

CREOSOTE COUNCIL II

RESPONSE TO NCAMP CREOSOTE PETITION

ATTACHMENT 3

May 31, 2002

ENVIRONMENTAL ISSUES
RELATED TO THE USE OF
CREOSOTE WOOD PRESERVATIVE

by

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ENVIRONMENTAL ISSUES RELATED TO THE USE OF CREOSOTE

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I. INTRODUCTION

Creosote has been used to preserve wood for approximately 100 years. Its efficacy in providing a durable, long-lived, product for use in extreme environments is well demonstrated by the ties that support the U.S. railway system. Over this time, real and potential environmental impacts have been studied extensively. The industrial application of creosote preservative to wood products is now governed by a system of Federal and state regulations. The Environmental Protection Agency (USEPA) has licensed creosote as a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

On February 26, 2002 the environmental group Beyond Pesticides/National Coalition Against the Use of Pesticides (NCAMP) filed a petition (the Petition) with the USEPA asking for the suspension and cancellation of the registration of creosote under FIFRA. This paper will address the various environmental issues that were cited in the petition.

Scientific studies and other data will be used to demonstrate that the continued use of creosote as a wood preservative is consistent with protecting our environment and conserving our resources. Creosote wood preserving plants operating in accordance with current environmental standards and regulations have minimal environmental impacts. Creosote preserved wood products, such as railway ties and utility poles, are appropriate and environmentally protective when in their intended uses.

II. PAST PRACTICES

Many of the arguments against the continued use of creosote made in the Petition relate to environmental problems caused by the past use and disposal of creosote. However, the Petition ignores the fact that current safeguards, processes and technologies in use at wood preserving facilities minimize potential impact to the environment; past practices are simply not reflective of current operations using creosote.

The Petition cites contamination at several U.S. locations and one in Canada. It is critical to understand that these impacts resulted from practices that are not now occurring. Most contamination at wood preserving facilities occurred many years ago prior to implementation of the environmental practices used under current state and federal environmental regulations. Prior to approximately 1980, “best practice” consisted of on-site management and disposal of wood preserving waste and wastewater. On-site management was considered responsible because the risks were thought to be limited to the facility property. Off-site facilities equipped to safely contain and/or treat the waste did not exist.

Today, a system of Federal and state regulations for air, water, solid, and hazardous waste carefully controls wood preserving operations and facilities. The various improvements in regulation and practice of wood preserving are discussed in detail below. The practices that caused past contamination have ceased. Objections based on past problems that are no longer occurring are neither relevant nor appropriate to consideration of continued use of creosote wood preservative.

Similarly, contamination problems at old creosote preserving plants that have been closed are neither relevant nor appropriate to the issue of continued use of creosote. While these sites may be listed as Superfund sites with continuing remedial work underway, and while their existence supports the need for continued regulation of industrial processes, their mere existence is not justification for discontinuation of creosote wood preservatives.

III. NATURE OF CREOSOTE

A. Introduction.

It is important to understand the physical and chemical properties of creosote to understand how creosote interacts with the environment. The following paragraphs describe some of the more important characteristics of creosote and how these relate to creosote in the environment.

B. Creosote constituents have low solubility in water.

When creosote liquid is placed into water, it will remain as a separate phase while the low molecular weight PAH (LPAH) constituents gradually dissolve into the water up to their solubility limits, near the separate phase creosote liquid. Naphthalene, comprising approximately 5 to 20% of total liquid creosote, has a solubility in water of approximately 32 ppm. The remaining constituents of creosote have solubility of less than 5 ppm (Brooksⁱ) with most in the low parts per billion (ppb) range. Over many years of contact, most creosote will remain as a separate phase. This limits the dispersion of creosote into the environment. Low solubility also means that rain or soil moisture will not leach the creosote from wood so that creosote will remain in the treated wood for many years.

C. Creosote is more dense, or heavier, than water.

If mixed with water, creosote will form a separate phase that sinks to the bottom of the water column. This means that when spilled, creosote tends to remain in the same place, collect in low areas, or generally move more slowly than water in a stream. If creosote is released into groundwater, it will tend to migrate down to the bottom of the aquifer and settle in the lowest locations. This can make removal of creosote from the aquifer difficult. In contrast, oil spilled into water will float on the surface and rapidly spread to cover large areas. The low solubility and higher density also makes wastewater treatment more effective. Simple gravity separation is used at wood preserving plants to remove the separate phase creosote from the wastewater.

D. Creosote constituents bind to soil.

The higher molecular weight constituents of creosote, including those considered to be potential carcinogens, have the strongest affinity to sorb to soil particles (Brooksⁱⁱ) and are, therefore, least likely to migrate further in the environment. The higher molecular weight constituents of creosote, including those considered to be carcinogens, have higher lipid and sediment affinities along with very low solubility factors (Brooksⁱⁱⁱ). These constituents also tend to bond to organic fractions of soil (Brooks^{iv}), further immobilizing them. These constituents will remain in the soil rather than leach to surface or ground water. Furthermore, the potentially carcinogenic compounds in creosote make up a very small percentage

of the PAH constituents in the mixture and have insignificant release mechanisms to the environment.

E. Creosote will biodegrade.

Creosote is a good wood preservative because in concentrated form it is an effective pesticide capable of preventing degradation of wood by insects and fungi for many years. However, when in dilute form, these constituents can be biologically degraded by bacteria and fungi. In fact, most creosote wood preserving facilities utilize biological wastewater processes to pre-treat their wastewater prior to discharge. Degradation processes have been studied in several media including surface water, groundwater, soil, and wastewater. Brooks (1997)^v explains how the degradation processes effectively remove creosote constituents from most aquatic environments. Concerning soil contamination from past practice, EPA^{vi} selected biological treatment as the remedy for soil contaminated with creosote at a Superfund site and that treatment work is now successfully completed. Both toxicity and total creosote constituents were effectively reduced to non-hazardous levels by biological treatment using naturally occurring bacteria. There is ample evidence that creosote constituents will degrade when they are not highly concentrated, such as in liquid creosote or tar, and when they are in an aerobic, moist environment, such as surface water or topsoil.

The fact that some ground waters have become contaminated with creosote constituents may seem to refute the above statements. However, the conditions that caused the contamination and the physical conditions in the groundwater medium must be considered. Generally, creosote entered groundwater many years ago at wood preserving plants via direct leakage of creosote waste or wastewater from facilities that have now been updated. Thus, the concentration and quantity of creosote was large compared to expected releases from current wood preserving practice or from creosote treated wood products. Once creosote is in the groundwater, the rate of degradation is limited by the supply of oxygen available to the organisms that could degrade creosote constituents. Degradation is further limited by the low to very low solubility of the high molecular weight constituents. Thus, concentrated creosote in groundwater may persist for many years. These situations do not demonstrate that creosote does not degrade, but that the environmental conditions are not right for that degradation to occur. In fact, under the right conditions, in-situ biological treatment is being used successfully at sites where creosote constituents have contaminated groundwater.

F. Creosote has low vapor pressure.

Understanding the meaning and potential impacts of creosote emissions to the air is complicated. “Creosote” as a whole has a very low vapor pressure. That is why it can be injected into wood ties or poles and still be present and effective after 30 years of exposure to severe climatic conditions. However, a small fraction of creosote constituents have significantly higher vapor pressure than the

rest of the mixture. While still having moderately low vapor pressure (roughly 50 times less volatile than water), these will vaporize into the air, especially at elevated temperatures. These lighter constituents, naphthalene, methyl naphthalenes, and indene account for less than 20% of the mass of creosote solution, yet account for about 75 percent of emissions from the treating process and from freshly treated wood. Note that such vapor emissions have a short life in the environment due to chemical- and photo-oxidation, further minimizing any potential environmental impact.

G. Creosote constituents are non-bioaccumulative.

The question of bioconcentration of PAHs from creosote has been evaluated extensively by Brooks^{vii}. He concludes that, while there is a moderate bioconcentration potential for PAHs that are dissolved in the water column, this is mitigated by the rapid metabolism and/or excretion of the PAHs by the aquatic organisms. In contrast, very little uptake occurs of PAH contained in sediments. He further concludes that PAHs do not bioaccumulate up the food chain. *“PAHs are rapidly metabolized and excreted by vertebrates and arthropods. In bivalves, which do not efficiently metabolize PAHs, the half-life of most PAHs examined was in the range of 2 to 16 days. These data suggest that PAHs are not persistent in the tissues of aquatic species and that the movement of PAHs through the food chain to higher trophic levels is minimal, if it occurs at all.”*

IV. CURRENT CREOSOTE WOOD PRESERVING

A. Current treatment practices are environmentally protective.

Regulation of hazardous wastes only began about 20 years ago with the promulgation of the Resource Conservation and Recovery Act (RCRA). The wood preserving industry was one of the first to be regulated under RCRA. Under current regulatory schemes, process wastes including sludge, tank bottoms, and contaminated soil, are collected, stored, treated, and disposed in accordance with well established procedures complying with EPA and state hazardous waste regulations that are protective of the environment.

The most significant environmental improvement in wood preserving operations has been the elimination of waste and wastewater ponds. Wastewater treatment and subsequent effluent discharge must meet NPDES and/or requirements for discharge to publicly owned treatment works (POTW). Wastewater is now stored and treated in above ground tanks. Most of these have secondary containment. Creosote that settles from wastewater is recycled to the preservative process. Solid waste that results from wastewater treatment is handled, stored, and disposed according to RCRA hazardous waste regulations. Following separation, wastewater is generally further treated in a biological process, such as activated sludge, and then either discharged to a POTW for further treatment and discharge or discharged in accordance with an NPDES permit.

Another significant improvement in wood preserving facilities has been the addition of drip pads. These pads, mostly of concrete and sealed with a protective coating, collect any drippage of preservative that may occur immediately after treatment as well as any precipitation that may fall on the drip pad and bundles of treated wood surfaces. Drip pads must meet RCRA design and operation requirements. Furthermore, management and disposal of process wastes must also comply with RCRA. Treated wood must not be dripping when placed into the storage yard and frequent inspections for and immediate cleanup of drippage in the storage yard are required. Treatment cycles have now been modified so that most creosote treated wood does not drip at all after treatment.

Each fresh charge of treated wood is inspected for dripping creosote and held on the drip pad until the operator certifies that it is not dripping. Regulations further require that preservers conduct frequent inspections of treated wood storage areas to detect any drippage to the ground and that they have and implement, as needed, contingency plans for occasions when drippage to the ground is detected.

This focus on minimizing drippage of preservative has also caused preservers to improve the treatment cycle design by adding an extended final vacuum to the treatment cycle that basically pulls any free (non-binding) creosote from the treated wood. The amount of free creosote on the surface of the wood and the excess preservative within the wood that is likely to drip have been greatly

reduced. Thus, the treated wood today is much cleaner and less likely to drip than in the past.

B. Toxic release inventory data show that creosote releases are minor.

1. General—U.S. industries report releases of chemicals designated as toxic by the USEPA in annual Form R reports. The USEPA makes this information available to the public in the Toxic Release Inventory (TRI) database. The Petition cited TRI data for the creosote wood preserving industry. Below, the TRI data is analyzed and explained so that creosote releases can be understood and placed in perspective of the overall U.S. environment. For example, emissions from vehicles on our nation's highways, cited below, make the releases of creosote seem insignificant.

2. While the release numbers discussed below may seem large, they must be understood in the context of other activities. Compared to oil refineries, power plant boilers, or segments of city highways, these emissions are minimal. For example, EPA^{viii} estimates that 27.9 million tons (that is 55,800,000,000 pounds) of volatile organic carbons (VOC) were emitted to the air in the United States in 1995. Creosote emissions are included with VOC emissions although, strictly speaking, creosote constituents are not VOCs, but rather semi-volatile compounds.

3. Wood preserving plants report various types of “releases” of creosote annually. In these reports, wood preservers estimate actual amounts of creosote or totals for the creosote constituents that are released, transferred, or disposed. In each case, the amount reported is an estimate of the amount of creosote constituents contained within a specific medium. For example, a plant discharging 1,000,000 pounds of wastewater containing 1 part per million creosote (total PAH) to a POTW would report 1 pound of creosote transferred to the POTW on their Form R. Amounts of creosote discussed below have been obtained from the EPA TRI database^{ix}. The database was searched for “creosote” and SIC 24, lumber and wood products industry.

4. For creosote, estimation is further complicated by the fact that creosote is not a single chemical but a mixture of many heavy organic chemicals that are all derived from coal during the process of coke manufacturing. Generally, the amount of creosote reported is estimated using the sum of detected creosote constituents in a sample. A combination of process knowledge, analytical and monitoring data, and professional judgement are required to make the assumptions and calculations needed to make the release estimates.

5. Reporting Facilities—Wood preserving releases are reported under SIC code 24, Lumber and Wood Products. In 1999, 56 facilities within SIC code 24 reported releases of creosote.

6. Process wastewater—The amounts of creosote released in process wastewater are reported as amounts that are transferred to publicly-owned treatment works

(POTWs) for further treatment and amounts in wastewaters that are discharged in accordance with National Pollutant Discharge Elimination System (NPDES) permits. In 1999, the total amount of creosote constituents transferred to POTWs was approximately 20,000 pounds. Since process water discharged to surface water per NPDES permits is mixed with stormwater, it is addressed below. Note that due to the nature of creosote, most creosote constituents in wastewater would consist of the more soluble low molecular weight PAH compounds, such as naphthalene. Wastewater transferred to POTWs is mixed with other domestic and industrial sewage, biologically and physically treated, and discharged in accordance with each POTW's NPDES permit. Only a very small fraction of the influent creosote would pass through the final treatment and into the environment.

7. Stormwater—Wood preserving plants generally cover a significant area, often about 100 acres. Runoff of stormwater is regulated and permitted by NPDES permits. This discharge usually will not (but may) include treated process water. In 1999, about 22,000 pounds of creosote were reported to have been released in surface discharges. About half of this was reported at one facility, so may be an error or represent some other unique situation. Stormwater discharges normally occur during and after a significant rainfall. Therefore, any creosote constituents contained in storm water will be carried by large quantities of storm runoff, resulting in high dilution and low concentrations. While environmental impacts may be occurring due to some of these discharges, any such impact should be addressed by the existing NPDES regulatory framework on a case by case basis. Most facilities are well operated, comply with permits, and are not impacting the stream environments where the discharges occur.

8. Air—1999 total reported emissions of creosote are about 633,000 pounds. Note that about 171,000 pounds are reported for one facility, so may represent an error or some other unique situation. Removing this one facility is not representative of typical ones, 462,000 pounds were released by 55 facilities, which equates to about 23 pounds per day per facility. Analysis based on constituent concentrations in creosote and their relative vapor pressures indicate that this total consists of at least 90% non-PAH volatiles and double-ring PAHs, such as naphthalene. Less than 0.001% (or less than 0.1 pound per facility per year) would be potentially carcinogenic PAH compounds.

9. Land—About 15,000 pounds of creosote are reported as released to the ground in 1999. Note that nearly all of this is reported at one facility, so may be an error or represent a unique situation. The other 55 facilities report no significant quantities. This is reasonable because of the use of drip pads and other drip control practices. When drips or spills do occur, they are cleaned up by the operators and properly disposed as solid, hazardous waste and reported as an off-site transfer.

10. Off-site disposal—In 1999, 1.36 million pounds of creosote were reported transferred off-site for waste management. This includes creosote contained in process waste and in soil or other cleanup materials. This material may have been

solidified and disposed in hazardous waste landfills, incinerated, or burned for energy recovery. This quantity was not released to the environment. It was properly managed to limit risks to the environment and human health by methods approved and regulated by the EPA.

11. Our nation’s highway traffic emits large quantities of the same constituents that make up creosote. The following emission quantities provide a comparison of scale between the wood preserving industry emissions and highway emissions of similar materials:

Material	Creosote Wood preserving Plants		US Highway Emissions ^x	
	Basis	Amount (tons)	Basis	Amount (tons)
7 Potentially Carcinogenic PAHs	462,000 lbs creosote at <0.001 % CPAH	0.002	Sum of 7 PAHs on-highway emissions	42
Volatile Organic Compounds (VOCs)	All creosote emissions considered VOCs	231	Sum of benzene, ethyl benzene, formaldehyde, n-hexane, styrene, & toluene on-highway emissions	963,500

Inspection of the above table makes it clear that emissions from creosote wood preserving facilities are small in comparison to overall national and highway emissions.

C. PAHs are everywhere.

Dwelling on PAH levels near wood preserving facilities or around treated wood misses a fundamental point. PAHs are ubiquitous. They come from volcanoes, forest fires, and natural biological processes as well as from human activities such as cooking food, burning fuel, transportation, and manufacturing (essentially any combustion process). Bradley, et al^{x1}, reported levels of total and potentially carcinogenic PAHs in New England area urban soils. The cumulative effect of all sources of PAH resulted in average urban surface soil concentrations of 13.4 ppm and a 9.0 ppm for total PAHs and potentially carcinogenic PAHs, respectively. Using this data for the top 6-inches of soil and assuming soil density of 100 pounds per cubic foot, the average urban environment contained over 12,000 pounds of potentially carcinogenic PAH per square mile. These levels are significantly higher than USEPA’s typical cleanup standards of 0.1 ppm total potentially carcinogenic PAHs. The annual emission of about 0.1 pound of potentially carcinogenic PAH from the average wood preserving facility is insignificant in this light.

V. CREOSOTE-PRESERVED WOOD PRODUCTS

A. Introduction

Since creosote preserved wood products are often installed in sensitive environments, people have questioned whether such use is appropriate. This section will address the environmental issues related to creosote preserved wood in the environment.

B. Creosote preserved ties use in railway system is environmentally appropriate.

1. Creosote stays in the wood, very little migrates out.

a) Industry experience clearly shows that most creosote impregnated into the wood remains with the products because these ties generally have useful lives of 30 years and, at that point, still contain visibly significant and useful amount of creosote preservative. Creosote treated ties used by farmers for fence posts often last 100 years from the date of initial treatment. This conclusion is further demonstrated by scientific studies noted below.

b) AquAeTer^{xii} completed a model to estimate emissions of creosote from the creosote-preserved wood. Emissions of naphthalene, the most volatile significant constituent in creosote, were modeled based on test data from treated wood and creosote analyses. The model showed a long term, decreasing, geometric trend of emissions. Percentages of naphthalene remaining in the wood over time is as follows:

- end of 1 year 96%
- end of 10 years 68%
- end of 20 years 46%
- end of 40 years 21%

Naphthalene is the most volatile significant component of creosote and even after 40 years, over 20% is still in the wood product. Other components with significantly lower vapor pressures will remain much longer.

c) In a study of decay resistance of creosote treated oak, Chow and Bajwa^{xiii} compared the retention of creosote in newly treated wood samples with the remaining retention of creosote after many years of exposure in the environment. Compared with the new product retention, on average, 67 percent remained after 5 years, 57 percent after 30 years, and 46 percent after 40 years. Clearly, after the initial release of the more mobile constituents, most creosote remains in the wood products for a very long time.

2. While some creosote constituents do migrate from creosote treated railway ties over time, the rate of migration is highest with newly treated ties and during

the hottest weather. An assessment for the Railway Tie Association by Brooks^{xiv} considered risks associated with creosote-preserved ties in the railway rights-of-way. He concluded that any creosote constituents that could dissolve into the water would be at concentrations sufficiently low that they would not stress plants or animals. He further concluded, *“In all cases studied to date, the use of creosote treated wood, even in massive bridge structures, has not significantly compromised the biological integrity.”*

3. Evaluation of creosote treated tie releases in railways is complicated by the fact that most PAHs found within the railway rights-of-way come from sources other than creosote, e.g., diesel fuel drips and exhaust from locomotives operating on the tracks. In order to measure any potential adverse environmental impact associated with releases from creosote-preserved ties only, Commonwealth Edison and the Railway Tie Association conducted a mesocosm study that isolated the railway bed from other confounding factors, such as fuel oil drips or other rail line uses. The study was designed to model the sensitive environment of a wetland. The resulting study report by Brooks^{xv} demonstrated that:

- Released creosote remains in the immediate vicinity of the rail bed and there is no significant migration into the surrounding environment;
- The rate of release diminishes with time;
- The low molecular weight constituents generally degrade within the ballast due to photo- and chemical oxidation (weathering);
- The high molecular weight constituents adhere to the ballast rock and are immobilized; and
- Over time, the rate of degradation matches the rate of release so that no significant accumulation of creosote constituents occurs.

In this report, Brooks further states; *“The bottom line is that there is no indication in this study that PAH lost from either the Newly Treated or Weathered Ties presents any potential stress for dragonflies or any other more sensitive species in this wetland.”*

C. Creosote preserved poles use is environmentally responsible.

1. Soil around poles

As with creosote treated railway ties, the creosote in creosote treated poles mostly remains in the pole. EPRI^{xvi} examined the soil around 22 in-service creosote-treated utility poles. Findings were similar to and support those for railway ties, some creosote does migrate from the poles to the surrounding soil. An equilibrium state results with the rate of migration into the soil equaling the rate of degradation within the soil.

2. Creosote stays in the poles

Andrew Stewart reports in Wood Pole Newsletter^{xvii} that utility poles generally have a service life expectancy of about 33 years and, with proper maintenance, can last much longer. This is because the preservative

remains in the wood and effective. Testing conducted by the Forest Products Laboratory^{xviii} reported similar life expectancy of creosote treated posts of 41 years.

D. Creosote treated lumber for bridge construction is safe and environmentally responsible when used appropriately.

1. Appropriate design and treatment cycles are required.

Appropriate design standards and preservative procedures provide preserved lumber that can be utilized in bridges and create minimal environmental impacts. Bridges are installed over water, in sensitive environmental settings, and are generally highly visible. Therefore, engineers must be careful to select the most appropriate preservative specification for preserved wood. Guides and specifications are available from the wood preserving industry to assist engineers and wood preservers in ensuring that materials used in bridges are of proper quality, including:

- American Wood Preservers Association Standards, 1999^{xix};
- Western Wood Preservers Institute Best Management Practices for Treated Wood in Aquatic and Wetland Environments^{xx}; and
- Recommended Retentions for Western Species^{xxi}.

For bridge timbers and pilings preserved with creosote, it is important that the correct amount is impregnated into the wood, that the wood is properly pre-conditioned and post-conditioned to provide the best treatment and surface quality. During construction, it is important the debris and sawdust from treated wood be collected and properly disposed.

Compliance with these procedures will result in an installation with the least possible environmental impacts.

2. Environmental effects study

Brooks^{xxii} completed an assessment of the environmental effects associated with bridges constructed of creosote and other preservative for the U. S. Forest Service. For this study, “Bridges were selected to present, as much as possible, worst case projects with respect to preservative contamination of the water column and sediments.” At the two creosote bridge sites studied, elevated levels of creosote constituents were detected adjacent to and immediately downstream from the bridges. At one bridge, elevated levels of PAHs between the bridge and 10-feet downstream could cause minor adverse effects. However, testing of the sediments that contained the elevated PAHs exhibited no toxicity compared with the other samples and background samples collected. At the other bridge, PAH levels were elevated, but at levels not expected to cause adverse impact. Furthermore, sediment samples did not exhibit any increase in toxicity. The study documents that:

- At most, only minor potential exists for adverse effects due to PAH constituents from creosote contained in stream sediment;
- Such sediments are not toxic to stream organisms tested; and
- The impact is limited to within approximately 10 feet downstream from the bridge.

E. Recycling of creosote treated wood products to uses consistent with original intended use is safe and environmentally responsible.

1. Conserve resources

Creosote treated wood that is taken out of service by its original owners may still have considerable useful life for a similar end use. For example, poles may be damaged at the ground line but, while shorter, still be good above that. Valuable new end uses include use as fence posts or as shorter light or utility poles. Railway ties are often removed from service following rail line abandonment or for a major line upgrade. Many of the removed ties that do not meet the specifications for a Class 1 railway may be suitable for railways carrying lighter or fewer trains. If not suitable for that, they can be beneficially used in retaining walls or landscaping, where high strength is not required. In all these cases, if the used material were not recycled, owners would have to purchase new materials instead. Recycling the used treated wood product is win-win. Original owners can often sell the product or at least avoid disposal costs. Secondary owners obtain valuable products meeting their needs at a lower cost than for new material. Less forest and other resources are consumed. Preserving and recycling wood results in useful lifecycles of 50 or more years. Compare this with the wood used for newsprint whose useful lifecycle is often measured in minutes.

2. After service life weathering, there is a low potential for further leaching or loss of preservative to environment.

Treated wood products spend most of their life cycles in the open, exposed to rain, wind, and sun. Creosote constituents are released from the product at a geometric rate of reduction in releases to the point where the release approaches zero.

3. Safe to use around gardens

People have questioned whether it is safe to use used creosote-preserved railway ties around a garden, such as for a raised bed. Questions of safety or acceptable risk are very personal. The environmental evidence below supports the conclusion that creosote constituents from used preserved wood will not result in elevated PAH levels in food grown in proximity to that preserved wood.

- Little additional preservative leaching is likely after many years in service.
- Creosote constituents will rapidly degrade in an environment with nutrients, water, and aeration, such as garden soil.
- The high molecular weight constituents that may be slower to degrade will bind to soil organic matter and not be biologically available to plants. Garden soil is typically rich in organic matter.
- Garden vegetables are not likely to concentrate creosote constituents from the soil. Edwards^{xxiii} summarized data related to quantities of PAHs in soil and in plant tissue grown from that soil. For example, using garden soil containing 86.6 µg/kg benzo(a)pyrene (BAP) and 1,109 µg/kg total PAHs, peeled onion contained roughly 0.1 and 0.3 percent, peeled beets contained 0.02 and 0.1 percent, and tomato peel contained 0.01 and 0.1 percent of the soil levels of BAP and total PAHs, respectively. These soil levels represent contaminated soil and are much higher than a worst case expectation of PAHs that could leach from used treated wood.

4. Precautions normal to woodworking minimize risk

Common sense precautions should be followed when working with preservative treated wood, whether newly treated or used. The precautions are listed in the Consumer Information Sheets available from USEPA and American Wood Preservers Institute^{xxiv}.

F. Recycling for energy recovery or incineration of creosote treated wood is environmentally responsible.

1. Conserve resources

After creosote treated wood has completed its normal product life cycle, it still is a valuable energy resource. Use of used creosote treated wood again presents a win-win situation. The last owner of the product may be able to sell the wood or, at least, can avoid the cost of disposal. The fuel user obtains a good quality fuel at a competitive price. The citizens benefit by minimizing use of valuable landfill space, not needing to develop new landfills, importing less fuel, emitting less pollution, and obtaining competitively priced electric power. As fuel, used creosote treated wood offers approximately 5,000 BTU/pound. Every 2 tons of treated wood used to generate electricity will replace approximately 1 ton of coal.

2. Cost effective

Used creosote treated wood is used as fuel where it can be obtained at a cost less than for equivalent heat value from conventional fuels, such as fuel oil or natural gas. In instances where the fuel is used in a co-generation facility, the used wood fuel must allow the generator to

produce electricity to sell to the utility at less than the utility will sell its power. Since all the businesses, from companies selling their used treated wood, to those using it as fuel, to the utility companies are involved to make or increase their profits, use of used creosote treated wood is cost effective. These businesses would not use the wood as fuel otherwise.

3. Hazardous constituent emissions are insignificant

a) Emissions from boilers using creosote treated wood for at least part of their fuel have been tested at several facilities. The California Air Resources Board conducted tests at a series of wood-fired boilers to determine emissions of constituents regulated under the California Toxic Hot Spots Act. Modeling using this data indicated no significant risk due to these emissions.

b) Some wood preserving companies operate wood-fired boilers that are permitted to burn creosote treated wood. Koppers Industries, Inc. conducted tests of its Grenada, MS boiler in 1996^{xxv}. While burning a ground wood fuel consisting of a mixture of 50-percent creosote-treated used railway ties and 50-percent pentachlorophenol-treated used utility poles, stack testing documented emissions of PAHs associated with creosote at levels at or lower than were emitted from burning only untreated wood fuel. No potentially carcinogenic PAH emissions were detected in this test. However, a very conservative (one that would over-estimate) emission factor was calculated assuming CPAH were at the method detection limits. A CPAH emission factor so calculated would be:

0.01 lbCPAHs/1000 tons fuel

If this boiler operated according to test conditions of about 7400 pounds of fuel per hour, 24 hours per day, 365 days per year, the high range estimate of potentially carcinogenic PAH emission would be only about one-third of a pound per year.

c) Emissions are similar to emissions from untreated wood fuel. Use of used creosote treated wood to fuel industrial furnaces, such as boilers, emits no more emissions than if those same furnaces were fired by conventional fuels such as fuel oil or coal. EPA's reference document for emission factors (USEPA AP-42^{xxvi}) provided factors for wood-fired boilers. The following table summarizes some of these factors for to constituents of interest for creosote and uses data noted above, for a boiler fired with used treated wood.

Comparison of Emission Factors

Fuel Type:	Creosote treated wood	Untreated Wood Fuel
Data Source:	Koppers Grenada Test	USEPA, AP-42, 1.6
Controls	Mechanical Control Only	Mechanical Control Only
Units of Measure:	(lb/MM BTUs)	(lb/MM BTUs)
Constituent		
Naphthalene	1.29E-05	9.70E-05
Toluene		9.20E+04
Phenanthrene	9.89E-07	7.00E-06
Benzo(a)anthracene	1.01E-07	6.50E-08
Chrysene	1.01E-07	3.80E-08
Benzo (b,k)fluoranthene	1.01E-07	3.60E-08
Benzo(a)pyrene	1.01E-07	2.60E-06
Dibenz(a,h)anthracene	1.01E-07	6.50E-08
Benzo(g,h,l)perylene	1.01E-07	9.30E-08
Indeno(1,2,3-c,d)pyrene	1.01E-07	8.70E-08
Total CPAHs	7.09E-07	2.98E-06
Carbon Dioxide (CO ₂)		195

The test conducted using treated wood fuel produced a lower emission factor than the AP-42 factor for untreated wood fuel emissions.

4. Greenhouse Gases

The Petition misleadingly claims that incineration of creosote treated wood “produces tremendous amounts of greenhouse gases.” Any use of carbon based fuel will result in production of carbon dioxide (CO₂), including the food we all consume. Combustion of wood fuel will produce CO₂ at levels similar to competing fuels. The difference is that wood fuel is a renewable energy source and that the CO₂ was previously removed from the atmosphere by the trees producing the wood. This is part of the natural carbon cycle. If the same wood had been left to rot in the forest rather than being harvested, the same CO₂ would have been emitted. As new trees are grown, the CO₂ will again be incorporated into wood tissue.

5. Dust from grinding and fuel handling should be controlled to minimize exposures and nuisance.

The Petition cites examples of emissions of dust from facilities grinding treated wood for fuel. Dust from such facilities should be controlled.

However, this issue is no different than would be considered for a coal fired facility. Reasonable limits on dust generation are required and should be applied at the local level. However, the fact that some facilities grinding creosote treated wood generate dust does not support the banning of creosote treated wood or the use of creosote treated wood for energy recovery.

G. Disposal of treated wood in landfills is appropriate, after other options have been considered.

1. Disposal in landfills is last choice

While the options of recycling are preferred, there will continue to be circumstances where landfill disposal is the most practical, cost-effective solution for disposal of waste treated wood. Therefore, the option of disposal in landfills should be maintained.

2. Leach testing of creosote treated wood indicates landfill disposal is environmentally proper.

EPA developed the Toxicity Characteristic Listing Procedure (TCLP) test specifically to identify waste materials that would not be appropriate for disposal in landfills. The test subjects a waste sample to an aqueous solution more vigorous than that likely to exist in a landfill. The liquid is then tested to determine levels of hazardous constituents leached from the waste. The USEPA modeled leaking landfills to determine levels of constituents in leachate likely to be a problem. Note that most landfills today are more protective of the environment than the conditions evaluated in the model. If the TCLP leachate for the sample is less than the regulatory levels set by USEPA, then the material may be disposed in a non-hazardous landfill.

Several evaluations of creosote treated wood, both of recently treated and used treated wood, have been done according to the TCLP procedure. Summary results of these evaluations are available from American Wood Preservers Institute^{xxvii} web site. In all samples of creosote treated wood evaluated, levels were well below the regulatory limits. Thus, according to EPA required methods of evaluation, it is safe and legal to dispose of creosote treated wood in non-hazardous landfills.

3. Creosote treated wood waste is not a hazardous waste

Waste is considered “hazardous waste” and subject to the Resource Conservation and Recovery Act (RCRA) regulations if the material is listed or exhibits a hazardous characteristic, such as flammability, corrosivity, reactivity, or toxicity. Creosote treated wood is not included in any hazardous waste listing. Creosote treated wood has been tested for

characteristics and determined not to be a characteristic hazardous waste. Some test results demonstrating the non-hazardous character of treated wood are summarized in the web site by AWPI^{xxviii}. Therefore, waste creosote treated wood is not a hazardous waste.

4. Landfill disposal of creosote treated wood wastes poses no unusual risk to waste collectors or landfill operators

Hazards to waste collection workers or landfill operators posed by creosote treated wood wastes are no worse than hazards associated with normal household or construction waste. Broken glass, rancid food, containers of household chemicals all pose hazards to these workers. However, normal care, reasonable safety precautions, and personal hygiene minimize these risks.

H. Industry guidance on appropriate use of creosote treated wood is available.

The wood preserving industry has acted responsibly by recognizing that preserved wood is not right for every situation. While creosote treated wood is safe to use in most locations for its approved uses, there are certain situations where alternate products should be used. In work for the Western Wood Preservers Institute, Brooks^{xxix} created a model to predict the concentrations of creosote constituents at various distances and times from the installation of creosote treated wood structures in marine environments. This can be used as a tool to estimate potential impacts. In cases of very low water flow and/or existing environmental stresses, installation of creosote treated wood structures may not be advisable. As noted in section D.1, this model and other materials are available for use by regulators, engineers, or others from the Western Wood Preservers Institute web site.

VI. CONCLUSION

The continued use of creosote as a wood preservative and of the creosote-preserved wood products for their intended uses is environmentally responsible. The practices that caused contamination at wood preserving facilities in the past have been corrected. Current wood preserving facility practices have minimal adverse environmental impacts and meet established environmental standards. Adverse environmental impacts related to past practices are not relevant and should not be used to justify discontinuing its usage. The continued use of creosote treated wood products, such as railway ties and utility poles, is compatible with a healthy environment. Reuse of used creosote-preserved products for secondary uses where the preservative qualities are of value, such as for landscaping, retaining walls, smaller or industrial railways, or fencing, conserve valuable resources and pose insignificant environmental risks. Recycling of used creosote treated wood for energy recovery offers further benefits of economy, efficient resource utilization, and lessened environmental impacts. Where practical and cost effective, disposal of waste creosote-preserved wood in landfills is economically and environmentally responsible. Continued use of creosote wood preservative in accordance with USEPA FIFRA registration and regulation is compatible with protection of our environmental quality.

VII. REFERENCES

- ⁱ K. M. Brooks, Literature Review, Computer Model and Assessment of Potential Environmental Risks Associated with Creosote Treated Wood Products Used in Aquatic Environments, Revised June 1, 1997.
- ⁱⁱ Ibid.
- ⁱⁱⁱ Ibid.
- ^{iv} Ibid.
- ^v Ibid.
- ^{vi} EPA web site at <http://www.epa.gov/region5superfund/npl/ILD990817991.htm>, Dec. 20, 2000.
- ^{vii} K. M. Brooks, Literature Review, Computer Model and Assessment of Potential Environmental Risks Associated with Creosote Treated Wood Products Used in Aquatic Environments, Revised June 1, 1997.
- ^{viii} USEPA, Summary of Air Quality and Emissions Trends, AIRTrends 1995 Summary, web site at <http://www.epa.gov/air/aqtrnd95/summary.html>.
- ^{ix} USEPA TRI Explorer, web site at <http://www.epa.gov/cgi-bin>.
- ^x USEPA, Control of Emissions of Hazardous Air Pollutants from Mobile Sources, Final Rule, Federal Register, 29 March 2001, pg 17230.
- ^{xi} L.J. N. Bradley, B.H. Magee, and S. L. Allen, Background levels of Polycyclic Aromatic Hydrocarbons (PAH) and Selected Metals in New England Urban Soils, *Journal of Soil Contamination*, 3(4), 1994, pgs. 349-361.
- ^{xii} AquAeTer, Calculated Emissions from Creosote-Treated Wood Products (Cross-Ties and Poles), October 13, 1994.
- ^{xiii} Poo Chow and Dilpreet S. Bajwa, Weathering Effects on the Decay Resistance of Creosote-Treated Oak, University of Illinois, Urbana, IL, published in Proceedings of the American Wood Preservers Association, available at www.rta.org/two_tier/research.htm.
- ^{xiv} K. M. Brooks, The Environmental Risks Associated with the Use of Pressure Treated Wood in Railway Rights-of-Way, March 29, 2001.
- ^{xv} K. M. Brooks, Final Report, Evaluation of Polycyclic Aromatic Hydrocarbon Migration from Railway Ties into Ballast and Adjacent Wetlands, September 22, 2000.
- ^{xvi} Electric Power Research Institute, Pole Preservatives in Soils Adjacent to In-Service Utility Poles in the United States, Report TR-108598, Dec. 1997, 192 pp.
- ^{xvii} Andrew H. Stewart, Wood Pole Life Span: What You Can Expect, Wood Pole Newsletter, Western Wood Preservers Institute, Vol. 20, 1996.
- ^{xviii} USDA, Forest Service Forest Products Laboratory, Comparison of Wood Preservatives in Mississippi Post Study (1997 Progress Report), July 1977.
- ^{xix} American Wood Preservers Association, 1999 Book of Standards. Available at www.awpa.com/standards.
- ^{xx} Western Wood Preservers Institute, Best Management Practices for the Use of Treated Wood in Aquatic Environments, Available at www.wwpinstitute.org/mainpages/thebmpswoodinaquat.shtml.
- ^{xxi} Western Wood Preservers Institute, Recommended Retentions, AWWPA Pressure Treatment Retentions, Western Species Only, available at www.wwpinstitute.org/mainpages.
- ^{xxii} K. M. Brooks, An Assessment of the Environmental Effects Associated with Bridges Constructed of Wood Preserved with Creosote, Pentachlorophenol, or Chromated-Copper-Arsenate (CCA-C), Draft, Contract –RJVA-2828, July 6, 2000.
- ^{xxiii} Nelson T. Edwards, Polycyclic Aromatic Hydrocarbons (PAH's) in the Terrestrial Environment—A Review, *Journal of Environmental Quality*, Volume 12, Oct.-Dec. 1983, pg. 427-441.
- ^{xxiv} American Wood Preservers Institute, EPA Approved Consumer Information Sheet, web site, http://www.preservedwood.com/safety/epa_creo.html.
- ^{xxv} Koppers Industries, Inc, Stack Testing Report, Grenada Plant, Tie Plant, MS, 6 May 1996, submitted to the Mississippi Department of Environmental Quality.
- ^{xxvi} USEPA, AP-42, Emission Factors by Chapter, web site at <http://www.epa.gov/ttn/chief/ap42/index.html>
- ^{xxvii} American Wood Preservers Institute web site, <http://www.preservedwood.com/rotate/rotate.html>.
- ^{xxviii} Ibid.
- ^{xxix} K. M. Brooks, Literature Review, Computer Model and Assessment of the Potential Environmental Risks Associated with Creosote Treated Wood Products Used in Aquatic Environments, Revised June 1, 1997.

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1999-2001 Koppers (China) Carbon and Chemicals Co. Ltd., Tangshan, China, Technical and Operations Manager
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Rebuild and start-up coal tar distillation plant in China
Manage corporate environmental compliance system
Environmental management system
Training
Environmental audits
Environmental permits, including Title V and NPDES
CERCLA and RCRA investigations and cleanup
SARA Reporting
Air and Wastewater Environmental Systems Engineering and Design
Construction management
Depositions and courtroom testimony