REMEDIAL STRATEGIES
FOR THE
WOOD PRESERVING INDUSTRY

PRESENTED AT

CANADIAN WOOD PRESERVING ASSOCIATION

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1.0 INTRODUCTION

Throughout history wood has been an important source of commerce and utilized heavily in the construction industry. However, the use of wood is limited by its susceptibility to breakdown by the insects, fungi, and other microorganisms. When moisture and air are present, most wood will decay rapidly, and even those with natural durability will eventually be degraded. Treatment with preservatives can extend the useful life and expand the utility of wood.

The American Wood Preserver's Association (AWPA) indicated that there are approximately 600 companies engaged in wood preserving in the United States and Canada. Most of the wood preserving facilities are producing a variety of the treated wood products and therefore engaged in several wood preserving processes.

The major wood preservatives used for treatment of wood are pentachlorophenol (PCP), creosote, and inorganic arsenic salts. The inorganic arsenical salts including copper chromium arsenic (CCA), and ammonia copper arsenic (ACA). PCP is mainly used for treating utility poles, posts and some lumber; creosote is mainly used in treating railroad ties, utility poles, and pilings, and the inorganic salts (ACA, CCA) are used mainly for construction lumber, plywood and poles. The choice of preservative is dependent upon the ultimate use of the wood.

Creosote is a blend of several fractions produced during the distillation of coal tar. Lorena and Gjovic (1971) showed that phenanthrene is the major component of creosote oil (21 percent), with fluorene, fluoranthene, pyrene, and acenaphthene the other major constituents (37 percent). The composition of creosote is presented in Table 1-1. Pentachlorophenol (PCP) has been used with a variety of carrying solvents. PCP has been successfully dissolved in oil, mineral spirits, and water. A typical application has approximately 5 percent PCP in water, oil, or mineral spirits. Technical grade PCP is composed of numerous phenolic and chlorophenolic compounds, which are listed in Table 1-2, the major component being pentachlorophenol (88 percent).

The composition of ACA, CCA, and FCAP are presented in Table 1-3.

Any environmental impact at wood treating plant sites is a direct result of operational practices currently being used or previously used at the site. Many of the environmental problems which normally are present at wood treating sites could have been avoided if proper operational and housekeeping practices had been instituted.

The guidelines developed by Wood Preservation Industry and Technical Steering Committee in conjunction with Environmental Canada, titled "Technical Recommendations for the Design and Operation of Wood Preservation Facilities," provides the necessary procedures to prevent the creation of environmental problems.

This paper intends to deal with what are the potential environmental issues associated with wood treating operations and presents two case studies on how to deal with these issues.

TABLE 1-1

COMPOSITION OF CREOSOTE (Wt. Percent)

Component	Lorenz and Gjovik, 1972
Naphthalene	3.0
2-Methylnaphthalene	1.2
1-Methylnaphthalene	0.9
Biphenyl	0.8
Acenaphthene	9.0
Dimethylnapthalenes	2.0
Dibenzofuron	5.0
Carbazole	2.0
Fluorene	10.0
Methylfluorenes	3.0
Phenanthrene	21.0
Anthracene	2.0
9,10-Dihydroanthracene	-
Methylphenanthrenes	3.0
Methylanthracenes	4.0
Fluoranthene	10.0
Pyrene	8.5
Benzofluornes	2.0
Chrysene	3.0
Benz(a)anthracene	-
Benz(j)fluoranthene	-
Benz(k)fluoranthene	-
Benz(a)pyrene	-
Benz(e)pyrene	-
Perylene	-
Benzo(b)chrysene	-

TABLE 1-2

COMPOSITION OF TECHNICAL PENTACHLOROPHENOL

Substance	% Composition
Pentachlorophenol	88
Impurities:	
Tetrachlorophenol	6
Trichlorophenol	0.1
2,4-dichlorophenol	1
2,6-dichlorophenol	1
Cl_8POP	3
2,3,7,8 TCDD	-*
PCDD	1 ppm
HCDD	4 ppm
HpCDD	100 ppm
OCDD	1000 ppm
Dibenzofurans	100 ppm
HCB	200 ppm

Source: "Commentary to EPA (11/2/79) concerning the Comparative Risk Assessment of Dowicide EC-7 and Pentachlorophenol DP-2 Antimicrobial."

*Present production of PCP contains trace (part per trillion) or no quantities of 2, 3, 7, 8 TCDD.

TABLE 1-3

CHEMICAL COMPOSITION OF FCAP, ACA AND CCA

Chemical	Composition in Percent				
	FCAP	ACA	CCA		
			A	B	C
CrO3	37		65.5	35.3	47.5
CuO		49.8	18.1	19.6	18.5
As205	25	50.2	16.4	45.1	34.0
F	22				
Dinitrophenol	16				

Source: U.S. Department of Agriculture, 1980.

2.0 POTENTIAL PROBLEM AREAS

Environmental issues generally encountered that are a result of past operating practices at wood treating plants are site soil, site groundwaters, and surface waters and sediments that contain "chemicals of interest." The additional potential waste streams that need to be addressed during site restoration as a result of ongoing operations are process wastewater, and process sludges. At both operating and closed wood treating sites, it is necessary to identify all known existing and potential sources of contamination, prior to selecting a site restoration program.

Potential soil and groundwater contamination sources are drip track areas, treating cylinder or tank areas, bulk chemical storage areas, transmission lines and pumps, treated wood storage areas, and sludge and process water disposal areas. Many of these source areas have been eliminated under present operating schemes, but the chemicals already introduced to the environment remain as a source of contamination.

Potential sources of contamination for surface water and sediments are contaminated groundwater, water that is introduced to contaminated soil or pavement prior to entering a surface water body, and discharge of process wastewater.

When developing a site restoration program, it is important to identify all potential source areas prior to selecting a remedial alternative.

3.0 POTENTIAL REMEDIAL ALTERNATIVES

Potential remedial alternatives can be separated into two categories: those appropriate for treating a contaminated solid media (soils and sludges), and those for treating a liquid media (groundwater, surface water and process water).

Some but not all of the contaminated liquids and solids can be treated either in situ or removed for treatment.

Some of the potential remedial technologies generally considered as part of the selection process for the most appropriate treatment system for the remediation of a contaminated waste stream at a wood treating site are:

Solid Media Removal Alternatives

- Excavation.
- Passive Removal of Oil/Sludges.
- Removal of Structure with Underlying Soil Contamination.

Soil Media Treatment Alternatives

- Composting
- Engineered BioDegradation System (EBDS^{SM}).
- Chemical Fixation/Solidification.
- Soil Washing/Flushing.
- In Situ Bioremediation.
- Incineration/Thermal Desorption

Soil Media Disposition Alternatives

- Soil Cover/Capping.
- On-Site Landfill.
- Off-Site Landfill.
- Sludge Reuse.

Groundwater Removal Alternatives

- Pumping wells.
- Collection trenches.
- Passive collection.

Liquid Media Treatment Alternatives

- Suspended Growth Biological Treatment.
- Fixed Film Biological Treatment.
- Air/Stream Stripping.
- UV/Chemical Oxidation.
- Fluidized Bed (BioFar^{SM}).
- Ion Exchange.
- Precipitation/Evaporation.
- BioFiltration.
- Reverse Osmosis.
- Solvent Extraction.

Liquid Media Disposition Alternatives

- POTW.
- NPDES.
- Industrial Wastewater Treatment.

For the decomposition of chemicals related to wood treating in wastewaters, suspended growth biological treatment systems are well established technologies and have been used for many years. Development of different biological treatment systems for the restoration of contaminated soils associated with creosote and PCP sites is comparatively a rather new approach. These systems refer to different unit processes which employ naturally adapted microorganisms to achieve desired reductions in soil contaminants. Such unit processes or combination of unit processes can be used to treat both liquid waste and solid waste, and can apply to treatment of excavated soils or groundwater/soil treated in place. Successful application of treatment processes depends largely on the know-how and experience applied during the design, construction, and operation of the site-specific treatment process. The specific unit process selected for biological treatment of a particular site is determined by its technical feasibility and economic viability. Success in the biological treatment of contaminated waste streams could be rewarding as the costs associated with these treatment alternatives are orders of magnitude lower when compared to the cost of incineration or an activated carbon adsorption unit.

A systematic approach consisting of the following steps results in the most economically efficient selection of a remedial alternative for bringing the site to an environmentally acceptable condition:

- site characterization;
- risk assessment;
- select the most appropriate remedial alternative; and
- implement remedial actions, if required.

For a particular site, "no action" could be an acceptable alternative provided that the decision-making risk assessment steps indicate that the levels of site-specific chemicals-of-interest in the waste stream are at or below acceptable risk limits. At the same time, a site requiring remedial action will also have to go through decision-making steps to determine the most cost-effective remedial alternative for the restoration of the site. Proper understanding of the different available remedial processes are, therefore, important in the selection of the appropriate treatment alternative. Technically feasible and cost-effective alternatives selected will vary from site-to-site.

4.0 SELECTION OF REMEDIAL STRATEGY

After a list of potential remedial strategies has been developed, a more detailed evaluation must be performed for those alternatives identified during the initial screening. The initial screening identified remedial alternatives which can effectively mitigate the waste constituents of concern at the site under investigation. Guidelines have been published by the United States Environmental Protection Agency for conducting remedial investigation and feasibility studies at sites contaminated with wood treating preservatives. (See references.) The following criteria are used to perform the detailed evaluation of potential remedial strategies:

- protection of the public health and environment,
- political constraints,
- social constraints,
- technical constraints, and
- economical constraints.

Remedial strategies that are identified in the initial screening need to be evaluated in more detail to determine if they satisfy any site-specific constraints.

Site-Specific Constraints

Technical
- Soil Type
- Waste Type
- Cleanup Goals
- Allowable Schedule for Completion

Nontechnical
- Present and Future Land Use
- Adjacent Land Use
- Public Pressure
- Regulatory Difficulties
- Client Needs
- Aesthetic Concerns
- Schedule for Implementation

The first criteria is to ensure that any remedial strategy would satisfactorily protect the public health and the environment. This is accomplished by performing a risk analysis and establishing cleanup criteria using a risk basis.

Strategies that meet the criteria established for protecting the public health and environment may be politically and socially unacceptable. In some instances the regulations, as they are written, provide the regulatory agencies with flexibility in establishing remedial goals. This can be either beneficial or detrimental depending on the direction and attitude of the regulatory agency involved.

Pressure from special interest groups or local residents can also influence the selection of the final remedial strategy. Public opinion and lobbying efforts from special interest groups have at times been successful in altering what otherwise would have been an appropriate remedial strategy. The selected remedial strategy in many instances must be aesthically appealing and also be compatible with future land use requirements.

If a remedial strategy satisfies all of these criteria, it can then be evaluated in detail for technical and economical suitability. The technical evaluation ensures that the remedial strategy is capable of restoring the affected media to levels of constituents of interest that meet the cleanup criteria previously established. The economical evaluation merely compares the costs of implementing each of the remedial strategies under consideration. Site-specific facility needs or constraints must also be considered when performing the economic evaluation. Using all of the information developed in the procedures mentioned above, a remedial strategy is selected.

5.0 SELECTED CASE STUDIES

Two case studies will be presented, one examines the benefits to a proactive approach to environmental issues and the other examines the resistant approach. There are certain situations where resistance may prove to be the proper alternative, however, this approach is not always the correct one. The two case studies to be presented are situations in which creosote, pentachlorophenol, and copper, chromium and arsenic were used as wood preservatives at the sites.

The first case study examines the proactive approach which has several benefits, those being that the regulatory agencies are less demanding and more flexible with companies that cooperate, and by taking the lead in environmental issues the plant can more or less control the project and set the schedule. The advantages and disadvantages of cooperating are presented below.

Cooperative Party

Advantages
- Reasonable Schedule Less Demands
- Better Control of Project
- Cost Benefit
- Improved Public Image

Disadvantages
- Assume Responsibility
- Changes in Future Regulation

Controlling the project and setting the schedule has allowed for less disruptance of normal business, better control over spending (both total cost and schedule of payments), has required less time from plant personnel, and has reduced consulting and legal fees. Consulting and legal fees were reduced by eliminating or reducing the need for hearings and responding to agency comments or requests.

Additional activities that provided long-term cost savings and improved relationships with the regulatory community were good housekeeping that improved the company image with the regulatory community and made for a better working relationship, implementation of design and operational changes that reduced or eliminated the possibility of a discharge to the environment as a result of plant operations. (Such as following the "Technical Recommendations for the Design and Operation of Wood Preservation Facilities," prepared for The Wood Preservation Industry Technical Steering Committee and Environment Canada), and implementing interim remedial actions without entering into a consent or administrative order with the regulatory agency. This overall strategy has allowed the company to address its environmental legacies and environmental issues resulting from current operations and still remain financially solvent.

The second case study examines a company that chose to disagree with policies or comments that the regulatory agencies provided. The advantages and disadvantages of resistance are presented below.

Resistant Party

Advantages
- Don't Assume Responsibility
- Better Regulatory Direction
- Potential Cost Sharing

Disadvantages
- Lose Control of Schedule and Scope
- Public Opposition
- More Costly

Such action at times may be prudent but carries with it a risk. The risks involved are many and can only be evaluated on a case-by-case basis. This strategy generally only applies to legacy problems and can be used in limited situations that involve ongoing operations. Disputing the responsibility for an environmental legacy problem with the regulatory agency leads to either a hearing before the environmental hearing board or before the courts.

The risks associated with litigation are:

- the regulatory agency can contract to have the work performed and sue to recapture costs plus damages;
- after litigation, a PRP-led project generally has an expanded scope of work;
- more stringent guidelines; and
- a tighter schedule.

This all leads to a more costly remedial solution.

REFERENCES

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