
23	-2	MC	20	1	1	0	0	0	0	0	0	5	0	0	0	8	0	0	0
24	-2	MC	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	-2	OC	0.0	1	2	0	0	0	0	0	0	3	0	0	0	1	0	0	0
26	-2	OC	0.0	2	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0
27	-2	OC	0.0	3	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0
28	-2	WP	0.5	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	-2	WP	0.5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	-2	WP	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	14	BP	0.5	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
32	14	BP	1.0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
33	14	BP	1.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	14	BP	2.0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
35	14	BP	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	14	BP	3.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	14	BP	3.5	1	0	1	0	0	0	0	0	1	0	0	0	2	0	0	0
38	14	BP	5.0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	14	BP	7.5	1	2	1	0	0	0	0	0	3	0	0	0	0	0	0	0
40	14	BP	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	14	BP	20	1	1	1	0	0	0	0	0	7	0	0	1	0	0	0	0
42	14	BP	30	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
43	14	MC	0.5	1	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0
44	14	MC	0.5	2	2	0	0	0	0	0	0	0	0	0	0	8	0	0	0
45	14	MC	0.5	3	0	0	0	0	0	1	0	2	0	0	0	3	0	0	0
46	14	MC	1.0	1	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0
47	14	MC	1.5	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
48	14	MC	2.0	1	0	0	0	0	0	1	0	4	3	0	1	2	0	0	0
49	14	MC	2.5	1	2	0	0	1	0	0	0	1	0	0	1	1	0	0	0
50	14	MC	3.0	1	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0
51	14	MC	3.5	1	3	0	0	0	0	0	0	3	0	0	1	5	0	0	0
52	14	MC	5.0	1	0	0	0	0	0	0	0	2	1	0	0	7	0	0	0
53	14	MC	7.5	1	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	MAC	MCF	MCN	MCS	MHA	MKA	MKP	MLC	MMC	MMN	MMS	MMP	MMT	MME	MNM	MNC	MNG
1	-2	BP	0.5	1	0	0	0	0	0	0	0	1	0	12	0	0	47	0	1	0	1
2	-2	BP	1.0	1	11	0	0	0	0	0	0	0	0	4	0	0	111	0	4	0	0
3	-2	BP	1.5	1	6	0	0	0	0	0	1	0	0	2	0	0	38	0	2	0	3
4	-2	BP	2.0	1	4	0	0	0	0	0	1	0	0	1	0	0	93	0	2	0	0
5	-2	BP	2.5	1	31	0	1	0	1	0	0	0	0	3	0	0	58	0	2	0	2
6	-2	BP	3.0	1	4	0	0	0	0	0	0	0	0	2	0	0	85	0	8	0	2
7	-2	BP	3.5	1	11	0	0	0	0	0	2	0	0	5	0	0	62	0	3	0	1
8	-2	BP	5.0	1	8	0	3	0	0	0	1	0	0	4	0	0	91	0	1	0	2
9	-2	BP	7.5	1	3	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0
10	-2	BP	10	1	5	0	1	0	0	0	1	0	0	2	0	0	76	0	5	0	0
11	-2	BP	20	1	5	0	0	0	0	0	0	0	0	1	3	0	103	0	6	0	1
12	-2	BP	30	1	1	0	0	0	0	0	0	0	0	1	0	0	29	0	1	0	1
13	-2	MC	0.5	1	10	0	0	0	0	0	0	0	0	2	0	0	21	0	4	0	0
14	-2	MC	1.0	1	6	0	0	0	0	0	0	0	0	0	0	0	212	0	1	0	0
15	-2	MC	1.5	1	2	0	0	0	0	0	0	0	0	0	0	0	125	0	1	0	0
16	-2	MC	2.0	1	8	0	0	0	0	0	0	0	0	0	0	0	81	0	2	0	2
17	-2	MC	2.5	1	2	0	0	0	0	0	0	0	0	1	0	0	67	0	7	0	2
18	-2	MC	3.0	1	3	0	0	0	0	0	0	0	0	2	0	0	77	0	4	0	1
19	-2	MC	3.5	1	4	0	0	0	0	0	0	0	0	1	0	0	108	0	13	0	1
20	-2	MC	5.0	1	7	0	0	0	0	0	0	0	0	1	0	0	75	0	3	0	4
21	-2	MC	7.5	1	6	0	0	0	0	0	0	0	0	1	0	1	104	0	7	0	4
22	-2	MC	10	1	13	0	0	0	0	0	0	0	0	0	0	0	25	0	6	0	1
23	-2	MC	20	1	2	0	0	0	0	0	0	0	0	0	0	0	102	0	8	0	3
24	-2	MC	30	1	16	0	0	0	0	0	0	0	0	0	0	0	63	0	8	0	4
25	-2	OC	0.0	1	0	1	0	0	0	2	0	0	0	3	0	0	47	0	1	1	2
26	-2	OC	0.0	2	5	0	0	0	0	0	0	0	0	0	0	0	47	0	4	0	0
27	-2	OC	0.0	3	0	0	1	0	0	0	0	0	0	0	2	0	22	0	1	0	1
28	-2	WP	0.5	1	4	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0
29	-2	WP	0.5	2	1	0	0	0	0	0	0	0	0	5	1	0	0	0	5	0	0
30	-2	WP	0.5	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
31	14	BP	0.5	1	5	0	0	0	0	0	0	0	0	0	5	0	56	0	12	0	1
32	14	BP	1.0	1	1	0	0	0	0	0	0	0	0	0	2	0	27	0	0	0	0
33	14	BP	1.5	1	6	0	0	0	0	3	0	0	0	0	6	0	36	0	0	0	1
34	14	BP	2.0	1	4	0	0	0	0	0	0	0	0	0	3	0	47	0	1	0	0
35	14	BP	2.5	1	5	0	0	0	0	0	0	0	0	0	1	0	45	0	2	0	2
36	14	BP	3.0	1	6	0	0	0	0	0	0	0	0	0	1	0	69	0	2	0	0
37	14	BP	3.5	1	4	0	0	0	0	0	0	0	0	1	0	0	49	0	1	0	1
38	14	BP	5.0	1	2	0	0	0	0	0	0	0	0	0	1	0	47	0	1	0	0
39	14	BP	7.5	1	5	0	0	0	0	0	0	0	0	2	0	0	59	0	1	0	0
40	14	BP	10	1	0	0	0	0	0	0	0	0	0	0	2	0	18	0	0	0	0
41	14	BP	20	1	1	0	0	0	0	0	0	0	0	0	0	0	48	0	4	0	0
42	14	BP	30	1	0	0	0	0	0	0	0	0	0	0	2	0	12	0	18	0	0
43	14	MC	0.5	1	1	0	0	0	0	0	0	0	0	0	0	0	21	0	1	0	1
44	14	MC	0.5	2	2	0	0	0	0	0	0	0	0	0	2	0	29	0	1	0	1
45	14	MC	0.5	3	0	0	1	0	0	0	0	0	0	0	0	0	79	0	3	0	1
46	14	MC	1.0	1	3	0	0	0	0	0	0	0	0	0	0	0	70	0	4	0	0
47	14	MC	1.5	1	1	0	0	0	0	0	0	0	0	1	0	0	45	0	5	0	1
48	14	MC	2.0	1	12	0	0	0	0	0	1	1	0	1	1	0	73	1	7	0	1
49	14	MC	2.5	1	2	0	0	0	0	1	0	0	0	1	1	0	57	0	6	0	1
50	14	MC	3.0	1	12	0	0	0	0	4	0	0	0	0	1	0	61	0	2	0	0
51	14	MC	3.5	1	3	0	0	0	0	0	0	0	0	0	0	0	55	0	3	0	1
52	14	MC	5.0	1	9	0	0	0	1	0	0	0	1	0	1	0	52	0	4	0	1
53	14	MC	7.5	1	1	0	0	0	0	2	0	0	0	0	0	0	81	0	2	0	1

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	MOS	MPT	MPC	MPSJ	MPL	MTM	MTSP	MTEL	MTS	MTURS	MTT	CAMU	CAS	CES	CHEMS	CHC	CLS
1	-2	BP	0.5	1	2	12	0	2	2	5	0	0	0	0	0	0	0	0	0	0	0
2	-2	BP	1.0	1	2	2	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0
3	-2	BP	1.5	1	2	4	0	1	0	3	0	0	2	0	0	0	0	0	0	0	0
4	-2	BP	2.0	1	2	8	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
5	-2	BP	2.5	1	4	5	0	0	1	8	0	0	0	0	0	0	0	0	0	0	0
6	-2	BP	3.0	1	2	11	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
7	-2	BP	3.5	1	4	5	0	1	0	9	0	0	0	0	0	0	0	0	0	0	0
8	-2	BP	5.0	1	0	8	0	3	0	9	0	0	0	0	0	0	0	0	0	0	0
9	-2	BP	7.5	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	-2	BP	10	1	0	7	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
11	-2	BP	20	1	2	6	0	0	0	6	0	0	0	1	0	0	0	0	0	0	0
12	-2	BP	30	1	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	-2	MC	0.5	1	0	2	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0
14	-2	MC	1.0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	-2	MC	1.5	1	0	4	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0
16	-2	MC	2.0	1	0	6	0	0	0	2	0	0	2	2	0	0	0	1	0	0	0
17	-2	MC	2.5	1	1	4	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0
18	-2	MC	3.0	1	0	7	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0
19	-2	MC	3.5	1	1	3	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0
20	-2	MC	5.0	1	0	10	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1
21	-2	MC	7.5	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
22	-2	MC	10	1	1	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
23	-2	MC	20	1	1	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
24	-2	MC	30	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	-2	OC	0.0	1	0	8	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
26	-2	OC	0.0	2	0	5	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
27	-2	OC	0.0	3	0	3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
28	-2	WP	0.5	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	-2	WP	0.5	2	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
30	-2	WP	0.5	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	14	BP	0.5	1	4	13	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0
32	14	BP	1.0	1	3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
33	14	BP	1.5	1	5	10	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
34	14	BP	2.0	1	7	8	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0
35	14	BP	2.5	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
36	14	BP	3.0	1	3	8	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0
37	14	BP	3.5	1	1	3	0	1	0	5	0	0	0	0	0	0	0	0	0	0	0
38	14	BP	5.0	1	5	5	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0
39	14	BP	7.5	1	2	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
40	14	BP	10	1	2	7	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
41	14	BP	20	1	2	8	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
42	14	BP	30	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	14	MC	0.5	1	1	6	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0
44	14	MC	0.5	2	1	5	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
45	14	MC	0.5	3	5	5	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
46	14	MC	1.0	1	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	14	MC	1.5	1	1	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48	14	MC	2.0	1	2	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
49	14	MC	2.5	1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	14	MC	3.0	1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	14	MC	3.5	1	2	3	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
52	14	MC	5.0	1	2	3	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
53	14	MC	7.5	1	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	CPAGS	CPSC	CPS	EAU	EOPH	MCOL	MNEM	MFORM	Abundance	Diversity
1	-2	BP	0.5	1	0	0	0	0	27	0	1	0	130	18
2	-2	BP	1.0	1	0	0	0	0	51	0	1	0	210	19
3	-2	BP	1.5	1	0	0	0	0	8	0	0	0	80	17
4	-2	BP	2.0	1	0	0	0	0	37	0	0	0	179	15
5	-2	BP	2.5	1	0	1	0	0	2	0	0	0	135	21
6	-2	BP	3.0	1	0	0	0	0	7	0	0	0	138	14
7	-2	BP	3.5	1	0	0	0	0	14	0	0	0	137	17
8	-2	BP	5.0	1	0	0	0	0	38	0	1	0	199	22
9	-2	BP	7.5	1	0	0	0	0	14	0	0	0	110	10
10	-2	BP	10	1	0	0	0	0	20	0	1	0	145	18
11	-2	BP	20	1	0	0	0	0	24	0	0	0	174	17
12	-2	BP	30	1	0	0	0	0	21	0	0	0	70	13
13	-2	MC	0.5	1	0	0	0	0	12	0	0	0	60	15
14	-2	MC	1.0	1	0	0	0	0	11	0	1	0	254	11
15	-2	MC	1.5	1	0	1	0	0	31	0	0	0	186	16
16	-2	MC	2.0	1	0	0	0	0	23	0	0	0	170	21
17	-2	MC	2.5	1	0	0	0	0	21	0	0	0	135	21
18	-2	MC	3.0	1	0	0	0	0	9	0	0	0	131	16
19	-2	MC	3.5	1	0	0	0	0	25	0	0	0	195	23
20	-2	MC	5.0	1	0	0	0	0	40	0	3	0	170	20
21	-2	MC	7.5	1	0	0	0	0	29	0	0	0	170	14
22	-2	MC	10	1	0	0	0	0	3	0	0	0	57	11
23	-2	MC	20	1	0	0	0	0	10	0	0	0	163	16
24	-2	MC	30	1	0	0	0	0	0	0	1	0	94	6
25	-2	OC	0.0	1	0	0	0	0	21	0	1	0	111	22
26	-2	OC	0.0	2	0	0	0	0	20	0	1	0	98	15
27	-2	OC	0.0	3	0	0	0	0	1	0	0	0	55	14
28	-2	WP	0.5	1	0	0	0	0	0	0	0	0	26	8
29	-2	WP	0.5	2	0	0	0	0	3	0	0	0	38	12
30	-2	WP	0.5	3	0	0	0	0	2	0	0	0	24	7
31	14	BP	0.5	1	0	0	2	0	43	0	0	0	170	21
32	14	BP	1.0	1	0	0	0	0	7	0	0	0	52	14
33	14	BP	1.5	1	0	0	0	0	12	0	0	0	104	16
34	14	BP	2.0	1	0	0	0	0	10	0	0	0	100	15
35	14	BP	2.5	1	0	0	0	0	7	0	0	0	75	12
36	14	BP	3.0	1	0	0	0	0	32	0	0	0	139	12
37	14	BP	3.5	1	0	0	0	0	40	0	0	0	121	16
38	14	BP	5.0	1	0	0	0	0	4	0	0	0	84	15
39	14	BP	7.5	1	0	0	1	0	30	0	1	0	138	17
40	14	BP	10	1	0	0	0	0	3	0	0	0	38	9
41	14	BP	20	1	0	0	1	0	28	0	2	0	118	18
42	14	BP	30	1	0	0	0	0	3	0	0	0	54	11
43	14	MC	0.5	1	0	0	0	0	7	0	0	0	62	14
44	14	MC	0.5	2	0	0	0	0	6	0	2	0	77	19
45	14	MC	0.5	3	0	0	1	0	24	0	1	0	142	23
46	14	MC	1.0	1	0	0	1	0	28	0	1	0	125	15
47	14	MC	1.5	1	0	0	0	0	18	0	0	0	100	13
48	14	MC	2.0	1	0	0	0	0	11	0	0	0	153	27
49	14	MC	2.5	1	0	0	0	0	21	0	0	0	110	19
50	14	MC	3.0	1	0	0	0	0	23	0	0	0	125	17
51	14	MC	3.5	1	0	0	0	0	20	0	0	0	128	20
52	14	MC	5.0	1	0	0	0	0	25	0	0	0	124	20
53	14	MC	7.5	1	0	0	0	0	56	0	0	0	179	16

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PAML	PAS	PAMO	PAMU	PAPHS	PAB	PCAPC	PCAPS	PCHAS	PCIRS	PDORR	PDORS	PDORDS	PEB
54	14	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
55	14	WP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	14	WP	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	14	WP	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	14	WP	2.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	14	WP	2.0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0
60	14	WP	2.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	14	MC	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	14	MC	10	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0
63	14	MC	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	14	MC	30	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
65	14	OC	0.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	14	OC	0.0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	14	OC	0.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	185	WP	0.5	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0
69	185	WP	0.5	2	0	0	0	7	0	0	0	0	0	0	0	0	0	0
70	185	WP	0.5	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0
71	185	WP	2.0	1	0	0	1	3	0	0	0	0	0	0	0	0	0	0
72	185	WP	2.0	3	0	0	1	7	0	0	0	0	0	0	1	0	0	0
73	185	OC	0.5	1	0	0	0	10	0	0	0	0	0	0	0	0	0	0
74	185	OC	0.5	2	0	0	1	7	0	0	0	0	0	3	0	0	0	0
75	185	OC	0.5	3	0	0	1	20	0	0	0	0	0	1	0	0	0	0
76	185	MC	10	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0
77	185	MC	10	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0
78	185	MC	20	1	0	0	0	8	0	0	0	0	0	0	0	0	0	1
79	185	MC	30	1	0	0	0	33	0	0	0	0	0	0	0	0	0	0
80	185	MC	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
81	185	MC	3.0	1	0	0	0	6	0	0	0	0	2	0	0	0	0	0
82	185	MC	3.5	1	0	0	0	5	1	0	0	0	0	0	0	0	0	0
83	185	MC	5.0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	1
84	185	MC	7.5	1	0	0	0	3	0	0	0	0	0	2	1	0	0	0
85	185	MC	10	1	0	0	0	8	0	0	0	0	0	0	0	0	0	0
86	185	MC	0.5	1	0	0	0	0	8	0	0	0	0	0	1	0	0	0
87	185	MC	0.5	2	0	0	0	11	0	0	0	0	0	0	0	0	0	0
88	185	MC	0.5	3	0	0	0	5	0	0	0	0	0	0	0	0	0	0
89	185	MC	1.0	1	0	0	0	12	0	0	0	0	0	11	0	0	0	0
90	185	MC	1.5	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
91	185	MC	2.0	1	0	0	0	5	0	0	0	0	0	0	0	0	0	1
92	185	BP	3.5	1	0	0	0	22	0	0	0	0	0	0	3	0	0	0
93	185	BP	5.0	1	0	0	3	34	0	1	0	0	0	0	0	0	0	0
94	185	BP	7.5	1	0	0	0	7	0	0	0	0	0	0	0	0	0	0
95	185	BP	10	1	0	0	0	17	0	0	0	0	0	0	0	0	0	0
96	185	BP	20	1	0	0	0	23	0	0	0	0	0	0	1	0	0	0
97	185	BP	30	1	0	0	0	18	0	0	0	0	0	0	0	0	0	0
98	185	BP	0.5	1	0	0	0	28	0	0	0	0	0	0	0	0	0	0
99	185	BP	1.0	1	0	1	0	29	1	0	0	0	0	0	0	0	0	0
100	185	BP	1.5	1	0	0	0	55	0	0	0	0	0	0	0	0	0	0
101	185	BP	2.0	1	0	0	0	7	0	0	0	0	0	2	0	0	0	0
102	185	BP	2.5	1	0	0	1	15	0	0	0	0	0	0	0	0	0	0
103	185	BP	3.0	1	0	0	0	38	0	0	0	0	1	0	0	0	0	0
104	384	BP	0.5	1	0	0	0	0	0	0	1	0	0	0	6	0	0	0
105	384	U	-2.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106	384	BP	1.0	1	0	0	0	0	0	1	3	0	0	0	10	0	0	0
107	384	BP	1.5	1	0	0	0	0	0	0	3	0	0	0	3	0	0	2

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PETL	PETS	PEL	PES	PEXOL	PGA	PGP	PGS	PGONS	PHF	PHS	PLP	PLS	PLC	PLL	PMS	PMD	PNC
54	14	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	14	WP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	14	WP	0.5	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
57	14	WP	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	14	WP	2.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	14	WP	2.0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	14	WP	2.0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
61	14	MC	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	14	MC	10	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
63	14	MC	20	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
64	14	MC	30	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
65	14	OC	0.0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
66	14	OC	0.0	2	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0
67	14	OC	0.0	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
68	185	WP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
69	185	WP	0.5	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
70	185	WP	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
71	185	WP	2.0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
72	185	WP	2.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
73	185	OC	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
74	185	OC	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	185	OC	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
76	185	MC	10	2	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0
77	185	MC	10	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0
78	185	MC	20	1	2	0	0	0	0	0	0	0	0	0	0	0	1	1	0	3	0	0
79	185	MC	30	1	2	0	0	0	0	0	0	0	0	0	0	0	1	1	0	34	0	0
80	185	MC	2.5	1	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	8	0	0
81	185	MC	3.0	1	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	6	0	0
82	185	MC	3.5	1	0	0	0	0	1	0	0	0	0	0	0	0	2	2	0	8	0	0
83	185	MC	5.0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0	0
84	185	MC	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	10	0	0
85	185	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	7	0	0
86	185	MC	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
87	185	MC	0.5	2	0	4	0	0	1	0	0	0	0	0	0	4	4	0	0	16	0	0
88	185	MC	0.5	3	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	6	0	0
89	185	MC	1.0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	17	0	0
90	185	MC	1.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
91	185	MC	2.0	1	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	5	0	0
92	185	BP	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	23	0	2
93	185	BP	5.0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	29	0	0
94	185	BP	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
95	185	BP	10	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	18	0	0
96	185	BP	20	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	7	0	0
97	185	BP	30	1	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	5	0	0
98	185	BP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	7	0	0
99	185	BP	1.0	1	0	0	0	0	2	0	0	0	0	0	0	0	3	0	0	12	0	0
100	185	BP	1.5	1	0	0	0	0	7	0	0	0	0	0	0	1	1	0	0	21	0	0
101	185	BP	2.0	1	0	0	0	0	3	0	2	0	0	0	0	0	2	0	0	21	0	0
102	185	BP	2.5	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	9	0	0
103	185	BP	3.0	1	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	12	0	0
104	384	BP	0.5	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0
105	384	U	-2.0	1	0	0	0	0	9	0	0	0	0	0	0	0	2	0	0	0	0	0
106	384	BP	1.0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
107	384	BP	1.5	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PNF	PNS	PNERS	PNERP	PNERSP	PORBS	PORBS	POF	PPARAS	PPP	PPECG	PPM	PPA	PPCAS	PPHYJ	PPHYS	PPB
54	14	MC	10	1	3	0	0	1	0	0	0	0	0	11	0	0	0	0	0	0	0
55	14	WP	0.5	1	4	0	0	0	0	0	0	0	0	9	0	2	0	0	0	0	0
56	14	WP	0.5	2	5	0	0	0	0	0	0	0	0	11	0	4	0	0	0	0	0
57	14	WP	0.5	3	4	0	0	0	0	0	0	1	0	11	0	1	0	0	0	0	0
58	14	WP	2.0	1	7	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0
59	14	WP	2.0	2	3	0	0	0	0	0	0	0	0	9	0	1	0	0	0	1	0
60	14	WP	2.0	3	3	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0
61	14	MC	10	2	3	0	0	0	0	0	0	1	0	4	0	1	0	0	0	0	0
62	14	MC	10	3	5	0	0	0	0	0	0	2	0	7	0	0	0	0	0	0	0
63	14	MC	20	1	2	0	0	0	0	0	0	2	0	6	0	2	0	0	0	0	0
64	14	MC	30	1	0	0	0	0	0	0	0	3	0	3	0	3	0	0	0	0	0
65	14	OC	0.0	1	2	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
66	14	OC	0.0	2	4	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
67	14	OC	0.0	3	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
68	185	WP	0.5	1	1	0	0	0	0	0	0	0	0	4	0	2	0	0	0	0	0
69	185	WP	0.5	2	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
70	185	WP	0.5	3	1	0	0	0	0	0	0	0	0	9	0	1	0	0	0	0	0
71	185	WP	2.0	1	2	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
72	185	WP	2.0	3	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
73	185	OC	0.5	1	4	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
74	185	OC	0.5	2	1	0	0	0	0	0	0	0	0	6	0	0	1	0	0	0	0
75	185	OC	0.5	3	2	0	0	0	0	0	0	0	0	2	0	5	0	0	0	0	0
76	185	MC	10	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
77	185	MC	10	3	4	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0
78	185	MC	20	1	3	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0
79	185	MC	30	1	2	0	1	0	0	0	0	1	0	7	0	1	0	0	0	0	0
80	185	MC	2.5	1	1	0	1	0	0	0	0	1	0	6	0	1	0	0	0	0	0
81	185	MC	3.0	1	2	0	0	0	0	0	0	0	0	4	0	3	0	0	0	0	0
82	185	MC	3.5	1	0	0	0	0	0	0	0	2	1	10	0	6	0	0	0	0	0
83	185	MC	5.0	1	6	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
84	185	MC	7.5	1	1	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
85	185	MC	10	1	5	0	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0
86	185	MC	0.5	1	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
87	185	MC	0.5	2	3	0	0	0	0	0	0	1	5	7	0	1	0	0	0	0	0
88	185	MC	0.5	3	2	0	1	0	0	0	0	2		6	0	4	0	0	0	0	0
89	185	MC	1.0	1	2	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0
90	185	MC	1.5	1	3	0	0	0	0	0	0	1	0	5	0	3	0	0	0	0	0
91	185	MC	2.0	1	3	0	0	0	0	0	0	0	0	7	0	0	2	0	0	0	0
92	185	BP	3.5	1	6	0	0	0	0	0	0	0	0	7	0	5	0	0	0	0	0
93	185	BP	5.0	1	5	0	0	0	0	0	0	0	0	6	0	7	0	0	0	0	0
94	185	BP	7.5	1	1	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0
95	185	BP	10	1	3	0	0	0	0	1	0	0	0	7	0	1	0	0	0	0	0
96	185	BP	20	1	1	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0
97	185	BP	30	1	9	0	0	0	0	0	0	0	0	3	0	6	0	0	0	0	0
98	185	BP	0.5	1	6	0	0	0	0	0	0	1	0	3	0	2	0	0	0	0	0
99	185	BP	1.0	1	4	0	0	0	0	0	0	0	0	11	0	2	0	0	0	0	0
100	185	BP	1.5	1	7	0	0	0	0	0	0	2	0	4	0	3	0	0	0	1	0
101	185	BP	2.0	1	7	0	0	0	0	0	0	0	0	1	0	8	0	0	0	0	0
102	185	BP	2.5	1	9	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
103	185	BP	3.0	1	6	0	1	0	0	0	0	1	0	6	0	2	0	0	0	0	0
104	384	BP	0.5	1	0	0	0	0	0	0	4	0	0	5	0	0	0	0	0	0	1
105	384	U	-2.0	1	1	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	2
106	384	BP	1.0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	7
107	384	BP	1.5	1	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	2

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PPODG	PPOLS	PPOLYSP	PPS	PPRIS	PPRIM	PPRIST	PSL	PSERS	PSPHS	PSPC	PSPIB	PSPIS	PSYLS	POP
54	14	MC	10	1	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0
55	14	WP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	14	WP	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	14	WP	0.5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	14	WP	2.0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
59	14	WP	2.0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
60	14	WP	2.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	14	MC	10	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	14	MC	10	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
63	14	MC	20	1	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0
64	14	MC	30	1	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0
65	14	OC	0.0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
66	14	OC	0.0	2	3	0	0	0	0	0	0	0	0	0	1	1	0	0	0
67	14	OC	0.0	3	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
68	185	WP	0.5	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
69	185	WP	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	185	WP	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	185	WP	2.0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
72	185	WP	2.0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	185	OC	0.5	1	1	0	0	0	0	0	0	2	0	0	0	8	0	0	0
74	185	OC	0.5	2	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0
75	185	OC	0.5	3	0	0	0	0	0	0	0	1	0	0	0	6	0	0	0
76	185	MC	10	2	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
77	185	MC	10	3	0	0	0	1	0	0	0	0	0	0	0	6	0	0	0
78	185	MC	20	1	1	0	0	0	0	0	0	2	0	0	0	4	0	0	0
79	185	MC	30	1	2	0	0	1	0	1	0	0	0	0	0	3	0	0	0
80	185	MC	2.5	1	0	0	0	0	0	0	0	5	0	0	0	1	0	0	0
81	185	MC	3.0	1	1	0	0	0	0	0	0	0	0	0	0	8	0	0	0
82	185	MC	3.5	1	2	0	0	0	0	0	0	6	0	0	0	10	0	1	0
83	185	MC	5.0	1	1	0	0	0	0	0	0	1	0	0	0	2	0	0	0
84	185	MC	7.5	1	1	0	0	0	0	0	0	0	0	0	0	9	0	1	0
85	185	MC	10	1	0	0	0	0	0	1	0	0	0	0	0	6	0	0	0
86	185	MC	0.5	1	5	0	0	0	0	0	0	0	0	0	0	5	0	0	0
87	185	MC	0.5	2	0	0	0	0	0	1	0	3	0	0	0	4	0	0	0
88	185	MC	0.5	3	0	0	0	0	0	0	0	0	0	1	0	7	0	0	0
89	185	MC	1.0	1	1	0	0	0	0	0	0	0	0	0	0	11	0	0	0
90	185	MC	1.5	1	1	0	0	0	0	1	0	0	0	0	0	3	0	0	0
91	185	MC	2.0	1	1	0	0	0	0	2	0	0	0	0	0	4	0	0	0
92	185	BP	3.5	1	1	0	0	0	0	0	0	1	0	0	0	3	0	0	0
93	185	BP	5.0	1	1	0	3	0	0	0	0	0	0	0	0	1	0	0	0
94	185	BP	7.5	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
95	185	BP	10	1	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0
96	185	BP	20	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0
97	185	BP	30	1	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0
98	185	BP	0.5	1	1	0	0	0	0	0	0	1	0	0	0	2	0	0	0
99	185	BP	1.0	1	1	0	5	0	0	1	0	4	0	0	0	9	0	0	0
100	185	BP	1.5	1	0	0	0	0	0	1	0	1	0	0	0	4	0	0	0
101	185	BP	2.0	1	2	0	0	0	0	0	0	1	0	0	0	2	0	0	0
102	185	BP	2.5	1	1	0	1	0	0	0	0	1	0	0	0	3	0	0	0
103	185	BP	3.0	1	3	0	4	1	0	3	0	0	0	0	0	2	0	0	0
104	384	BP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
105	384	U	-2.0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
106	384	BP	1.0	1	9	0	0	0	0	0	0	0	1	0	0	7	0	0	0
107	384	BP	1.5	1	2	0	0	0	0	0	0	0	0	0	0	9	0	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	MAC	MCF	MCN	MCS	MHA	MKA	MKP	MLC	MMC	MMN	MMS	MMP	MMT	MME	MNM	MNC	MNG
54	14	MC	10	1	2	0	0	0	0	0	0	0	0	0	0	0	81	0	6	0	3
55	14	WP	0.5	1	2	0	0	0	0	1	0	0	0	0	0	0	4	0	1	0	0
56	14	WP	0.5	2	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
57	14	WP	0.5	3	2	0	0	0	0	0	0	0	0	0	3	0	6	0	3	0	2
58	14	WP	2.0	1	2	0	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0
59	14	WP	2.0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
60	14	WP	2.0	3	2	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	0
61	14	MC	10	2	2	0	0	0	0	0	0	0	0	0	0	0	99	0	6	0	3
62	14	MC	10	3	7	0	0	0	0	1	0	0	0	0	0	0	62	0	3	0	2
63	14	MC	20	1	1	0	0	0	0	1	0	0	0	0	1	0	59	0	6	0	1
64	14	MC	30	1	1	0	0	0	0	0	0	0	0	1	0	0	54	0	5	0	0
65	14	OC	0.0	1	2	0	0	0	0	2	0	0	0	0	1	0	66	0	5	0	1
66	14	OC	0.0	2	1	0	0	0	0	0	0	0	0	1	0	0	47	0	4	0	2
67	14	OC	0.0	3	4	0	0	0	0	0	0	0	0	1	1	0	10	0	3	0	0
68	185	WP	0.5	1	6	0	0	0	0	0	0	0	0	0	0	0	9	0	3	0	0
69	185	WP	0.5	2	21	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
70	185	WP	0.5	3	5	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0
71	185	WP	2.0	1	15	0	0	0	0	0	0	0	0	2	0	0	2	0	3	0	0
72	185	WP	2.0	3	20	0	0	0	0	0	0	0	0	1	0	0	3	0	2	0	0
73	185	OC	0.5	1	9	0	0	0	0	0	0	0	0	0	0	0	11	0	4	0	2
74	185	OC	0.5	2	5	0	1	0	0	0	0	0	0	1	0	0	27	0	4	0	0
75	185	OC	0.5	3	7	0	0	0	0	0	0	0	0	0	0	0	135	0	2	0	0
76	185	MC	10	2	16	0	0	0	0	0	0	0	0	3	0	0	44	0	4	0	0
77	185	MC	10	3	9	0	0	0	0	0	1	0	0	1	0	0	83	0	0	0	0
78	185	MC	20	1	6	0	0	0	0	0	0	0	0	0	1	0	64	0	0	0	1
79	185	MC	30	1	9	0	0	0	0	0	1	0	0	0	0	0	46	0	2	0	1
80	185	MC	2.5	1	6	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0
81	185	MC	3.0	1	23	0	0	0	0	0	0	0	0	0	0	0	125	0	0	0	1
82	185	MC	3.5	1	4	0	0	0	0	0	1	0	0	0	0	0	168	0	3	0	0
83	185	MC	5.0	1	9	0	0	0	0	0	0	0	0	0	0	0	106	0	3	0	1
84	185	MC	7.5	1	7	0	0	0	0	0	0	0	0	1	0	0	94	0	2	0	0
85	185	MC	10	1	4	0	0	0	0	0	0	0	0	0	0	0	56	0	2	0	2
86	185	MC	0.5	1	8	0	0	0	0	0	0	0	0	0	0	0	66	0	2	0	0
87	185	MC	0.5	2	14	0	0	0	0	0	0	0	0	0	0	0	79	0	3	0	0
88	185	MC	0.5	3	17	0	0	0	0	0	0	0	0	0	2	0	101	0	1	0	0
89	185	MC	1.0	1	14	0	0	0	0	0	0	0	0	0	4	0	75	0	5	0	0
90	185	MC	1.5	1	5	0	0	0	0	0	1	0	0	0	0	0	56	0	0	0	0
91	185	MC	2.0	1	10	0	0	0	0	0	0	0	0	1	0	0	141	0	5	0	0
92	185	BP	3.5	1	21	0	0	0	0	0	1	0	0	1	0	0	170	0	4	0	2
93	185	BP	5.0	1	8	0	0	0	0	0	0	0	0	0	0	0	92	0	3	0	1
94	185	BP	7.5	1	10	0	0	0	0	0	0	0	0	0	0	0	14	0	2	0	0
95	185	BP	10	1	26	0	0	0	0	0	0	0	0	0	0	0	45	0	6	0	0
96	185	BP	20	1	12	0	0	0	0	0	0	0	0	1	0	0	37	0	2	0	0
97	185	BP	30	1	11	0	0	0	0	0	0	0	0	0	0	0	51	0	5	0	2
98	185	BP	0.5	1	4	0	0	0	0	0	0	0	0	0	0	0	26	0	0	0	0
99	185	BP	1.0	1	3	0	0	0	0	0	0	0	0	1	0	0	73	0	2	0	0
100	185	BP	1.5	1	20	0	0	0	0	0	0	0	0	0	0	0	57	0	1	0	1
101	185	BP	2.0	1	15	0	0	0	0	0	0	0	0	1	0	0	163	0	0	0	0
102	185	BP	2.5	1	22	0	0	0	0	0	0	0	0	0	2	0	44	0	3	0	0
103	185	BP	3.0	1	12	0	0	0	0	0	1	0	0	1	0	0	94	0	3	0	1
104	384	BP	0.5	1	2	0	0	0	1	0	0	0	0	3	1	0	25	3	3	6	0
105	384	U	-2.0	1	3	0	0	0	0	0	0	0	0	0	1	0	2	0	5	0	0
106	384	BP	1.0	1	50	0	0	0	0	0	0	0	0	16	1	0	58	2	7	0	2
107	384	BP	1.5	1	21	0	0	1	0	0	0	0	0	7	0	0	66	0	2	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	MOS	MPT	MPC	MPSJ	MPL	MTM	MTSP	MTEL	MTS	MTURS	MTT	CAMU	CAS	CES	CHEMS	CHC	CLS
54	14	MC	10	1	2	5	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
55	14	WP	0.5	1	0	4	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
56	14	WP	0.5	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	14	WP	0.5	3	1	4	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
58	14	WP	2.0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	14	WP	2.0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	14	WP	2.0	3	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
61	14	MC	10	2	3	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	14	MC	10	3	3	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
63	14	MC	20	1	4	5	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0
64	14	MC	30	1	0	6	0	1	0	2	0	0	1	0	0	0	0	0	0	0	0
65	14	OC	0.0	1	0	3	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
66	14	OC	0.0	2	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
67	14	OC	0.0	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	185	WP	0.5	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	185	WP	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	185	WP	0.5	3	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
71	185	WP	2.0	1	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	185	WP	2.0	3	4	6	0	0	0	3	0	0	0	2	0	0	0	0	0	0	0
73	185	OC	0.5	1	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
74	185	OC	0.5	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	185	OC	0.5	3	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	185	MC	10	2	0	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
77	185	MC	10	3	0	4	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0
78	185	MC	20	1	0	4	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
79	185	MC	30	1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	185	MC	2.5	1	0	7	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
81	185	MC	3.0	1	0	4	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
82	185	MC	3.5	1	1	9	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
83	185	MC	5.0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
84	185	MC	7.5	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
85	185	MC	10	1	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
86	185	MC	0.5	1	2	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
87	185	MC	0.5	2	1	11	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
88	185	MC	0.5	3	1	6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
89	185	MC	1.0	1	0	13	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
90	185	MC	1.5	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	185	MC	2.0	1	3	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
92	185	BP	3.5	1	2	11	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0
93	185	BP	5.0	1	3	7	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0
94	185	BP	7.5	1	2	5	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0
95	185	BP	10	1	3	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
96	185	BP	20	1	5	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
97	185	BP	30	1	2	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
98	185	BP	0.5	1	1	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
99	185	BP	1.0	1	1	19	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
100	185	BP	1.5	1	1	10	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
101	185	BP	2.0	1	2	6	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0
102	185	BP	2.5	1	8	9	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0
103	185	BP	3.0	1	0	11	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
104	384	BP	0.5	1	5	4	0	0	0	1	0	0	0	0	3	1	0	0	0	0	0
105	384	U	-2.0	1	0	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
106	384	BP	1.0	1	8	13	0	20	9	5	0	0	0	0	0	0	0	0	0	0	0
107	384	BP	1.5	1	8	11	0	8	2	10	0	0	0	0	0	0	0	0	0	0	0

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	CPAGS	CPSC	CPS	EAU	EOPH	MCOL	MNEM	MFORM	Abundance	Diversity
54	14	MC	10	1	0	0	0	0	16	0	0	0	136	14
55	14	WP	0.5	1	0	0	0	0	9	0	0	0	38	11
56	14	WP	0.5	2	0	0	0	0	2	0	0	0	26	8
57	14	WP	0.5	3	0	0	0	0	14	0	2	0	57	16
58	14	WP	2.0	1	0	0	0	0	3	0	0	0	30	10
59	14	WP	2.0	2	0	0	0	0	6	0	0	0	28	11
60	14	WP	2.0	3	0	0	0	0	8	0	0	0	31	9
61	14	MC	10	2	0	0	0	0	1	0	0	0	129	12
62	14	MC	10	3	0	0	0	0	9	0	0	0	108	15
63	14	MC	20	1	0	0	1	0	27	0	0	0	129	19
64	14	MC	30	1	0	0	0	0	3	0	0	0	89	17
65	14	OC	0.0	1	0	0	0	0	12	0	0	0	102	16
66	14	OC	0.0	2	0	0	0	0	21	0	0	0	93	14
67	14	OC	0.0	3	0	0	1	0	8	0	0	0	40	14
68	185	WP	0.5	1	0	0	0	5	0	0	0	0	46	12
69	185	WP	0.5	2	0	0	0	0	0	0	0	0	40	7
70	185	WP	0.5	3	0	0	0	4	0	0	0	0	30	12
71	185	WP	2.0	1	0	0	0	8	0	0	0	0	48	15
72	185	WP	2.0	3	0	0	0	5	0	0	0	0	64	15
73	185	OC	0.5	1	1	0	0	10	0	0	1	0	86	17
74	185	OC	0.5	2	0	0	0	4	0	0	0	0	68	15
75	185	OC	0.5	3	0	0	1	21	0	0	1	0	219	16
76	185	MC	10	2	0	0	0	15	0	0	0	0	101	13
77	185	MC	10	3	0	0	0	50	0	0	0	0	172	17
78	185	MC	20	1	0	0	0	22	0	0	2	0	134	21
79	185	MC	30	1	1	0	0	8	0	0	0	0	163	23
80	185	MC	2.5	1	0	0	0	8	0	0	0	0	130	16
81	185	MC	3.0	1	0	0	0	45	0	0	2	0	246	17
82	185	MC	3.5	1	0	0	0	67	0	0	0	0	312	22
83	185	MC	5.0	1	0	0	0	20	0	0	0	0	164	17
84	185	MC	7.5	1	0	0	0	7	0	0	0	0	149	16
85	185	MC	10	1	0	0	0	12	0	0	0	0	117	16
86	185	MC	0.5	1	0	0	1	24	0	0	2	0	135	16
87	185	MC	0.5	2	0	0	0	26	0	0	1	0	205	22
88	185	MC	0.5	3	0	0	0	29	0	0	1	0	196	21
89	185	MC	1.0	1	0	0	0	14	0	0	1	0	192	17
90	185	MC	1.5	1	0	0	0	14	0	0	2	0	105	16
91	185	MC	2.0	1	0	0	0	29	0	0	1	0	230	20
92	185	BP	3.5	1	0	0	0	53	0	0	1	0	344	23
93	185	BP	5.0	1	0	0	0	23	0	0	0	0	231	20
94	185	BP	7.5	1	0	0	2	5	0	0	0	0	61	17
95	185	BP	10	1	1	0	0	9	0	0	0	0	147	17
96	185	BP	20	1	0	0	1	25	0	0	4	0	133	21
97	185	BP	30	1	0	0	0	54	0	0	2	0	182	18
98	185	BP	0.5	1	0	0	0	6	0	0	1	0	98	17
99	185	BP	1.0	1	0	0	0	19	0	0	0	0	204	22
100	185	BP	1.5	1	0	0	0	34	0	0	0	0	238	21
101	185	BP	2.0	1	0	0	0	90	0	0	0	0	338	20
102	185	BP	2.5	1	0	0	0	20	0	0	1	0	159	20
103	185	BP	3.0	1	0	0	0	11	0	0	1	0	221	25
104	384	BP	0.5	1	0	0	0	5	0	0	1	4	90	24
105	384	U	-2.0	1	0	0	0	20	0	0	0	0	58	14
106	384	BP	1.0	1	0	0	0	10	0	0	0	0	245	23
107	384	BP	1.5	1	0	0	0	21	0	0	0	0	186	22

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PAML	PAS	PAMO	PAMU	PAPHS	PAB	PCAPC	PCAPS	PCHAS	PCIRS	PDORR	PDORS	PDORDS	PEB
108	384	BP	2.0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0
109	384	BP	2.5	1	0	0	0	0	0	0	0	0	0	0	6	0	0	0
110	384	BP	3.0	1	0	0	0	0	0	0	2	0	0	0	2	0	0	0
111	384	MC	0.5	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0
112	384	MC	0.5	2	0	0	0	0	0	1	1	0	0	0	1	0	0	0
113	384	MC	0.5	3	0	0	0	0	0	3	0	0	0	0	2	2	0	0
114	384	MC	1.0	1	0	0	0	0	0	0	1	0	0	0	2	0	0	0
115	384	MC	1.5	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0
116	384	MC	2.0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
117	384	MC	2.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
118	384	MC	3.0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
119	384	MC	3.5	1	1	0	0	0	0	0	0	0	0	0	2	0	0	0
120	384	MC	5.0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
121	384	MC	5.0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0
122	384	MC	7.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	384	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
124	384	MC	10	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
125	384	MC	10	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
126	384	MC	20	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
127	384	MC	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
128	384	OC	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
129	384	BP	3.5	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0
130	384	BP	5.0	1	0	0	0	0	0	1	2	0	0	0	0	1	0	0
131	384	BP	7.5	1	5	0	0	0	0	0	0	0	0	0	1	0	0	0
132	384	BP	10	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
133	384	BP	20	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0
134	384	BP	30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135	384	WP	0.5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1
136	384	WP	2.0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	384	BP	0.5	1	0	0	0	0	0	0	1	0	0	0	0	6	0	0
			Occurences		2	5	8	41	4	6	12	3	5	10	20	7	1	16
			Total Number		6	5	11	474	11	8	19	3	6	25	47	15	1	20
			Average Number		0.04	0.04	0.08	3.46	0.08	0.06	0.14	0.02	0.04	0.18	0.34	0.11	0.01	0.15
			Median Number		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Variance		0.19	0.04	0.13	73.16	0.49	0.10	0.25	0.02	0.06	1.05	1.48	0.36	0.01	0.20
			Variance/Mean		4.32	0.97	1.66	21.15	6.05	1.70	1.82	0.99	1.30	5.74	4.31	3.31	1.00	1.36

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PETL	PETS	PEL	PES	PEXOL	PGA	PGP	PGS	PGONS	PHF	PHS	PLP	PLS	PLC	PLL	PMS	PMD	PNC
108	384	BP	2.0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
109	384	BP	2.5	1	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
110	384	BP	3.0	1	0	0	0	0	0	0	1	0	0	0	0	0	6	0	0	0	0	0
111	384	MC	0.5	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
112	384	MC	0.5	2	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
113	384	MC	0.5	3	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0
114	384	MC	1.0	1	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0
115	384	MC	1.5	1	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0	4	0
116	384	MC	2.0	1	0	0	0	1	0	0	2	0	0	0	0	0	3	0	2	0	0	0
117	384	MC	2.5	1	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0
118	384	MC	3.0	1	0	0	1	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0
119	384	MC	3.5	1	0	0	0	0	0	0	4	0	0	0	1	0	0	0	0	1	0	0
120	384	MC	5.0	1	0	0	0	0	0	0	1	0	0	0	0	0	4	0	0	0	0	0
121	384	MC	5.0	2	0	0	0	0	0	0	5	0	0	0	0	0	2	0	0	0	0	0
122	384	MC	7.5	1	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	2	2	0
123	384	MC	10	1	0	0	0	0	0	0	7	0	0	0	0	0	8	0	0	2	2	1
124	384	MC	10	2	0	0	0	0	0	0	2	0	0	0	0	1	2	0	0	3	1	0
125	384	MC	10	3	0	0	0	0	0	0	4	0	0	0	0	0	2	0	0	0	0	1
126	384	MC	20	1	0	1	0	0	0	0	2	0	0	0	0	0	3	0	1	0	0	0
127	384	MC	30	1	0	0	0	0	0	0	4	0	0	0	0	0	12	0	1	17	0	1
128	384	OC	0.5	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
129	384	BP	3.5	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
130	384	BP	5.0	1	0	0	0	0	0	0	2	0	0	0	0	0	6	0	0	0	0	0
131	384	BP	7.5	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0
132	384	BP	10	1	0	0	2	0	0	0	1	0	0	0	0	0	1	0	0	3	0	0
133	384	BP	20	1	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	1
134	384	BP	30	1	0	0	2	0	0	0	4	0	0	0	0	0	7	0	0	1	0	0
135	384	WP	0.5	3	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0
136	384	WP	2.0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
137	384	BP	0.5	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0
			Occurences		2	3	6	1	13	2	59	1	3	2	8	3	75	22	5	45	6	8
			Total Number		4	6	9	1	34	2	111	1	3	2	8	6	168	43	7	352	13	9
			Average Number		0.03	0.04	0.07	0.01	0.25	0.01	0.81	0.01	0.02	0.01	0.06	0.04	1.23	0.31	0.05	2.57	0.09	0.07
			Median Number		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
			Variance		0.06	0.13	0.11	0.01	1.16	0.01	1.64	0.01	0.02	0.01	0.06	0.13	3.28	0.79	0.08	35.32	0.23	0.08
			Variance/Mean		1.99	2.98	1.61	1.00	4.67	0.99	2.02	1.00	0.99	0.99	0.95	2.98	2.67	2.52	1.53	13.75	2.46	1.17

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PNF	PNS	PNERS	PNERP	PNERSP	PORBS	PORBS	POF	PPARAS	PPP	PPECG	PPM	PPA	PPCAS	PPHYJ	PPHYS	PPB
108	384	BP	2.0	1	1	0	0	0	0	0	0	0	0	2	1	0	3	0	0	0	7
109	384	BP	2.5	1	0	0	0	0	0	0	0	0	2	2	1	1	3	0	0	0	9
110	384	BP	3.0	1	1	0	0	0	0	0	0	0	0	6	1	5	0	0	0	0	1
111	384	MC	0.5	1	2	0	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0
112	384	MC	0.5	2	0	0	3	0	0	0	0	0	0	3	0	1	1	0	0	0	0
113	384	MC	0.5	3	0	0	0	0	0	0	0	0	0	4	2	1	0	0	0	0	3
114	384	MC	1.0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1
115	384	MC	1.5	1	4	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	2
116	384	MC	2.0	1	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0
117	384	MC	2.5	1	1	0	0	0	0	0	0	0	0	3	0	4	0	0	0	0	1
118	384	MC	3.0	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	2
119	384	MC	3.5	1	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
120	384	MC	5.0	1	5	0	0	0	0	0	0	0	0	2	0	3	1	0	0	0	0
121	384	MC	5.0	2	2	0	0	0	0	0	0	0	0	3	0	5	0	0	0	0	0
122	384	MC	7.5	1	1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	1	3
123	384	MC	10	1	4	0	0	0	0	0	0	0	0	5	1	0	0	0	1	0	0
124	384	MC	10	2	4	0	0	0	0	0	0	0	0	2	0	7	0	0	0	0	1
125	384	MC	10	3	1	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
126	384	MC	20	1	7	0	0	0	0	0	0	0	0	4	0	0	1	1	0	0	3
127	384	MC	30	1	3	0	0	0	0	0	0	1	0	7	1	0	0	0	0	0	1
128	384	OC	0.5	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
129	384	BP	3.5	1	0	0	0	0	0	0	0	0	0	6	0	0	2	0	0	0	17
130	384	BP	5.0	1	0	0	0	0	0	0	0	0	0	4	1	0	0	0	0	0	4
131	384	BP	7.5	1	0	0	0	0	0	0	0	0	0	3	0	1	1	0	0	0	5
132	384	BP	10	1	4	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	3
133	384	BP	20	1	1	0	0	0	0	0	0	0	0	5	0	2	0	0	0	0	5
134	384	BP	30	1	2	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	6
135	384	WP	0.5	3	3	0	0	0	0	0	0	0	0	6	0	1	1	0	0	0	4
136	384	WP	2.0	2	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0	1
137	384	BP	0.5	1	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	1
			Occurences		113	4	7	2	2	1	1	29	3	135	16	84	11	1	3	3	27
			Total Number		390	8	9	2	2	1	4	43	8	724	19	218	17	1	4	3	94
			Average Number		2.85	0.06	0.07	0.01	0.01	0.01	0.03	0.31	0.06	5.28	0.14	1.59	0.12	0.01	0.03	0.02	0.69
			Median Number		2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
			Variance		5.76	0.14	0.11	0.01	0.01	0.01	0.12	0.66	0.22	9.28	0.18	3.83	0.23	0.01	0.04	0.02	4.29
			Variance/Mean		2.02	2.46	1.61	0.99	0.99	1.00	4.00	2.10	3.72	1.76	1.29	2.41	1.83	1.00	1.48	0.99	6.25

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	PPODG	PPOLS	PPOLYSP	PPS	PPRIS	PPRIM	PPRIST	PSL	PSERS	PSPHS	PSPC	PSPIB	PSPIS	PSYLS	POP
108	384	BP	2.0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
109	384	BP	2.5	1	9	0	0	0	0	0	0	0	1	0	0	1	0	0	0
110	384	BP	3.0	1	2	0	0	0	0	0	0	0	3	0	0	3	0	0	0
111	384	MC	0.5	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
112	384	MC	0.5	2	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0
113	384	MC	0.5	3	4	0	0	0	1	0	0	0	4	0	0	1	0	0	0
114	384	MC	1.0	1	6	0	0	0	0	0	0	0	0	0	0	2	0	0	0
115	384	MC	1.5	1	3	0	0	0	0	0	0	0	3	0	0	2	0	0	0
116	384	MC	2.0	1	2	0	0	0	0	0	0	0	2	0	0	1	0	0	0
117	384	MC	2.5	1	2	0	0	0	0	0	0	0	2	0	0	1	0	0	0
118	384	MC	3.0	1	0	0	0	0	1	0	0	0	0	0	0	3	0	0	0
119	384	MC	3.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	384	MC	5.0	1	4	0	0	0	0	0	0	0	4	0	0	0	0	0	0
121	384	MC	5.0	2	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0
122	384	MC	7.5	1	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0
123	384	MC	10	1	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0
124	384	MC	10	2	0	0	0	0	0	0	0	0	9	0	0	2	0	0	0
125	384	MC	10	3	1	0	0	0	0	0	0	0	0	0	1	6	0	0	0
126	384	MC	20	1	1	0	0	0	1	0	0	0	0	0	0	8	0	0	0
127	384	MC	30	1	2	0	0	0	5	0	0	0	0	0	0	2	0	0	0
128	384	OC	0.5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
129	384	BP	3.5	1	7	0	0	0	0	0	0	0	0	0	0	6	0	0	0
130	384	BP	5.0	1	3	0	0	0	0	0	0	0	0	0	0	5	0	0	0
131	384	BP	7.5	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0
132	384	BP	10	1	4	0	0	0	0	0	0	0	26	0	0	9	0	0	0
133	384	BP	20	1	8	0	0	0	0	0	0	0	0	0	0	1	0	0	0
134	384	BP	30	1	5	0	0	0	1	0	0	0	0	0	0	7	0	0	0
135	384	WP	0.5	3	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
136	384	WP	2.0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
137	384	BP	0.5	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4
			Occurences		70	9	6	6	6	11	1	42	14	1	8	99	2	3	1
			Total Number		154	9	15	6	10	14	1	98	62	1	8	390	2	3	4
			Average Number		1.12	0.07	0.11	0.04	0.07	0.10	0.01	0.72	0.45	0.01	0.06	2.85	0.01	0.02	0.03
			Median Number		1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00
			Variance		3.08	0.06	0.38	0.04	0.22	0.15	0.01	1.88	5.91	0.01	0.06	9.37	0.01	0.02	0.12
			Variance/Mean		2.74	0.94	3.45	0.96	2.95	1.48	1.00	2.63	13.06	1.00	0.95	3.29	0.99	0.99	4.00

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	MAC	MCF	MCN	MCS	MHA	MKA	MKP	MLC	MMC	MMN	MMS	MMP	MMT	MME	MNM	MNC	MNG
108	384	BP	2.0	1	30	0	0	0	0	0	0	0	0	9	0	0	26	0	3	0	0
109	384	BP	2.5	1	53	0	0	0	0	0	0	0	0	11	7	0	30	3	11	0	0
110	384	BP	3.0	1	48	0	0	0	0	0	0	0	0	19	0	0	45	0	6	0	0
111	384	MC	0.5	1	20	0	0	0	0	0	0	0	0	3	0	0	123	0	6	0	0
112	384	MC	0.5	2	28	0	0	0	0	0	0	0	0	7	0	0	104	2	5	0	0
113	384	MC	0.5	3	41	0	0	1	0	0	0	0	0	17	1	0	81	0	37	0	0
114	384	MC	1.0	1	27	0	0	1	0	0	0	0	0	2	0	0	152	1	2	0	1
115	384	MC	1.5	1	51	0	0	0	0	0	0	0	0	4	0	0	124	0	2	0	0
116	384	MC	2.0	1	42	0	0	0	0	0	0	0	0	9	0	0	108	0	3	0	0
117	384	MC	2.5	1	34	0	0	1	0	0	0	0	0	12	1	0	91	2	10	0	0
118	384	MC	3.0	1	23	0	0	0	0	0	0	0	0	9	0	0	75	0	2	0	0
119	384	MC	3.5	1	23	0	0	0	0	0	0	0	0	6	2	0	71	2	3	0	0
120	384	MC	5.0	1	19	0	0	0	1	0	0	0	0	4	1	0	209	0	5	0	1
121	384	MC	5.0	2	37	0	0	1	0	0	0	0	0	8	0	0	228	0	2	0	0
122	384	MC	7.5	1	30	0	0	2	0	0	0	0	0	14	0	0	63	0	0	0	0
123	384	MC	10	1	27	0	0	0	0	0	0	0	0	27	0	0	145	0	0	0	0
124	384	MC	10	2	33	0	0	0	0	0	0	0	0	12	3	0	76	0	4	0	1
125	384	MC	10	3	23	0	0	0	0	1	0	1	0	10	4	0	104	0	5	0	1
126	384	MC	20	1	14	0	0	1	0	0	0	0	0	6	4	0	75	0	1	0	2
127	384	MC	30	1	16	0	0	0	0	0	0	0	0	16	4	0	117	0	0	0	0
128	384	OC	0.5	2	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0
129	384	BP	3.5	1	77	0	0	0	0	0	0	0	0	0	6	0	69	0	4	0	1
130	384	BP	5.0	1	60	0	0	0	0	0	0	0	0	7	2	0	93	0	2	0	0
131	384	BP	7.5	1	22	0	0	0	1	0	0	0	0	0	17	0	41	0	9	0	2
132	384	BP	10	1	81	0	0	0	0	0	0	0	0	3	14	0	35	1	5	0	3
133	384	BP	20	1	7	0	0	2	0	0	0	0	0	4	4	0	30	0	6	0	1
134	384	BP	30	1	29	0	0	0	1	0	0	0	0	4	8	0	103	0	0	0	0
135	384	WP	0.5	3	23	0	0	1	0	0	1	0	0	0	5	0	6	0	3	0	0
136	384	WP	2.0	2	2	0	0	1	0	0	0	0	0	2	0	0	1	0	9	0	1
137	384	BP	0.5	1	2	0	0	0	1	0	0	0	0	3	1	0	25	3	3	6	0
			Occurences		128	1	6	10	7	10	13	3	1	72	48	1	134	10	115	3	61
			Total Number		1703	1	8	12	7	18	14	3	1	336	140	1	8722	20	480	13	97
			Average Number		12.43	0.01	0.06	0.09	0.05	0.13	0.10	0.02	0.01	2.45	1.02	0.01	63.66	0.15	3.50	0.09	0.71
			Median Number		6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	59.00	0.00	3.00	0.00	0.00
			Variance		223.69	0.01	0.10	0.11	0.05	0.29	0.11	0.02	0.01	19.98	5.52	0.01	2089.49	0.32	16.94	0.53	0.94
			Variance/Mean		17.99	1.00	1.70	1.25	0.96	2.22	1.05	0.99	1.00	8.15	5.40	1.00	32.82	2.17	4.84	5.56	1.33

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	MOS	MPT	MPC	MPSJ	MPL	MTM	MTSP	MTEL	MTS	MTURS	MTT	CAMU	CAS	CES	CHEMS	CHC	CLS
108	384	BP	2.0	1	5	4	0	5	0	9	0	0	0	0	0	0	1	0	0	0	0
109	384	BP	2.5	1	9	13	0	8	0	11	0	0	0	0	0	0	4	0	0	0	0
110	384	BP	3.0	1	15	30	0	15	7	14	0	10	0	0	0	1	0	0	0	0	0
111	384	MC	0.5	1	4	4	0	1	1	13	0	0	0	0	0	0	0	0	0	0	0
112	384	MC	0.5	2	8	9	0	5	0	11	0	0	0	0	0	0	0	0	0	0	0
113	384	MC	0.5	3	8	8	0	9	4	21	0	0	1	0	0	0	0	0	0	0	0
114	384	MC	1.0	1	8	4	0	4	1	8	0	0	0	0	0	0	1	0	0	0	0
115	384	MC	1.5	1	7	16	0	4	6	17	0	0	0	0	0	0	5	0	0	0	0
116	384	MC	2.0	1	6	3	0	6	0	8	0	0	0	0	0	0	1	0	0	0	0
117	384	MC	2.5	1	2	11	0	1	0	12	0	0	0	0	0	1	0	0	0	0	0
118	384	MC	3.0	1	8	4	0	2	0	5	0	0	1	0	0	0	0	0	0	0	0
119	384	MC	3.5	1	9	15	0	1	1	12	0	0	1	0	0	0	0	0	0	0	0
120	384	MC	5.0	1	3	8	0	4	8	16	0	0	0	0	0	0	0	0	0	0	0
121	384	MC	5.0	2	10	19	0	1	1	20	0	0	0	0	0	0	0	0	0	0	0
122	384	MC	7.5	1	23	16	0	1	4	21	0	0	0	0	0	0	1	0	0	0	0
123	384	MC	10	1	10	29	0	1	1	27	0	0	0	0	0	0	0	0	0	0	0
124	384	MC	10	2	4	11	0	0	3	4	0	0	0	0	0	0	0	0	0	0	0
125	384	MC	10	3	6	10	0	1	2	16	0	0	0	0	0	0	2	0	0	0	1
126	384	MC	20	1	5	7	0	2	8	10	0	0	0	0	0	0	0	0	0	0	0
127	384	MC	30	1	11	29	0	6	6	21	0	0	0	0	0	0	0	0	0	0	0
128	384	OC	0.5	2	0	4	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
129	384	BP	3.5	1	1	13	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0
130	384	BP	5.0	1	4	16	0	7	3	0	1	0	0	0	0	0	0	0	0	0	0
131	384	BP	7.5	1	6	6	0	9	5	0	0	0	0	0	0	0	0	0	0	0	0
132	384	BP	10	1	4	13	0	7	2	0	0	0	0	0	0	0	0	0	0	0	0
133	384	BP	20	1	6	6	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0
134	384	BP	30	1	0	17	0	4	3	8	0	0	0	0	0	0	1	0	0	0	0
135	384	WP	0.5	3	5	6	0	9	1	1	0	0	0	0	0	0	0	0	0	0	0
136	384	WP	2.0	2	1	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0
137	384	BP	0.5	1	5	4	0	0	0	1	0	0	0	0	3	1	0	0	0	0	0
			Occurences		96	130	3	55	37	89	5	1	19	8	2	4	9	1	1	1	2
			Total Number		367	876	3	181	99	449	10	10	26	13	6	4	17	1	1	1	2
			Average Number		2.68	6.44	0.02	1.32	0.72	3.28	0.07	0.07	0.19	0.09	0.04	0.03	0.12	0.01	0.01	0.01	0.01
			Median Number		2.00	5.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Variance		11.35	28.62	0.02	8.29	2.91	28.00	0.20	0.73	0.26	0.17	0.13	0.03	0.36	0.01	0.01	0.01	0.01
			Variance/Mean		4.24	4.44	0.99	6.28	4.02	8.54	2.75	10.00	1.36	1.84	2.98	0.98	2.90	1.00	1.00	1.00	0.99

Appendix XIVb. Benthic Infauna - Raw Data - Sooke Basin Creosote Evaluation Study.

Case	Date	Site	Distance (m)	Repl.	CPAGS	CPSC	CPS	EAU	EOPH	MCOL	MNEM	MFORM	Abundance	Diversity
108	384	BP	2.0	1	0	0	0	7	0	0	0	0	118	20
109	384	BP	2.5	1	0	0	0	2	0	0	0	0	200	24
110	384	BP	3.0	1	0	0	0	20	0	0	0	0	263	24
111	384	MC	0.5	1	0	0	0	6	0	1	0	0	194	18
112	384	MC	0.5	2	0	0	0	14	0	0	0	0	211	21
113	384	MC	0.5	3	0	0	0	47	0	0	0	0	306	26
114	384	MC	1.0	1	0	0	0	12	0	0	0	0	243	24
115	384	MC	1.5	1	0	0	0	31	0	0	0	0	297	22
116	384	MC	2.0	1	0	0	1	28	0	0	2	0	235	22
117	384	MC	2.5	1	0	0	0	19	0	0	0	0	215	22
118	384	MC	3.0	1	0	0	0	22	0	0	0	0	166	21
119	384	MC	3.5	1	0	0	0	7	0	0	0	0	167	20
120	384	MC	5.0	1	0	0	0	85	0	0	1	0	390	23
121	384	MC	5.0	2	0	0	0	74	0	0	0	0	434	18
122	384	MC	7.5	1	0	0	0	39	0	0	0	0	237	21
123	384	MC	10	1	0	0	0	37	0	0	0	0	344	19
124	384	MC	10	2	0	0	0	68	0	0	0	0	254	23
125	384	MC	10	3	0	0	0	33	0	0	0	0	239	25
126	384	MC	20	1	0	0	0	27	0	0	0	0	196	26
127	384	MC	30	1	0	0	0	19	0	0	0	0	302	23
128	384	OC	0.5	2	0	0	0	0	0	0	0	0	15	8
129	384	BP	3.5	1	0	0	0	20	0	0	2	0	240	20
130	384	BP	5.0	1	0	0	0	29	0	0	0	0	253	21
131	384	BP	7.5	1	0	0	0	19	0	0	0	0	161	22
132	384	BP	10	1	0	0	0	43	0	0	0	0	268	25
133	384	BP	20	1	0	0	0	19	0	0	0	0	121	22
134	384	BP	30	1	0	0	0	25	0	0	1	0	245	22
135	384	WP	0.5	3	1	0	0	21	0	0	0	0	106	23
136	384	WP	2.0	2	0	0	0	11	0	0	0	0	44	16
137	384	BP	0.5	1	0	0	0	5	0	0	1	4	90	24
			Occurences		4	2	12	68	65	1	37	2	137	137
			Total Number		4	2	14	1641	1121	1	52	8	20239	2402
			Average Number		0.03	0.01	0.10	11.98	8.18	0.01	0.38	0.06	15	6
			Median Number		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	434	27
			Variance		0.03	0.01	0.12	338.39	153.47	0.01	0.52	0.23	147.7	17.5328467
			Variance/Mean		0.98	0.99	1.19	28.25	18.76	1.00	1.36	3.97	135	17