MANAGEMENT OF WOOD WASTE UNDER DREDGED MATERIAL MANAGEMENT PROGRAMS (DMMP) AND THE SEDIMENT MANAGEMENT STANDARDS (SMS) CLEANUP PROGRAM

DMMP CLARIFICATION PAPER
SMS TECHNICAL INFORMATION MEMORANDUM

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INTRODUCTION

Wood waste is commonly encountered in the aquatic environment of the Pacific Northwest, due to the prevalence of lumber, pulp, and paper industries. Log rafting, bark stripping, and other wood processing activities often result in wood waste entering the aquatic environment. In some cases, wood waste has been used as fill along shorelines or otherwise deposited into intertidal and subtidal areas. The phrase "wood waste", as used in this paper, may include any natural or processed material of woody origin, ranging from large logs, branches, and pieces of bark lying on top of sediments, to thick deposits of sawdust, wood chips, or similar materials, to highly decomposed fibrous materials thoroughly mixed with sediments. In some cases, wood waste is the only issue. In other locations, wood waste may be mixed with petroleum, wood preservatives, or other contaminants.

Wood waste has been increasingly encountered by the agencies responsible for sediment management activities, including dredged material disposal, aquatic lands lease management, and sediment site cleanup. Questions have arisen regarding the potential adverse effects of wood waste, the agencies' regulatory authority to address wood waste, and the approach that will be taken to manage wood waste. This memorandum provides background information on these topics and clarifies the approach taken by the agencies toward regulation of wood waste in the aquatic environment.

PROBLEM STATEMENT

Wood waste can have a variety of physical and chemical adverse impacts on aquatic life, depending on its form. Wood waste, like any organic waste, creates a biological oxygen demand in sediments as it decomposes, and excessive amounts can reduce or eliminate the aerobic zone (Pease, 1974; Schaumberg 1973). A lack of oxygen in sediments limits the survival of benthic organisms, and can produce a shift in the benthic community toward species tolerant of organic enrichment (Schuytema and Shankland, 1976). In addition, compounds such as sulfides, ammonia, and methane can build up in anaerobic sediments due to natural biological processes to levels that are toxic to many benthic organisms

(Hansen et al., 1971; Conlan and Ellis, 1979; Freese and O'Clair, 1987). Some compounds, such as sulfides, form primarily in marine waters, while others, such as methane, are more likely to be present in freshwater systems (Mitsch and Gosselink, 1993; Libes, 1992).

Wood waste leaches and/or degrades into some compounds that can be toxic to aquatic life, such as phenols and methylated phenols, benzoic acid and benzyl alcohol, terpenes, and tropolones (Buchanan et al., 1976; Peters et al., 1976; Pease, 1974; Lewin and Goldstein, 1991; Benedict, 1971; Schermer and Phipps, 1976; WDF, 1960). Several of these compounds have SMS criteria due to documented adverse effects on aquatic life in Puget Sound; others have been determined through laboratory studies to be toxic to salmon and other fish. Different types of wood and bark leach different chemicals and show varying degrees of toxicity in laboratory bioassays (Graham and Schaumberg, 1969; Schaumberg, 1973; Schuytema and Shankland, 1976; Kai, 1991; Laks, 1991). Certain of these compounds (e.g., terpenes and tropolenes) are much more bioavailable in freshwater than in marine waters (Pease, 1974).

Finally, large masses of wood waste may provide an inappropropriate physical substrate for benthic colonization, spawning, and other habitat needs, and may smother aquatic plants and benthic organisms (Harris et al., 1985; Chang and Levings, 1976; Schultz and Berg, 1976; Conlan and Ellis, 1979; Jackson, 1986; Servizi et al., 1971; O'Clair and Freese, 1988). Large accumulations of wood waste are slow to degrade and may persist in the aquatic environment for decades (Ellis, 1970; Conlan, 1977; Schultz and Berg, 1976; Harmon et al., 1986). Additional information on the impacts of wood waste can be found in recent literature reviews prepared by TetraTech (1996), Floyd & Snider and Pentec (1997), and Pentec (1997).

For all of these reasons, wood waste is considered a deleterious substance that may have adverse effects on aquatic life. However, there are occasions when lesser amounts of uncontaminated large woody debris can provide habitat benefits (Schaumberg, 1973; Pease, 1974; Pentec, 1994). The severity of wood waste effects in sediments depends directly on its physical form, its degree of incorporation into sediments, the amount of wood waste present, the amount of flushing in the area, the habitat (freshwater or marine), and the type of wood from which the waste was derived. Therefore, the adverse impacts of wood waste are largely site-specific, and may vary considerably even within a small area. This has led to considerable discussion of the best approach to regulating wood waste in the aquatic environment.

REGULATORY AUTHORITIES

Authorities for Addressing Wood Waste under the Dredged Material Management Programs.

Dredging and disposal authorities do not specifically address woodwaste, but specify regulation of dredged and fill material in "waters of the United States". The Clean Water

Act prohibits the discharge of dredged or fill material except in compliance with section 404. Section 404 sets up a procedure for issuing permits specifying discharge sites and discharge conditions ... The permitting authority (either the Corps of Engineers or an approved State program) approves discharges at particular sites through application of the section 404(b)(1) Guidelines, which are the substantive criteria for dredged and fill material discharges under the Clean Water Act. The guidelines at 40 CFR 230.10(c) state in part that "...no discharge of dredged or fill shall be permitted which will cause or contribute to significant degradation of the waters of the U.S. Findings of significant degradation related to the proposed discharge shall be based upon appropriate factual determinations, evaluations and tests ...". Wood waste is often associated with dredged material and has been used as fill for projects in this region.

Congress granted to the states the responsibility for certifying under Section 401 of the CWA that a proposed discharge will comply with all applicable provisions of State and Federal water quality laws. Ecology and EPA Region 10 have interpreted these laws to include sediment quality as an aspect of water quality. This certification is required from any applicant for a Federal permit (or Federal project) to conduct any activity which may result in any discharge into State waters. Compliance with Section 401 also ensures that any such discharges will comply with the applicable provisions of Sections 301, 302, 303, 306, and 307 of the CWA. In particular, Section 303 allows states to establish water quality standards and provides that discharges meet these standards.

Ecology also establishes guidelines for State and local administration of the Washington Shoreline Management Act (SMA), which provides guidance on regulating woodwaste (RCW 90.58) . Ecology ensures that permits issued by local governments are consistent with the intent of the act.

Authorities for Addressing Wood Waste under SMS

The Sediment Management Standards derive their authority from both the State Water Pollution Control Act (Chapter 90.48 RCW) and the Model Toxics Control Act (Chapter 70.105D RCW). Chapter 90.48 provides authority for the department to promulgate regulations that set standards to protect the waters of the state, and regulate discharges of polluting substances. Pollution is defined in RCW 90.48.020 as any "contamination ... or discharge of any liquid, ... solid, ... or other substance into any waters of the state as will or is likely to ... render such waters harmful, detrimental or injurious to the public health ... fish, or other aquatic life." The Model Toxics Control Act provides authority for the department to set cleanup standards and require cleanup of hazardous substances on land and in water. Hazardous substances are defined in RCW 70.105D.020(7)(e) to include " Any substance ... including solid waste decomposition products, determined by the director by rule to present a threat to human health or the environment".

The Sediment Management Standards provide authority in WAC 173-204-520(5) to require cleanup of "other deleterious substances" on a case-by-case basis. This section states that the cleanup level for such substances shall be "at or below levels which cause

minor adverse effects in marine biological resources, or which correspond to a significant health risk to humans, as determined by the department." The term "other toxic, radioactive, biological, or deleterious substances" is defined in WAC 173-204-200(17), and specifically includes organic debris within the definition. This definition by rule of organic debris as a deleterious substance meets the Model Toxics Control Act requirement cited above.

PROPOSED ACTIONS

The following sections describe proposed actions to address wood waste under the DMMP and the SMS cleanup program.

Dredged Material Management Program

Collection of sediments in the field should include a visual assessment of wood debris[1] fractions (logs, branches, bark, saw dust, silt-clay sized wood fragments in the sample). This analysis typically would not include the larger woody debris, such as logs, or branches that can be selectively removed during dredging as part of debris removal by the dredging contractor. The PSDDA program requires debris removal prior to disposal, and does not allow disposal of debris greater than 24" X 24" at the open-water disposal sites. Sediments with larger pieces of woody debris may require debris removal by passing the dredged material through a 24" X 24" steel screen. Anything passing through a 24" X 24" screen must be considered as part of the sample/wood debris volume estimation exercise, which could include bark, or smaller pieces of woody residue grading from gravel sized to silt and clay sized particles. This fraction of the sample should be objectively analyzed in the laboratory to quantify the wood fraction as described below.

Wood debris can be quantified in the laboratory on either a volume or a weight-specific basis. While quantifying wood debris in sediments on a volumetric basis may be more ecologically meaningful, it is much more difficult and less accurate than quantifying it on a weight specific basis. Therefore, dredged material assessment of wood debris will be accomplished on a dry weight-specific basis, then converted to a volumetric basis by multiplying the weight-based number by two[2] (example: 25% by weight @50% by

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[1] Debris is currently defined by the PSDDA agencies as (Phase II MPR, pages 6-3 and 6-6):

> "... material that could cause interference with **particular uses**. Floatable debris comprises material, such as logs, that could cause navigation hazards or solids, such as plastic or wood chunks, that could foul beaches. Non-floatable debris comprises material that could reasonably be expected to cause conflicts with bottom net or trawl fishing. Because functional definitions of debris are used, dredged material, if consolidated into large chunks, could itself be considered debris if, for example, it could snag nets and thus interfere with fishing activities."

The current policy as specified in the PSDDA Management Plan Report (Phase II) requires selective removal of debris from dredged material suitable for unconfined open-water disposal.

[2] Observed ratio from Port of Everett/South Terminal Dredging Project reported in Floyd & Snider and Pentec (1997).

volume). Ecology in the past has regulated dredged material with wood debris volumes greater than 50% by weight under Section 401 (water quality certification) as generally being unsuitable for unconfined open-water disposal. The proposed guidance stipulates that dredged material containing significant amounts of woody material/debris will now be tested to quantify the organic fraction[3]. Dredged material containing an organic fraction greater than 25% dry weight will be required to undergo biological testing to assess the suitability of the material for unconfined open-water disposal. Likewise, dredged material containing an organic fraction less than 25% dry weight will be considered suitable for unconfined open-water disposal without further testing unless one or more chemicals of concern exceed chemical screening levels.

When samples with significant quantities of wood debris are subjected to biological testing some toxicity associated with ammonia, sulfides, and methane generated from natural biological processes in the sediments may occur. In these cases, applicants may wish to consider monitoring interstitial ammonia levels before initiating bioassays to ensure that total ammonia levels are equal to or less than 20 mg/l. If ammonia levels exceed 20 mg/l, the EPA/ACOE protocol for reducing ammonia levels may be followed before initiating bioassays (EPA/COE, 1993).

Sediment grainsize is an important consideration when selecting the species to be used in the amphipod test and choosing appropriate reference sediments. Therefore, in addition to conventional grainsize analysis, applicants should analyze the residue left from the modified Total Volatile Solids analysis for grain size. The organic-free particle size distribution should be used in conjunction with the conventional particle size distribution in selecting the appropriate amphipod species and reference sediment.

SMS Cleanup Program

Because of its potential to cause adverse impacts to aquatic life, Ecology will require wood waste cleanup at sites when it is demonstrated to be harmful. However, because the toxicity of wood waste varies considerably depending on the factors described above, Ecology is not proposing to develop a specific chemical criterion (such as a TOC level) above which cleanup would be required.

Instead, like any other contaminant for which chemical criteria are not available, sediments contaminated with wood waste and the chemical byproducts of the breakdown of wood waste will be assessed through the biological testing procedures listed in SMS (bioassays and/or benthic studies) as described in the PSEP protocols. Results of the biological tests will be compared to biological SQS and CSL levels currently established in the SMS rule. Because a portion of the *in situ* toxicity of wood waste is associated with the production

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[3] One method recently applied to a dredging project involved a weight based method: quantification by modified Total Volatile Solids (TVS) analysis (ASTM D-2974C) protocol, where the sample size was increased to 100-300 grams of sample. Other methods may be proposed by the applicant in lieu of this approach, but must be approved by the agencies with jurisdiction over dredging and disposal.

of ammonia and sulfides in sediments, for the purpose of assessing sediment compliance with the biological SQS and CSL, modifications to the PSEP protocols should *not* be made that would reduce the toxicity of these chemicals to bioassay species (e.g., purging or flow-through testing). However, modified bioassay tests may be proposed under the alternative technologies rule to evaluate the contribution to toxicity from conventional pollutants vs. toxic/persistant chemicals, since these classes of chemicals may require different technologies to effectively remediate.

During several recent site investigations, Ecology has found that sediment vertical profile imaging (SVPI), or other similar technology, may be useful as a screening tool to help focus the selection of areas for bioassay testing. Because the adverse impacts of wood waste are typically associated with anaerobic sediments, mapping of the thickness of the aerobic zone, production of methane, and presence or absence of benthic organisms through SVPI can be helpful in cost-effectively screening areas that are unimpacted (similar to reference) and areas that are clearly heavily impacted by wood waste and/or other organic contamination. Alternatively, areas likely to be impacted may be screened through analysis of conventional parameters, such as TOC, and comparison of these levels to reference areas. Biological testing can then be focused on those areas with intermediate levels of impact to identify the SQS/CSL boundaries. These or other screening processes may be proposed under the alternative technologies rule during a site investigation to reduce the costs of bioassay testing.

At some sites, wood wastes may be present in sufficient quantities that they may be classified as solid wastes rather than sediments. In accordance with solid waste regulations, Ecology may require in such a case that the deposits of wood waste (or any other solid waste materials encountered) be removed from the aquatic environment and disposed of in a permitted solid waste facility, even when toxicity to aquatic life is low. Various screening methods can be used to map areas with heavy deposits of wood waste, including visual inspection of van Veen or core samples, diver- or remotely-operated video transects, side-scan sonar surveys, SVPI, and/or analysis of organic residue by weight, as described for the dredging program.

Although several commenters requested clarification on the relationship between the solid waste and sediment cleanup program, it is not possible to provide additional specificity at this time, since solid waste rules and policies regarding wood wastes are evolving. Please see the responsiveness summary for additional information.

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