UPDATE ON WOOD PRESERVING CHEMICALS IN CALIFORNIA LANDFILL LEACHATE

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Executive Summary

In 2004 a study was conducted to provide information on the possible impact of disposal of treated wood waste in lined portions of Class 2 and Class 3 (non-hazardous) landfills in California. To evaluate possible environmental impacts of current methods of disposal, leachate monitoring data from a variety of California landfills was reviewed and concentrations of chemicals used in treated wood were compared to screening levels. Data were gathered both from landfills that accept treated wood waste and from those which do not. This report updates that study with data from the most recent analyses of Chemicals of Concern from some of the landfills previously surveyed.

Lined Class 2 and 3 landfills are engineered and managed to minimize the impact of leachate from any type of waste on ground and surface water. They provide a secure, monitored environment for disposal of many types of waste.

While this study's focus is on the chemicals used to treat wood, treated wood waste is clearly not the only potential source of these chemicals in landfills. The metals, arsenic, chrome, copper, and zinc, exist naturally in soil and groundwater, and in many types of municipal and industrial waste. The polycyclic aromatic hydrocarbons, naphthalene and benzo(a)pyrene exist naturally in petroleum and coal, as combustion by-products and in normal municipal and industrial waste. Although the fraction of chemicals contributed by treated wood waste to landfill leachate is not known, conclusions about the levels of these chemicals found in leachate can still be made.

The results from this update continue to support a conclusion that most metals from treated wood chemicals in landfill leachate are below drinking water standards and, therefore, present no significant risk of contaminating drinking water. Arsenic and the organic chemicals which might result from treated wood products were either below the drinking water standard or below the Limit Threshold Concentration Value modeled for landfills with composite liners using the U.S. Environmental Protection Agency's Tier I Industrial Waste Management Evaluation Model. In summary, the study supports the safety of the current practice of disposal of treated wood waste in Class II or Class III composite-lined landfills. Current practice does not create a threat to human health or the environment. There have been no significant changes since the last report and current values are within the range of those reported previously for individual landfills.

Introduction

This report provides an update to a study conducted in 2004 to concerns related to the disposal of treated wood waste in lined portions of Class 2 and Class 3 (non-hazardous) landfills in California. In that report leachate monitoring data from a variety of California landfills was reviewed and concentrations of chemicals used in treated wood were compared to screening levels. Data was gathered both from landfills that accept treated wood waste and from those which did not. In the current study, data from the most recent analyses of Chemicals of Concern from some of the landfills previously surveyed is compared to the mean and maximum values previously reported.

A description of current treatment practices, disposal methods and landfill design and operation was given in the original report, which is attached as Appendix 1. It is important to consider the level of waste management required in lined Class 2 and 3 landfills and the additional environmental protection given by these practices even though these are considered to be facilities accepting "non-hazardous" waste.

Constituents of Concern

Constituents of Concern (COCs) are the chemicals that must be monitored at the landfills. The COCs for a particular facility are determined by the CRWQCB based on analyses that are done at least every 5 years that measure several hundred chemicals. Some landfills monitor the entire list every year and others monitor for a more limited list more frequently.

This report compares results from the 2004 report to those from more recent analyses. The chemicals selected are inorganic chemicals arsenic, chromium, copper, and zinc and organic chemicals, benzo(a)pyrene, naphthalene and pentachlorophenol. The inorganic chemicals represent copper napthante and CCA, CA-B, CBA-A, ACZA and ACQ water-based preservatives. Benzo(a)pyrene and naphthalene are constituents of creosote treatment. In the previous report Chromium VI was also reported, however, the most recent data sets do not all include this constituent, so it has been omitted from the comparison.

It is important to note that the presence in leachate of chemicals sometimes used for wood preservation does not prove that they came from preserved wood. There are other, potential sources that may be as or more significant than the disposed treated wood. Arsenic, chrome, copper, and zinc are naturally occurring, common elements in the earth's crust. Studies have shown that arsenic is ubiquitous in California soils[1]. Most soil will contain about 1 to 5 mg/Kg of arsenic. Naphthalene and benzo(a)pyrene are found naturally in coal, petroleum, and as combustion by-products. Agricultural or other industrial waste may contain the same chemicals. Bio-chemical reactions within the landfill may dissolve and mobilize trace metals from any of these sources.

Selection of Landfills for This Update

Data in RWQCB files in Region 5S were reviewed for landfills where data had been reported in the previous study. One of the landfills had closed, but was still analyzing leachate as part of its post-closure requirement. Unlike the last study where, generally, landfills analyzed leachate for all of the chemicals selected for inclusion in this study

each year, analyses for all of the COCs were only being done on a once in 5-year basis. The data from that analysis was selected, or if there was more than one data set, the most recent data were selected.

Screening Levels

There are a variety of criteria that could be compared to the chemical concentrations in the landfill leachate. Because the leachate is generally sent to a waste treatment plant (POTW), it may not have chemical concentrations higher than those acceptable to the treatment facility. However, because one of the concerns about disposal of treated wood waste is the potential threat to groundwater as a source of drinking water, Maximum Contaminant Levels[2] (MCLs) set by US EPA regulate allowable concentrations of chemicals in drinking water. Comparing concentrations in leachate to acceptable levels in drinking water is a very conservative assessment. MCLs are available for all COCs reviewed in this report except for zinc and naphthalene. For zinc, a secondary standard of 5 mg/L can be used as a target value. For naphthalene, the State of California has established an action level of 0.17 mg/L as a drinking water limit under Proposition 65[3]. The data evaluation below uses these criteria as a first tier screen.

As described below, for some of the chemicals in this study, analytical detection limits are above MCL values. Also, in a few instances for the inorganic chemicals, particularly for arsenic, concentrations in the leachate are above the MCL. Modeling can be used to determine whether these values in leachate would be expected to generate unacceptable concentrations in ground water, based on predicted leaching rates through composite liners. The U.S. Environmental Protection Agency's Tier I Industrial Waste Management Evaluation Model (IWEM)[4] has been used to determine what leachate concentrations threshold value (LCTV) would not be expected to produce unacceptable concentrations in groundwater. Maximum values found in this study are compared to the values calculated in this model. Model calculations are shown in Appendix I.

Units: mg/L	Screening Level	LCTV
Arsenic	0.01	5
Chromium	0.05	1000
Copper	1	1000
Zinc	5	1000
Pentachlorophenol	0.001	80
Naphthalene	0.17	1000
Benzo(a)pyrene	0.0002	1000

Data Collection and Evaluation

Data Collection

Of the seven sites in this report, six accept treated wood waste and one does not. One of the sites, Fink Road, did not accept treated wood waste in 2004 but began to accept it in the 3rd quarter of 2007.

Landfill	Accept	County	Class
BUENA VISTA	Yes	Amador	II
HAY ROAD LANDFILL	Yes	Solano	II
OSTROM ROAD LANDFILL	Yes	Yuba	II
ROCK CREEK LANDFILL	Yes	Calaveras	II
WESTERN REGIONAL LANDFILL	Yes	Placer	III
FINK ROAD LANDFILL	Yes[1]	Stanislaus	II
YOLO COUNTY CENTRAL LANDFILL	No	Yolo	II/III

[1] Began accepting treated wood waste in 3Q 2007

All data were abstracted from publicly available reports. For the 2004 report, data were collected from the 2001, 2002 and 2003 reports, except for Yolo County Landfill, where data from 2003 were not yet available. Complete data sets are included in the 2004 Report. In some cases, the data from 2006 to the present for these landfills is now available on Geotracker at geotracker.warterboards.ca.gov.

Data Evaluation

Mean and maximum values for each chemical for each site were calculated for the 2004 report. If the chemical was not detected in the sample, or was present at a trace level between the method detection limit and the reporting limit, one-half the value of the reporting limit was used to calculate the mean. If a chemical was never detected in any sample from the landfill, a less than code (<) is used in the summary table to indicate that the mean was calculated from method reporting limit values only or that the maximum values is a reporting limit. Method reporting limits very depending on the laboratory and the sample involved. These may range for example from ND<0.10 to ND<0.0001 depending on the lab and the sample.

In this report, the for each landfill, mean and maximum from 2004 for the landfill is compared to the data from a 5-year COC report or the latest data set for each sampling point in the landfill, since for most landfills over the period there were not enough data points to permit calculating a meaningful mean or maximum value.

Buena Vista

Constituent	Units	2010	2004 Mean	2004 Max
Arsenic	mg/l	0.010	0.010	0.012
Chromium	mg/l	ND<0.010	0.007	0.010
Copper	mg/l	0.036	<0.005	<0.01
Zinc	mg/l	0.170	0.100	0.190
Pentachlorophenol	mg/l	ND<0.010	<0.0375	<0.05
Naphthalene	mg/l	ND<0.005	<0.00058	<0.0025
Benzo(a)Pyrene	mg/l	ND<0.002	<0.0075	<0.02

Treated Wood Accepted?	CLOSED

NOTES:
ND = Not Detected
closed 2004

Hay Road

		S-1		S-2.1		S-2.2A		S-2.2B		S-4.1		
Constituent	**Units**	**2010**		**2010**		**2010**		**2010**		**2010**	**2004 Mean**	**2004 Max**
Arsenic	mg/l	0.0093t		ND<0.15		0.0230		ND<0.0075		0.0345t	0.0312	0.089
Chromium	mg/l	0.0037t		0.0036t		0.0048		0.0064t		0.049	0.0044	0.10
Copper	mg/l	ND<0.0023		ND<0.0046		ND<0.0046		ND<0.0023		ND<0.023	0.0133	0.083
Zinc	mg/l	ND<0.0059		ND<0.012		ND<0.012		ND<0.0059		0.014	0.0575	0.60
Pentachlorophenol	mg/l	ND		ND		ND		ND		ND	<0.0769	<0.20
Naphthalene	mg/l	0.0.038t		0.0034		0.041		ND<0.00072		0.1	0.0039	0.012
Benzo(a)Pyrene	mg/l	ND		ND		ND		ND		ND	<0.0154	<0.04

		S-5.1A		S-5.1B		S-9.1A		S-11.1		S-11.2
Constituent	**Units**	**2010**		**2010**		**2010**		**2010**		**2010**
Arsenic	mg/l	0.0079t		0.032t		ND<0.0075		0.031t		0.012t
Chromium	mg/l	0.0042t		0.041		0.0026t		0.0033t		0.0084t
Copper	mg/l	ND<0.0023		ND<0.0046		0.03		ND<0.0023		ND<0.0023
Zinc	mg/l	ND<0.0059		ND<0.012		ND<0.0059		0.0096t		ND<0.0059
Pentachlorophenol	mg/l	ND		ND		ND		ND		ND
Naphthalene	mg/l	ND<0.00036		0.0032		ND<0.0018		ND<0.00036		ND<0.0018
Benzo(a)Pyrene	mg/l	ND		ND		ND		ND		ND

Treated Wood Accepted?	Yes

NOTES:
t< = trace present above method detection limit (MDL), but below quantitation limit (QL) indicated; t = estimated value between QL and MDL
ND = Not Detected

Ostrom

		Sump-1A		Sump-1B		Sump-2A		Sump 2B			
Constituent	**Units**	**2006**		**2006**		**2006**		**2006**		**2004 Mean**	**2004 Max**
Arsenic	mg/l	0.028		0.033		ND<0.020		ND<0.020		0.0211	0.027
Chromium	mg/l	0.016		0.017		0.016		0.012		0.0284	0.058
Copper	mg/l	ND<0.05		ND <0.010		ND <0.010		ND <0.010		0.0094	0.026
Zinc	mg/l	ND <0.010		ND <0.010		ND <0.010		0.048		0.0813	0.19
Pentachlorophenol	mg/l	ND<0.010		ND<0.010		ND<0.010		ND<0.010		<0.1222	<1
Naphthalene	mg/l	0.0037		0.017		0.0027		0.0019		<0.0031	<0.01
Benzo(a)Pyrene	mg/l	ND<0.002		ND<0.002		ND<0.002		ND<0.002		<0.0244	<0.2

Treated Wood Accepted?	Yes

NOTES:
t = trace present above method detection limit, but below quantitation limit indicated
ND = Not Detected

Rock Creek Landfill

Constituent	Units	Primary 2006	Secondary 2006	Sump 2006	Pond 2006	2004 Mean	2004 Max
Arsenic	mg/l	ND<0.02	ND<0.01	ND<0.01	ND<0.01	0.014	0.053
Chromium	mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01	<0.005	<0.01
Copper	mg/l	ND<0.01	ND<0.01	0.042	ND<0.01	0.006	0.012
Zinc	mg/l	ND<0.01	ND<0.01	0.440	ND<0.01	0.027	0.120
Pentachlorophenol	mg/l	ND<0.01	ND<0.01	ND<0.01	ND<0.01	<0.025	<0.05
Naphthalene	mg/l	ND <0.005	ND <0.005	ND <0.005	ND <0.005	<0.0035	<0.02
Benzo(a)Pyrene	mg/l	ND<0.002	ND<0.002	ND<0.002	ND<0.002	<0.005	<0.01

Treated Wood Accepted?	Yes

NOTES:
t = trace present above method detection limit, but below quantitation limit indicated
NR = Not Reported
ND = Not Detected

Western Regional

		M-12	M-13	M-14		
Constituent	**Units**	**2007**	**2007**	**2007**	**2004 Mean**	**2004 Max**
Arsenic	mg/l	0.067	0.015	0.020	0.015	0.030
Chromium	mg/l	0.0056t	0.0024t	ND <0.01	<0.005	<0.01
Copper	mg/l	0.0058t	0.0089t	0.016t	<0.005	<0.01
Zinc	mg/l	0.0096t	0.017t	0.037	0.020	0.021
Pentachlorophenol	mg/l	ND <0.050	ND <0.010	ND<0.5	<0.056	<0.2
Naphthalene	mg/l	0.012	0.01	0.0037t	<0.0032	<0.01
Benzo(a)Pyrene	mg/l	ND <0.050	ND <0.010	ND<0.5	<0.011	<0.04

Treated Wood Accepted?	**Yes**

NOTES:
t< = trace present above method detection limit (MDL), but below quantitation limit (QL) indicated;
t = estimated value between QL and MDL
ND = Not Detected

Fink Road		LF-3, Cell #1 and #2 Lift Station		LF-2 Cell #3 Sump		
Constituent	**Units**	**2010**		**2010**	**2004 Mean**	**2004 Max**
Arsenic	mg/l	0.190		0.0034	0.0473	0.13
Chromium	mg/l	ND<0.005		ND<0.01	0.0065	0.02
Copper	mg/l	ND<0.005		0.0033t	0.0044	0.005
Zinc	mg/l	ND<0.005		0.017	0.0123	0.027
Pentachlorophenol	mg/l	ND <0.010		ND <0.010	ND<0.005	ND<0.01
Naphthalene	mg/l	ND<0.005		0.0036	ND<0.00058	ND<0.002
Benzo(a)Pyrene	mg/l	ND<0.002		ND<0.002	ND<0.001	ND<0.002

Treated Wood Accepted?	No in 2003	Yes from 2007

NOTES:
NA = Not Analyzed
ND = Not Detected
t< = trace present above method detection limit (MDL), but below quantitation limit (QL) indicated; t = estimated value between QL and MDL

Yolo

Constituent	Units	Leachate Pump Station 1 2010	Leachate Pump Station 2 2010	2004 Mean	2004 Max
Arsenic	mg/l	0.018	0.049	0.016	0.021
Chromium	mg/l	0.052	0.039	0.034	0.10
Copper	mg/l	0.002	0.003	<0.0043	<0.01
Zinc	mg/l	0.014	0.015	0.0693	0.31
Pentachlorophenol	mg/l	ND<0.00075	ND<0.010	<0.036	<0.18
Naphthalene	mg/l	0.180	0.0067t	0.0451	0.11
Benzo(a)Pyrene	mg/l	ND<0.00088	ND<0.010	<0.0017	<0.0085

Treated Wood Accepted?	No

NOTES:
t< = trace present above method detection limit (MDL), but below quantitation limit (QL) indicated; t = estimated value between QL and MDL
ND = Not Detected

Concentrations of chromium, copper and zinc for the current samples are all less than their respective MCLs in landfills accepting treated wood waste as are the mean values from the data reported in 2004. The only measurement above the MCL was 0.052 mg/L chromium (MCL – 0.05 mg/L) in a 2010 sample from Yolo landfill which does not accept treated wood waste. Overall, both types of landfills have similar concentrations of these constituents. Arsenic concentrations in this data set are above the MCL as they were in the 2004 data set, but. all leachate concentrations are well below the Tier I IWEM model calculation.

Benzo(a)pyrene and pentachlorophenol were not detected in any samples analyzed either in this set of data or in the data reported in 2004. Naphthalene was occasionally detected, but was always below the screening level. Detection limits for benzo(a)pyrene and pentachlorophenol are substantially higher than their MCLs. As described above, modeling has been used to determine whether these detection limit values in leachate would be expected to generate unacceptable concentrations in ground water based on predicted leaching rates through composite liners and all results are well below the LCTV calculated from the IWEM model.

Conclusions

These results indicate that continued disposal of treated wood waste in Class II and III composite-lined landfills has not increased the concentrations in leachate of chemicals that might be coming from this waste. Most metals that might come from treated wood chemicals in landfill leachate are below drinking water standards and, therefore, present no significant risk of contaminating drinking water. Arsenic and the organic chemicals which might result from treated wood products were either below the drinking water standard or below the Limit Threshold Concentration Value modeled for landfills with composite liners. The chemicals summarized in this study are present in many types of waste, not just treated wood and, in fact, the chemical levels in leachate from landfills accepting treated wood are similar to levels at a landfill that does not. In summary, the study supports the safety of the current practice of disposal of treated wood waste in composite-lined landfills.

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Appendix I

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Executive Summary

This study responds to concerns related to the disposal of treated wood waste in lined portions of Class 2 and Class 3 (non-hazardous) landfills in California. To evaluate possible environmental impacts of current methods of disposal, leachate monitoring data from a variety of California landfills has been reviewed and concentrations of chemicals used in treated wood have been compared to screening levels. Data have been gathered both from landfills that accept treated wood waste and from those which do not.

Lined Class 2 and 3 landfills are engineered and managed to minimize the impact of leachate from any type of waste on ground and surface water. They provide a secure, monitored environment for disposal of many types of waste.

While this study's focus is on the chemicals used to treat wood, treated wood waste is clearly not the only potential source of these chemicals in landfills. The metals, arsenic, chrome, copper, and zinc, exist naturally in soil and groundwater, and in many types of municipal and industrial waste. The polycyclic aromatic hydrocarbons, naphthalene and benzo(a)pyrene exist naturally in petroleum and coal, as combustion by-products and in normal municipal and industrial waste. Although the fraction of chemicals contributed by treated wood waste to landfill leachate is not known, conclusions about the levels of these chemicals found in leachate can still be made.

These results support a conclusion that most metals from treated wood chemicals in landfill leachate are below drinking water standards and, therefore, present no significant risk of contaminating drinking water. Arsenic and the organic chemicals which might result from treated wood products were either below the drinking water standard or below the Limit Threshold Concentration Value modeled for landfills with composite liners using the U.S. Environmental Protection Agency's Tier I Industrial Waste Management Evaluation Model. In summary, the study supports the safety of the current practice of disposal of treated wood waste in Class II or Class III composite-lined landfills. Current practice does not create a threat to human health or the environment.

Introduction

This study responds to concerns related to the disposal of treated wood waste in lined portions of Class 2 and Class 3 (non-hazardous) landfills in California. To evaluate possible environmental impacts of current methods of disposal, leachate monitoring data from a variety of California landfills has been reviewed and concentrations of chemicals used in treated wood have been compared to screening levels. Data have been gathered both from landfills that accept treated wood waste and from those which do not.

A description of current treatment practices, disposal methods and landfill design and operation is given below. It is important to consider the level of waste management required in lined Class 2 and 3 landfills and the additional environmental protection given by these practices even though these are considered to be facilities accepting "non-hazardous" waste.

Background

Wood Preservation

Wood preservatives have been used since the 19th century to extend the service life of wood products. Preserved wood products have made much development possible and have also reduced the need for new wood by allowing wood to stay in service longer.

Preservatives can be divided into two general categories – Oil-type and Waterborne systems.

In oil-type systems, the preservative is either 100 percent active ingredient (creosote) or the active dissolved in an oil-based solvent (pentachlorophenol-oil). The mixture then fills or coats the wood cell walls during treatment. The three most common preservatives used on industrial, transportation and utility products are Creosote, Pentachlorophenol and Copper Naphthenate.

Creosote is a mixture of chemicals distilled from coal tar. It has been in use in the United States since the late 1800s and is still the primary treatment for railroad ties. Pentachlorophenol is used primarily for treating utility poles and cross-arms and bridge timbers.

Copper Napthenate is a general use wood preservative that has been used since 1889 and commercially since 1911. It is used in both a pressure and non-pressure treated process for the treatment of utility poles, lumber, piling, fence and guardrail posts, wood shingles and millwork, as well as some non-wood applications.

In waterborne systems, water is the carrier for the preservative chemicals. The chemicals react or precipitate into the wood substrate and become attached to wood cells, minimizing leaching. The historical preservative systems include CCA – Chromated Copper Arsenate and ACZA – Ammoniacal Copper Zinc Arsenate; which continue to be used for industrial applications. More recently, copper azole (CA-B and CBA-A) and ammoniacal copper quaternary compound (ACQ) have been introduced. These preservatives are primarily used to treat wood for residential building products with some industrial applications.

Disposal of Treated Wood

For purposes of this study "Treated Wood Waste" is defined as wood material that has been treated with a preservative and is discarded by the user as either construction waste or as material removed from use.

Most treated wood waste is and has been disposed in municipal solid waste landfills. Treated wood waste is not a hazardous waste according to US EPA hazardous waste regulations. California regulations would classify most treated wood as a non-RCRA (California-only) hazardous waste based on total threshold limit concentrations (TTLC) of the preservative chemicals and/or the aquatic toxicity characteristic standard. However, the state Department of Toxic Substances (DTSC) has issued letters granting variance from the hazardous waste disposal requirements provided that the treated wood waste is disposed in lined sections of landfills. Treated wood waste from utility companies is exempt from hazardous waste regulation by legislation.

Estimates have been made of amounts of treated wood reaching landfills. The Integrated Waste Management Board (IWMB) estimates that 28% of the waste reaching landfills is construction and demolition debris (C&D)[1]. It has also been estimated that 17% of soft wood used in construction is pressure treated[2]. This would mean that less than 5% of the waste reaching landfills from C&D was treated wood waste. Other treated wood waste comes from utilities, but there has been a serious effort to divert this waste either to reuse or to waste to energy projects. Discussions with landfill operators generally produced the response that treated wood waste was 1-2% of their waste stream.

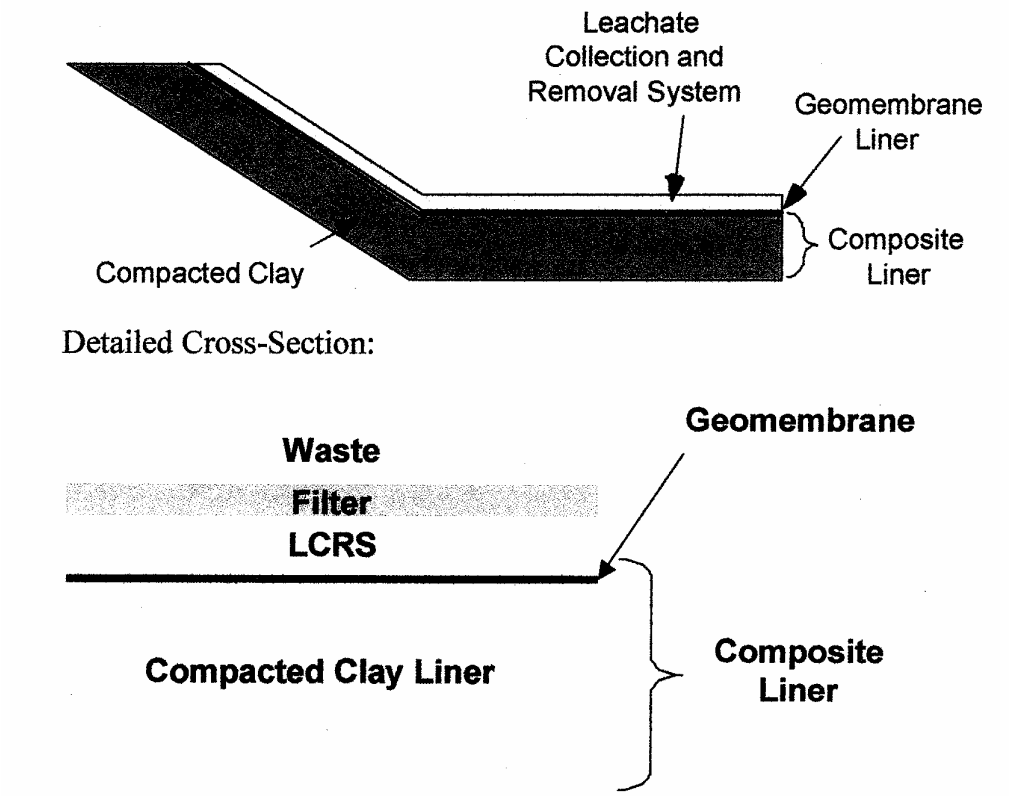
Selection of Landfills for This Study

Landfills for this study were selected based on availability of data. Landfills are administered by the Regional Water Quality Control Boards (RWQCBs). After reviewing available information, Regional Boards whose regions included Class II and III landfills were contacted to determine which landfills had composite liners. The landfills were contacted directly to determine whether or not they accepted treated wood waste. To be included in this study, landfills had to either accept or reject all of the types of treated wood described above. If they accepted some types, but not others, they were eliminated. Data in RWQCB files in Region 2, Region 5F and Region 5S were reviewed. This produced data from 10 different counties across California. Generally, landfills selected for this study analyzed leachate for all of the chemicals selected for inclusion in this study in each of the last 3 years. Selecting landfills with full data sets allows comparison across chemical types. Having three years of data allows comparison of year on year variability of chemical concentrations in the leachate.

Lined Landfills

Lined landfills are designed to prevent hazardous chemicals that might leach from waste from reaching the environment. Composite lined landfills such as those currently permitted to receive treated wood waste have multiple barrier layers, leachate collection systems and extensive groundwater monitoring requirements. Regulations allow the leachate to be returned to the lined landfill cell that the leachate originated from, but generally, leachate is collected and removed from the landfill at regular intervals and

disposed of either to a sewage treatment plant or to a lined evaporation pond. A typical landfill design is illustrated below[3]:



The minimum thickness of the compacted clay liner shall not be less than 2-feet, unless an alternative design has been approved by the California Regional Water Quality Control Board (RWQCBs). Chemical concentrations in the leachate are monitored as specified by the RWQCBs. In addition, groundwater underneath the landfill and possibly other leak detection devices such as lysimiters under the clay liner are monitored to determine if the system is working properly. The landfill is also tested for leaks at least annually. All results are reported to the CRWQCB, and the information is available to the public.

Constituents of Concern

Constituents of Concern (COCs) are the chemicals that must be monitored at the landfills. The COCs for a particular facility are determined by the CRWQCB based on analyses that are done at least every 5 years that measure several hundred chemicals. Some landfills monitor the entire list every year and others monitor for a more limited list more frequently.

This study reviews levels of chemicals that might come from treated wood in the leachate from landfills. The chemicals selected are inorganic chemicals arsenic, chromium, chromium VI, copper, and zinc and organic chemicals, benzo(a)pyrene, naphthalene and pentachlorophenol. Chromium VI is considered to be a more toxic form of chromium. The inorganic chemicals represent copper napthante and CCA, CA-B, CBA-A, ACZA

and ACQ water-based preservatives. Benzo(a)pyrene and naphthalene are constituents of creosote treatment.

It is important to note that the presence in leachate of chemicals sometimes used for wood preservation does not prove that they came from preserved wood. There are other, potential sources that may be as or more significant than the disposed treated wood. Arsenic, chrome, copper, and zinc are naturally occurring, common elements in the earth's crust. Studies have shown that arsenic is ubiquitous in California soils[4]. Most soil will contain about 1 to 5 mg/Kg of arsenic. Naphthalene and benzo(a)pyrene are found naturally in coal, petroleum, and as combustion by-products. Agricultural or other industrial waste may contain the same chemicals. Bio-chemical reactions within the landfill may dissolve and mobilize trace metals from any of these sources.

Screening Levels

There are a variety of criteria that could be compared to the chemical concentrations in the landfill leachate. Because the leachate is generally sent to a waste treatment plant (POTW), it may not have chemical concentrations higher than those acceptable to the treatment facility. However, because one of the concerns about disposal of treated wood waste is the potential threat to groundwater as a source of drinking water, Maximum Contaminant Levels[5] (MCLs) set by US EPA regulate allowable concentrations of chemicals in drinking water. Comparing concentrations in leachate to acceptable levels in drinking water is a very conservative assessment. MCLs are available for all COCs reviewed in this report except for zinc and naphthalene. For zinc, a secondary standard of 5 mg/L can be used as a target value. For naphthalene, the State of California has established an action level of 0.17 mg/L as a drinking water limit under Proposition 65[6]. The data evaluation below uses these criteria as a first tier screen.

As described below, for some of the chemicals in this study, analytical detection limits are above MCL values. Also, in a few instances for the inorganic chemicals, particularly for arsenic, concentrations in the leachate are above the MCL. Modeling can be used to determine whether these values in leachate would be expected to generate unacceptable concentrations in ground water, based on predicted leaching rates through composite liners. The U.S. Environmental Protection Agency's Tier I Industrial Waste Management Evaluation Model (IWEM)[7] has been used to determine what leachate concentrations threshold value (LCTV) would not be expected to produce unacceptable concentrations in groundwater. Maximum values found in this study are compared to the values calculated in this model. Model calculations are shown in Appendix I.

Units: mg/L	Screening Level	LCTV
Arsenic	0.05 (0.01)[a]	5
Chromium	0.05	1000
Cr VI	0.021	5
Copper	1	1000
Zinc	5	1000
Pentachlorophenol	0.001	80
Naphthalene	0.17	1000
Benzo(a)pyrene	0.0002	1000

[a] Current MCL 0.05, 0.01 MCL as of 2006.

Data Collection and Evaluation

Data Collection

Lined landfills that generate data on the majority of the wood treatment chemicals were chosen for the study. Of the ten sites selected, seven accept treated wood waste and three do not accept treated wood waste. The landfills are located in 10 different California counties, providing a reasonable geographic distribution.

Landfill	Accept	County	Class
BUENA VISTA	Yes	Amador	II
HAY ROAD LANDFILL	Yes	Solano	II
OSTROM ROAD LANDFILL	Yes	Yuba	II
ROCK CREEK LANDFILL	Yes	Calaveras	II
WESTERN REGIONAL LANDFILL	Yes	Placer	III
SANIFILL INC. - McKITTRICK SITE	Yes	Kern	II
VASCO ROAD	Yes	Alameda	III
FINK ROAD LANDFILL	No	Stanislaus	II
YOLO COUNTY CENTRAL LANDFILL	No	Yolo	II/III
KIEFER	No	Sacramento	III

All data were abstracted from publicly available reports. Data was collected from the 2001, 2002 and 2003 reports, except for Yolo County Landfill, where data from 2003 was not yet available and the 2000, 2001 and 2002 reports were used and Vasco Road Landfill, where data from the last two quarters of 2000, 2001, 2002 and the first two quarters of 2003 were used. Data from one of the leachate collection areas was excluded from this study because it only holds incinerator ash and not other types of waste and so results are not comparable to other site. Complete data sets are included as Appendix 1. Complete report references are included as Appendix 2.

Data Evaluation

Mean values for each chemical for each site were calculated. These values are most representative of long-term concentrations in the leachate. Maximum concentrations for each site are also reported. If the chemical was not detected in the sample, or was present at a trace level between the method detection limit and the reporting limit, one-half the value of the reporting limit was used to calculate the mean. If a chemical was never detected in any sample from the landfill, a less than code (<) is used in the summary table to indicate that the mean was calculated from method reporting limit values only or that the maximum values is a reporting limit. Method reporting limits very depending on the laboratory and the sample involved. These may range for example from 10 to 1000 depending on the lab and the sample.

Inorganic Constituents

The following tables compare the mean values of inorganic constituents from the landfills accepting or not accepting treated wood waste to MCL values for the inorganic constituents selected for review in this study and maximum values to the U.S. Environmental Protection Agency's Tier I IWEM value.

Landfills Accepting Treated Wood Waste

Mean Units: mg/L	Rock Creek	Ostrom	Hay Road	Western	Buena Vista	McKittrick	Vasco Road	MCL
Arsenic	0.014	0.021	0.031	0.015	0.010	**0.051**	0.016	**0.05 (0.01)[a]**
Chromium	<0.005	0.028	0.0044	<0.005	0.0071	0.035	0.019	**0.05**
Cr VI	<0.0025	0.021	0.0036	0.012	<0.0025	NA	NA	**0.021**
Copper	0.0059	0.0094	0.013	<0.005	<0.005	<0.015	0.0076	**1**
Zinc	0.027	0.081	0.057	<0.020	0.10	0.089	0.025	**5**

[a] Current MCL 0.05, 0.01 MCL as of 2006.
NA – Not analyzed

Landfills Not Accepting Treated Wood Waste

Mean Units: mg/L	Fink	Yolo	Kiefer	MCL
Arsenic	0.05	0.016	0.013	**0.05 (0.01)[a]**
Chromium	0.01	0.034	<0.0042	**0.05**
Cr VI	0.0051	<0.0015	<0.0025	**0.021**
Copper	0.004	<0.0043	<0.0042	**1**
Zinc	0.01	0.0069	<0.0067	**5**

[a] Current MCL 0.05, 0.01 MCL as of 2006.

Landfills Accepting Treated Wood Waste

Maximum Units: mg/L	Rock Creek	Ostrom	Hay Road	Western	Buena Vista	McKittrick	Vasco Road	LCTV
Arsenic	0.053	0.027	0.089	0.03	0.012	0.073	0.042	**5[a]**
Chromium	<0.010	0.058	0.1	<0.01	0.01	0.073	0.11	**1000**
Cr VI	<0.005	0.12	0.016	0.026	<0.005	NA	NA	**5**
Copper	0.012	0.026	0.083	<0.01	<0.01	0.05	0.11	**1000**
Zinc	0.12	0.19	0.6	0.021	0.19	0.173	0.36	**1000**

[a] Current MCL 0.05, 0.01 MCL as of 2006.
NA – Not analyzed

Landfills Not Accepting Treated Wood Waste

Maximum Units: mg/L	Fink	Yolo	Kiefer	LCTV
Arsenic	0.13	0.021	0.027	**5[a]**
Chromium	0.02	0.1	<0.01	**1000**
Cr VI	0.01	<0.006	<0.005	**5**
Copper	0.005	<0.01	<0.01	**1000**
Zinc	0.027	0.31	<0.02	**1000**

[a] Current MCL 0.05, 0.01 MCL as of 2006.

Mean concentrations of chromium, chromium VI, copper and zinc are all less than their respective MCLs in landfills accepting treated wood waste. They are also less than the MCL at landfills not accepting treated wood waste. Overall, both types of landfills have similar concentrations of the constituents of interest.

Maximum values of copper and zinc are all below the MCL. Mean concentrations of arsenic are generally below the current MCL, but above the MCL value that takes effect in 2006. Maximum values of arsenic and chromium are above the MCL at some sites, however, all leachate concentrations are well below the Tier I IWEM model calculation.

Organic Constituents

Benzo(a)pyrene and pentachlorophenol were not detected in any samples analyzed. Naphthalene was occasionally detected, but was always below the screening level. Mean values for benzo(a)pyrene and pentachlorophenol derived from the detection limits are substantially higher than their MCLs. As described above, modeling has been used to determine whether these detection limit values in leachate would be expected to generate unacceptable concentrations in ground water based on predicted leaching rates through composite liners. The tables below compare maximum concentrations based on detection limits for benzo(a)pyrene, pentachlorophenol and naphthalene with the LCTV calculated from the IWEM model.

Landfills Accepting Treated Wood Waste

Maximum Units: mg/L	Rock Creek	Ostrom	Hay Road	Western	Buena Vista	McKittrick	Vasco Road	LCTV
Pentachlorophenol	<0.050	<1	<0.2	<0.2	<0.05	<0.05	NA	80
Naphthalene	<0.020	<0.01	0.012	<0.01	<0.0025	<0.0032	0.27	1000
Benzo(a)pyrene	<0.010	<0.2	<0.04	<0.04	<0.02	<0.01	NA	1000

NA – not analyzed
mg/L = parts per million (ppm)

Landfills Not Accepting Treated Wood Waste

Maximum Units: mg/L	Fink	Yolo	Kiefer	LCTV
Pentachlorophenol	<0.01	<0.18	<0.05	80
Naphthalene	<0.002	0.11	0.0027	1000
Benzo(a)pyrene	<0.002	<0.0085	<0.01	1000

mg/L = parts per million (ppm)

All values for organics are much less than the LCTV.

Conclusions

These results support a conclusion that most metals that might come from treated wood chemicals in landfill leachate are below drinking water standards and, therefore, present no significant risk of contaminating drinking water. Arsenic and the organic chemicals which might result from treated wood products were either below the drinking water standard or below the Limit Threshold Concentration Value modeled for landfills with composite liners. The chemicals summarized in this study are present in many types of waste, not just treated wood and, in fact, the chemical levels in leachate from landfills accepting treated wood are similar to levels at landfills that do not. In summary, the study supports the safety of the current practice of disposal of treated wood waste in composite-lined landfills.

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Appendices

Appendix I: Landfill Leachate Concentration Model Calculations

MEMO

To: WWPI
From: Sarah Foster, Paul Chrostowski, CPF Associates, Inc.
Date: March 16, 2004
Subj: Industrial Waste Management Evaluation Model (IWEM) Tier 1 Data

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Introduction

Information from the U.S. Environmental Protection Agency's landfill modeling using the Industrial Waste Management Evaluation Model (IWEM) is provided in this memo.[1] As outlined in the proposal for this project, the results from USEPA's Tier 1 modeling using IWEM were compiled for a list of compounds representative of a number of wood treatment preservatives.

The wood preservatives addressed in this compilation consist of:

- CCA (chromated copper arsenate),
- creosote,
- pentachlorophenol,
- ACZA (ammoniacal copper zinc arsenate), and
- disodium octaborate tetrahydrate (borates).

The specific compounds selected to represent these wood preservative systems consist of:

- pentachlorophenol,
- benzo(a)pyrene and naphthalene to address creosote (benzo(a)pyrene to address potential carcinogenic effects and naphthalene to address non-cancer effects),
- chromium, copper and arsenic to address CCA, and
- zinc to address ACZA.

Boron and borates were not addressed in USEPA's IWEM modeling.

The IWEM model calculates leachate concentration threshold values (LCTVs) for landfills that can be compared to actual or potential leachate levels. The LCTV is defined as the maximum leachate concentration in a landfill for which a chemical in groundwater in a downgradient monitoring well is not likely to exceed a specified threshold concentration (either a drinking water maximum contaminant level (MCL) or a health-based number). USEPA states that the Tier 1 LCTVs are expected to be protective in 90% of the landfill cases. Also, all LCTVs assume the portion of a landfill occupied by the waste of concern is 100%.

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[1] U.S. Environmental Protection Agency. 2002. Industrial Waste Management Evaluation Model (IWEM), available for download from http://www.epa.gov/epaoswer/non-hw/industd/iwem.htm. Version 1.0. Also, U.S. Environmental Protection Agency. 2002. Industrial Waste Management Evaluation Model (IWEM) Technical Background Document. Office of Solid Waste and Emergency Response. August 2002. EPA 530-R-02-012.

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The IWEM model also calculates dilution attenuation factors (DAFs) for organic compounds. The DAF is determined by dividing the LCTV by the threshold monitoring well concentration (i.e., DAF = LCTV/MCL or DAF = LCTV/health-based number). The DAF reflects the capability of the unsaturated and saturated zones below a landfill, and landfill liners, to slow the transport of constituents from leachate in a landfill to a monitoring well.

The IWEM model does not provide DAFs for metals because the partition coefficients (Kd values) for these constituents are nonlinear. Rather than use a single Kd value for each metal, IWEM includes sorption isotherms for each metal based on multiple sets of Kd values that reflect variations in groundwater pH and other geochemical conditions. The sorption isotherms are built-in to the IWEM model. An approximation of the DAF for a set of specific conditions evaluated by IWEM can, however, be calculated as described above for informational purposes.

Tier 1 Information

The Tier 1 modeling results from IWEM were calculated by USEPA based on default input information compiled by the Agency that describes chemical properties and landfill characteristics. USEPA collected the landfill information from several hundred facilities across the U.S. during a 1986 survey. All landfills in the modeling were assumed to be closed and capped, and at their maximum capacity.

Table 1 presents the chemical-specific input information used by USEPA for the selected wood preservative constituents in its Tier 1 modeling. Table 2 presents the Tier 1 results for each constituent for a composite liner scenario.[2] Where possible, USEPA calculated LCTVs based on both drinking water MCLs and health-based numbers. Note that these LCTVs are highly conservative with respect to the organic compounds due to the assumption of no degradation.

In general, the results suggest that treated wood products can be disposed of safely in landfills with composite liners. The choice of whether to rely on an MCL-based LCTV or a health-based LCTV, if both are available, is apparently negotiable with the relevant state regulatory agency.[3] These results may also be put into perspective by comparing the Tier 1 LCTVs to available leachate information from treated wood products to determine which landfill scenarios may be acceptable under USEPA's default modeling assumptions.

[2] USEPA also evaluated two other landfill liner scernarios – no liner and a single liner.
[3] Personal communication with D. Cozzie, Office of Solid Waste and Emergency Response. USEPA, July 3, 2003.

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Table 1
Tier I Industrial Waste Evaluation Model (IWEM): Input Information

Compound	Koc (log Koc) for organics (a)	Retardation factor	Decay coefficient ($year^{-1}$)	Carcinogen (C) or Noncarcinogen (NC)	Maximum Contaminant Level (MCL) (mg/L)	Health-Based Number for Water Ingestion (mg/L)	Health-Based Number for Inhalation from Water Use (mg/L)
Organic Compounds							
Benzo(a)pyrene	631,000 (5.8)	1700	0	C	0.0002	0.000013	0.0054
Naphthalene	1,290 (3.11)	4.4	0	NC	--	0.49	0.019
Pentachlorophenol	1,150 (3.06)	4.0	0	C	0.001	0.00081	54
Inorganic Compounds							
Arsenic	--	--	0	C	0.05	0.000064	--
Chromium III	--	--	0	NC	0.1	36.7	--
Chromium VI	--	--	0	NC	0.1	0.0734	--
Copper	--	--	0	NC	1.3	--	--
Zinc	--	--	0	NC	--	7.34	--
Boron/Borate	NA	NA	NA	NA	NA	NA	NA

Notes

NA = Not analyzed by USEPA in IWEM.

-- = not applicable.

(a) Rather than use a single Kd value for each metal, IWEM includes sorption isotherms for each metal that are based on multiple sets of Kd values that reflect variations in groundwater pH and other geochemical conditions. The sorption isotherms are built-in to the IWEM model.

Sources of Tier 1 data:

USEPA (2002a) - U.S. Environmental Protection Agency. 2002. Industrial Waste Management Evaluation Model (IWEM) Technical Background Document. Office of Solid Waste and Emergency Response. August 2002. EPA 530-R-02-012. Appendix B tables provide chemical-specific properties. Appendix C tables provide source input parameters (e.g., infiltration rates). Appendix F tables provide Tier 1 LCTV results.

USEPA (2002b) - U.S. Environmental Protection Agency. 2002. Industrial Waste Management Evaluation Model (IWEM), available for download from http://www.epa.gov/epaoswer/non-hw/industd/iwem.htm. Version 1.0.

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Table 2
Tier I Industrial Waste Evaluation Model (IWEM):
Modeling Results

Compound	Leachate Concentration Threshold Value (LCTV) (mg/L): Composite Liner (a)		
	Dilution attenuation factor (DAF)	LCTV Based on MCL	LCTV Based on Health-Based Number (b)
Organic Compounds			
Benzo(a)pyrene	*	1,000 (d,e)	1,000 (d,e)
Naphthalene	110,000	--	1,000 (d,e)
Pentachlorophenol	99,000	97	80
Inorganic Compounds			
Arsenic	*	5.0 (c)	5.0 (c)
Chromium III	*	1,000 (e)	1,000 (e)
Chromium VI	*	5 (c)	5 (c)
Copper	*	1,000 (e)	--
Zinc	*	--	1,000 (e)
Boron/Borate	NA	NA	NA

Notes

NA = Not analyzed by USEPA in IWEM.

-- = not applicable.

* = DAF not provided because groundwater concentration was exceedingly low and/or the LCTV was capped.

(a) Composite infiltration rate - min = 0; median = 0; max = 4.01E-4 m/year.

(b) All LCTVs are based on health-based numbers for water ingestion, except for naphthalene for which the LCTV is based on inhalation exposure (associated with showering).

(c) Value set at TC Rule concentration cap.

(d) Value exceeds the compound's water solubility.

(e) Value set at leachate concentration threshold value (LCTV) cap of 1000 mg/L.

LCTV definition: The LCTV is the maximum leachate concentration in a landfill for which water in a downgradient monitoring well is not likely to exceed the specified threshold concentration (either an MCL or a health-based number). The Tier 1 LCTVs are expected to be protective in 90% of the landfill cases. All LCTVs assume the portion of landfill occupied by the waste of concern is 100%.

Sources of Tier 1 data:

USEPA (2002a) - U.S. Environmental Protection Agency. 2002. Industrial Waste Management Evaluation Model (IWEM) Technical Background Document. Office of Solid Waste and Emergency Response. August 2002. EPA 530-R-02-012. Appendix B tables provide chemical-specific properties. Appendix C tables provide source input parameters (e.g., infiltration rates). Appendix F tables provide Tier 1 LCTV results.

USEPA (2992b) - U.S. Environmental Protection Agency. 2002. Industrial Waste Management Evaluation Model (IWEM), available for download from http://www.epa.gov/epaoswer/non-hw/industd/iwem.htm. Version 1.0.

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Appendix II: Landfill Data

Buena Vista

Constituent	Units	2001	2002	2003		Mean	Max
Arsenic	mg/l	0.008	0.012	NA		0.010	0.012
Chromium	mg/l	0.0041	0.01	NA		0.0071	0.01
Chromium VI	mg/l	ND <0.005	ND <0.005	NA		< 0.0025	< 0.005
Copper	mg/l	ND <0.010	ND <0.010	NA		< 0.005	< 0.01
Zinc	mg/l	0.19	ND <0.020	NA		0.10	0.19
Pentachlorophenol	mg/l	ND <0.050	ND <0.100	NA		< 0.0375	< 0.05
Naphthalene	mg/l	ND <0.0005	ND <0.0025	ND <0.0005		< 0.0006	< 0.0025
Benzo(a)Pyrene	mg/l	ND <0.010	ND <0.020	NA		< 0.0075	< 0.02

Treated Wood Accepted?	Yes

NOTES:
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)

Fink Road

		LF-3, Cell #1 and #2 Lift Station[1]					LF-2, Cell #2 and #3, Sump Outfall					LF-2 Cell #3 Sump							
Constituent	**Units**	**2001**	**2Q 2002**	**4Q 2002**	**2Q 2003**	**4Q 2003**	**2001**	**2Q 2002**	**4Q 2002**	**2Q 2003**	**4Q 2003**	**2001**	**2Q 2002**	**4Q 2002**	**2Q 2003**	**4Q 2003**		**Mean[1]**	**Max[1]**
Arsenic	mg/l	ND <0.040	0.430	0.240	0.25	0.47	0.004	0.009	0.085	0.03	0.012	0.033	0.029	0.13	0.051	t <0.05		0.05	0.13
Chromium	mg/l	ND <0.50	ND <1	ND <1	t <0.5	ND <0.5	t <0.010	ND <0.010	0.02	t <0.010	t <0.010	t <0.010	ND <0.010	ND <0.010	t <0.010	ND <0.010		0.01	0.02
Chromium VI	mg/l	ND <0.020	ND <0.004	ND <0.020	ND <0.002	t <0.004	ND <0.020	ND <0.002	t <0.002	t <0.002	t <0.002	ND <0.020	0.002	0.01	0.0095	NA		0.0051	0.01
Copper	mg/l	ND <0.50	ND <1	0.34	0.2	t <0.5	ND <0.010	ND <0.010	0.005	ND <0.010	0.0027	ND <0.010	ND <0.010	t <0.002	ND <0.010	ND <0.010		0.004	0.005
Zinc	mg/l	ND <0.50	ND <1	0.31	t <0.5	ND <0.5	ND <0.010	ND <0.010	0.017	0.016	0.013	ND <0.010	0.019	0.027	0.011	t <0.010		0.01	0.027
Pentachlorophenol	mg/l	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	NA		< 0.005	< 0.01
Naphthalene	mg/l	ND <0.0005	ND <0.0005	ND <0.002	ND <0.0005	ND <0.002	ND <0.0005	ND <0.0005	ND <0.002	ND <0.0005	ND <0.002	ND <0.002	ND <0.0005	ND <0.002	ND <0.0005	NA		< 0.0006	< 0.002
Benzo(a)Pyrene	mg/l	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	ND <0.002	NA		< 0.001	< 0.002

Treated Wood Accepted?	No

NOTES:

[1] Not included in mean or max because unit accepts fly ash only

t = trace present above method detection limit, but below reporting limit indicated

NA = Not Analyzed

ND = Not Detected

Half the reporting limit for "not detected" and "trace" values is used in calculating the mean

mg/L = parts per million (ppm)

Hay Road

		S-1			S-2.1		S-2.2A	S-2.2B			S-4.1	S-5.1A					Overall	
Constituent	**Units**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2003**	**2001**	**2002**	**2003**		**Mean**	**Max**	**Mean**	**Max**
pH	su	6.7	6.85	6.92	7.5	7.17	6.47	6.9	7.51	6.79	6.98	5.92	7.19	7.66					
Arsenic	mg/l	0.012	0.0088	0.0095	0.012	ND <0.005	0.022	ND <0.20	ND <0.005	0.017	0.036	ND <0.20	0.029	0.044		0.03	0.044	0.031	**0.089**
Chromium	mg/l	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	0.011	ND <0.010	0.019	0.016		0.007	0.019	0.0044	**0.1**
Chromium VI	mg/l	ND <0.005	ND <0.005	NA	ND <0.005	ND <0.005	NA	ND <0.005	ND <0.005	NA	NA	0.016	ND <0.005	NA		0.004	0.016	0.0036	0.016
Copper	mg/l	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	0.083		0.011	0.083	0.013	0.083
Zinc	mg/l	ND <0.020	ND <0.020	ND <0.020	ND <0.020	ND <0.020	0.32	ND <0.020	ND <0.020	0.19	ND <0.020	0.044	0.024	0.025		0.053	0.32	0.057	0.6
Pentachlorophenol	mg/l	ND <0.050	ND <0.200	ND <0.200	ND <0.050	ND <0.200	ND <0.200	ND <0.050	ND <0.200	ND <0.200	ND <0.200	ND <0.050	ND <0.200	ND <0.200		< 0.077	< 0.2	< 0.077	< 0.2
Naphthalene	mg/l	t <0.001	t <0.001	ND <0.001	0.0039	0.0055	0.012	ND <0.002	ND <0.001	t <0.005	ND <0.110	ND <0.010	ND <0.001	ND <0.001		0.007	0.012	0.0039	0.012
Benzo(a)Pyrene	mg/l	ND <0.010	ND <0.040	ND <0.040	ND <0.010	ND <0.040	ND <0.040	ND <0.010	ND <0.040	ND <0.040	ND <0.040	ND <0.010	ND <0.040	ND <0.040		< 0.015	< 0.04	< 0.015	< 0.04

		S-5.1B			S-9.1A			S-9.1B			S-11.1			S-11.2			
Constituent	**Units**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**		**Mean**	**Max**
pH	su	7.1	7.57	7.29	7.09	7.2	7.35	7.56	7.27	7.02	7.52	7.52	6.93	7.63			
Arsenic	mg/l	ND <0.20	0.020	0.076	0.089	0.011	0.022	0.0091	0.011	0.016	0.0053	ND <0.005	0.0076	ND <0.005		0.032	0.089
Chromium	mg/l	ND <0.010	0.01	0.1	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010		0.001	**0.1**
Chromium VI	mg/l	ND <0.005	ND <0.005	NA	ND <0.005	ND <0.005	NA	ND <0.005	ND <0.005	NA	ND <0.005	0.0068	NA	ND <0.005		0.003	0.0068
Copper	mg/l	ND <0.010	0.04	ND <0.010	0.013	ND <0.010	0.016	0.055	ND <0.010	0.032	0.012	ND <0.010	ND <0.010	ND <0.010		0.016	0.055
Zinc	mg/l	ND <0.020	0.6	ND <0.020	ND <0.020	0.047	ND <0.020	0.041	0.033	ND <0.020	ND <0.020	ND <0.020	ND <0.020	ND <0.020		0.062	0.6
Pentachlorophenol	mg/l	ND <0.050	ND <0.200	ND <0.200	ND <0.050	ND <0.200	ND <0.200	ND <0.050	ND <0.200	ND <0.200	ND <0.050	ND <0.200	ND <0.200	ND <0.050		< 0.077	< 0.2
Naphthalene	mg/l	ND <0.002	ND <0.0025	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.005	ND <0.001	ND <0.001	ND <0.005	ND <0.005	t <0.001	t <0.005		< 0.001	< 0.005
Benzo(a)Pyrene	mg/l	ND <0.010	ND <0.040	ND <0.040	ND <0.010	ND <0.040	ND <0.040	ND <0.010	ND <0.040	ND <0.040	ND <0.010	ND <0.040	ND <0.040	ND <0.010		< 0.015	< 0.04

Treated Wood Accepted?	yes

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)
S-2.1 was not sampled in 2003 because it was dry
S-2.2A was not sampled in 2001 or 2002
S-11.1 was not sampled in 2002 or 2003 because it was dry

Kiefer Landfill

Constituent	Units	2001	2002	2003		Mean	Max
Arsenic	mg/l	ND <0.005	0.008	0.027		0.013	0.027
Chromium	mg/l	ND <0.005	ND <0.01	ND <0.01		< 0.0042	< 0.01
Chromium VI	mg/l	ND <0.005	ND <0.005	ND <0.005		< 0.0025	< 0.005
Copper	mg/l	ND <0.005	ND <0.01	ND <0.01		< 0.0042	< 0.01
Zinc	mg/l	ND <0.02	ND <0.01	ND <0.01		< 0.0067	< 0.02
Pentachlorophenol	mg/l	ND <0.050	ND <0.025	ND <0.050		< 0.021	< 0.05
Naphthalene	mg/l	0.001	ND <0.0005	0.0027		0.0013	0.0027
Benzo(a)Pyrene	mg/l	ND <0.010	ND <0.010	ND <0.010		< 0.005	< 0.01

Treated Wood Accepted?	No

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)

McKittrick

		Leachate A			Leachate B				
Constituent	**Units**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**Mean**	**Max**
Arsenic	mg/l	0.072	0.059	ND <0.01	0.037	0.073	0.061	0.051	0.073
Chromium	mg/l	ND <0.05	0.073	ND <0.01	ND <0.05	0.053	0.027	0.035	0.073
Copper	mg/l	ND <0.05	ND <0.02	ND <0.02	ND <0.05	ND <0.02	ND <0.02	< 0.015	< 0.05
Zinc	mg/l	ND <0.05	0.173	0.092	ND <0.05	0.144	0.072	0.089	0.173
Pentachlorophenol	mg/l	ND <0.050	ND <0.010	ND <0.010	ND <0.050	ND <0.010	ND <0.010	< 0.012	< 0.05
Naphthalene	mg/l	ND <0.0032	ND <0.001	ND <0.001	ND <0.0032	ND <0.001	ND <0.001	< 0.0009	< 0.0032
Benzo(a)Pyrene	mg/l	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	< 0.005	< 0.01

Treated Wood Accepted?	Yes

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)

Ostrom

		Sump-1A			Sump-1 Temp			Sump-2A				
Constituent	**Units**	**2000**	**2001**	**2002**	**2000**	**2001**	**2002**	**2000**	**2001**	**2002**	**Mean**	**Max**
pH	s.u.		7.0	7.2		7.1	7.0		7.4	7.2		
Arsenic	mg/l	0.023	0.024	0.027	0.013	0.017	0.017	0.024	0.022	0.023	0.021	0.027
Chromium	mg/l	0.032	0.015	0.019	0.058	0.041	0.056	ND <0.010	ND <0.010	0.025	0.028	0.058
Chromium VI	mg/l	0.023	0.013	ND <0.005	ND <0.005	0.12	0.0054	ND <0.005	0.5[a]	ND <0.005	0.021	0.12
Copper	mg/l	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	0.024	ND <0.010	0.026	ND <0.010	0.0094	0.026
Zinc	mg/l	0.045	0.022	0.049	0.09	0.14	0.14	0.033	0.19	0.023	0.081	0.19
Pentachlorophenol	mg/l	ND <0.200	ND <0.200	ND <1.0	ND <0.200	ND <0.200	ND <0.050	ND <0.200	ND <0.100	ND <0.050	< 0.122	< 1
Naphthalene	mg/l	ND <0.005	ND <0.005	t <0.005	ND <0.010	ND <0.010	t <0.005	ND <0.005	ND <0.005	t <0.005	< 0.0031	< 0.01
Benzo(a)Pyrene	mg/l	ND <0.040	ND <0.040	ND <0.200	ND <0.040	ND <0.040	ND <0.010	ND <0.040	ND <0.020	ND <0.010	< 0.024	< 0.2

Treated Wood Accepted?	Yes

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)

[a] Estimated from limited sample - value not included in mean or max calculation

Western

		M-11			M-12			M-13			M-14					
Constituent	**Units**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**		**Mean**	**Max**
pH	su	7.3	7.5		7.96	6.84		6.91	6.79		7.01	6.79				
Arsenic	mg/l	ND <0.01	0.0130	NA	0.01	0.018	NA	0.016	0.017	NA	0.012	0.03	NA		0.015	0.03
Chromium	mg/l	ND <0.01	ND <0.01	NA	ND <0.01	ND <0.01	NA	ND <0.01	ND <0.01	NA	ND <0.01	ND <0.01	NA		< 0.005	< 0.01
Chromium VI	mg/l	ND <0.005	ND <0.005	NA	ND <0.005	ND <0.005	NA	0.026	ND <0.005	NA	ND <0.005	ND <0.005	NA		0.012	0.026
Copper	mg/l	ND <0.01	ND <0.01	NA	ND <0.01	ND <0.01	NA	ND <0.01	ND <0.01	NA	ND <0.01	ND <0.01	NA		< 0.005	< 0.01
Zinc	mg/l	ND <0.02	ND <0.02	NA	ND <0.02	ND <0.02	NA	ND <0.02	ND <0.02	NA	ND <0.02	0.021	NA		0.020	0.021
Pentachlorophenol	mg/l	ND <0.050	ND <0.200	NA	ND <0.050	ND <100	NA	ND <0.050	ND <0.200	NA	ND <0.050	ND <0.200	NA		< 0.056	< 0.2
Naphthalene	mg/l	t <0.005	t <0.005	t <0.005	t <0.005	0.0056	t <0.010	t <0.005	t <0.005	t <0.010	ND <0.005	t <0.005	t <0.005		0.0032	< 0.01
Benzo(a)Pyrene	mg/l	ND <0.010	ND <0.040	NA	ND <0.010	ND <0.020	NA	ND <0.010	ND <0.040	NA	ND <0.010	ND <0.040	NA		< 0.011	< 0.04

Treated Wood Accepted?	yes

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)

Rock Creek Landfill

		Outfall			Pond			LDS-II-A			
Constituent	**Units**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2002**	**2003**	**Mean**	**Max**
pH	s.u.	6.7	8.04	8.08	9.1	9.28	8.33	6.79	6.81		
Arsenic	mg/l	ND < 0.050	ND <0.10	ND <0.10	0.053	ND <0.10	ND <0.10	ND <0.10	ND <0.10	0.014	**0.053**
Chromium	mg/l	ND <0.01	ND <0.01	ND <0.01	ND <0.01	ND <0.01	ND <0.01	ND <0.01	ND <0.01	< 0.005	< 0.010
Chromium VI	mg/l	ND < 0.005	ND < 0.005	ND < 0.005	ND < 0.005	ND < 0.005	ND < 0.005	ND < 0.005	ND < 0.005	< 0.0025	< 0.005
Copper	mg/l	ND <0.01	ND <0.01	ND <0.01	0.012	ND <0.01	ND <0.01	ND <0.01	ND <0.01	0.0059	0.012
Zinc	mg/l	0.021	ND <0.02	ND <0.02	ND <0.02	ND <0.02	ND <0.02	0.12	0.027	0.027	0.120
Pentachlorophenol	mg/l	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.050	< 0.025	< 0.050
Naphthalene	mg/l	ND <0.020	ND <0.005	ND <0.005	ND <0.010	ND <0.005	ND <0.005	ND <0.001	ND <0.005	< 0.004	< 0.020
Benzo(a)Pyrene	mg/l	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	ND <0.010	< 0.005	< 0.010

Treated Wood Accepted?	Yes

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)
No leachate was present in LDS-II-A until 2002

Vasco Road

SV1

Constituent	Units	2Q00	3Q00	4Q00	1Q01	2Q01	3Q01	4Q01	1Q02	2Q02	3Q02	4Q02	1Q03	Mean	Max
Arsenic	mg/l	0.004	0.005	ND <0.002	0.004	0.004	0.002	t <0.005	t <0.005	0.019	t <0.005	ND <0.005	t <0.005	0.0043	0.019
Chromium	mg/l	0.031	0.019	0.028	0.018	0.035	NA	ND <0.010	ND <0.010	ND <0.010	t <0.010	t <0.010	ND <0.010	0.0146	0.035
Copper	mg/l	0.006	0.005	ND <0.005	0.006	t <0.005	0.003	ND <0.010	ND <0.010	t <0.002	t <0.010	t <0.010	t <0.010	0.0043	< 0.006
Zinc	mg/l	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.020	NA	ND <0.020	ND <0.020	ND <0.020	ND <0.020	ND <0.020	ND <0.020	< 0.0155	< 0.05
Naphthalene	mg/l	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	t <0.001	t <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	< 0.5	< 0.001

Overall

Mean	Max
0.013	0.042
0.026	0.11
0.015	0.11
0.027	0.36
0.18	0.27

SV2

Constituent	Units	2Q00	3Q00	4Q00	1Q01	2Q01	3Q01	4Q01	1Q02	2Q02	3Q02	4Q02	1Q03	Mean	Max
Arsenic	mg/l	0.042	0.028	0.019	0.026	0.022	0.007	0.019	0.018	t <0.005	0.0075	0.0069	0.0094	0.0173	0.042
Chromium	mg/l	0.055	0.053	0.055	0.036	0.08	NA	ND <0.010	ND <0.010	ND <0.020	t <0.010	t <0.010	ND <0.005	0.0276	0.08
Copper	mg/l	0.006	ND <0.005	0.006	ND <0.005	t <0.005	ND <0.005	0.022	ND <0.010	t <0.002	t <0.010	t <0.010	t <0.010	0.0366	0.022
Zinc	mg/l	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.020	NA	0.034	ND <0.020	ND <0.020	ND <0.020	ND <0.020	ND <0.020	0.0176	< 0.05
Naphthalene	mg/l	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	t <0.001	ND <0.001	ND <0.001	< 0.05	< 0.001

SV3

Constituent	Units	2Q00	3Q00	4Q00	1Q01	2Q01	3Q01	4Q01	1Q02	2Q02	3Q02	4Q02	1Q03	Mean	Max
Arsenic	mg/l	0.01	0.017	0.015	0.017	0.018	0.001	0.005	0.008	0.0064	t <0.005	ND <0.005	0.0085	0.0092	0.018
Chromium	mg/l	0.074	0.062	0.073	0.05	0.11	NA	t <0.010	ND <0.010	ND <0.010	t <0.010	t <0.010	t <0.010	0.037	0.11
Copper	mg/l	0.04	ND <0.005	0.008	0.006	0.007	ND <0.010	ND <0.010	ND <0.010	ND <0.010	t <0.010	0.026	0.11	0.019	0.11
Zinc	mg/l	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.020	NA	t <0.020	0.02	ND <0.020	t <0.020	0.023	t <0.020	0.018	0.023
Naphthalene	mg/l	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	t <0.001	t <0.001	ND <0.001	ND <0.001	ND <0.001	ND <0.001	< 0.05	< 0.001

SV4

Constituent	Units	2Q00	3Q00	4Q00	1Q01	2Q01	3Q01	4Q01	1Q02	2Q02	3Q02	4Q02	1Q03	Mean	Max
Arsenic	mg/l	0.025	0.028	0.017	0.017	0.025	0.006	0.022	0.014	0.016	0.015	t <0.005	t <0.005	0.016	0.028
Chromium	mg/l	0.063	0.055	0.064	0.017	0.096	NA	ND <0.01	ND <0.01	ND <0.01	t <0.010	t <0.010	t <0.010	0.030	0.096
Copper	mg/l	0.02	0.012	0.007	0.036	0.008	ND <0.01	ND <0.01	ND <0.01	t <0.010	ND <0.01	t <0.010	ND <0.01	0.0098	0.036
Zinc	mg/l	ND <0.050	0.15	ND <0.050	0.36	ND <0.050	NA	0.026	t <0.020	ND <0.020	ND <0.020	ND <0.020	ND <0.020	0.060	0.36
Naphthalene	mg/l	0.11	0.12	0.12	0.055	0.19	0.19	0.24	0.27	0.25	0.27	0.25	0.21	0.19	0.27

SV5

Constituent	Units	2Q00	3Q00	4Q00	1Q01	2Q01	3Q01	4Q01	1Q02	2Q02	3Q02	4Q02	1Q03	Mean	Max
Arsenic	mg/l	0.022	0.006	0.008	0.022	0.033	0.009	0.021	0.026	0.015	0.0096	0.011	0.01	0.016	0.033
Chromium	mg/l	0.048	0.03	0.048	0.027	0.045	NA	ND <0.010	ND <0.010	ND <0.010	t <0.010	t <0.010	t <0.010	0.019	0.048
Copper	mg/l	0.013	0.018	0.007	ND <0.005	t <0.005	ND <0.010	t <0.010	ND <0.010	ND <0.010	ND <0.010	0.018	ND <0.010	0.0076	0.018
Zinc	mg/l	ND <0.050	ND <0.050	ND <0.050	ND <0.050	ND <0.050	NA	0.023	t <0.020	ND <0.020	ND <0.020	0.05	t <0.020	0.025	0.05
Naphthalene	mg/l	0.022	t <0.001	0.07	0.1	0.15	0.2	0.16	0.25	0.083	0.15	0.0048	0.071	0.11	**0.25**

Treated Wood Accepted?	yes

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)

Yolo

		Leachate Pump Station 1			Leachate Pump Station 2				
Constituent	**Units**	**2000**	**2001**	**2002**	**2000**	**2001**	**2002**	**Mean**	**Max**
Arsenic	mg/l	0.018	0.012	0.021	0.015	0.018	0.013	0.016	0.021
Chromium	mg/l	0.1	0.033	0.021	0.016	0.018	0.013	0.034	0.1
Chromium VI	mg/l	ND<0.002	ND <0.002	t <0.006	ND <0.002	ND <0.002	t <0.004	< 0.0015	< 0.006
Copper	mg/l	t <0.010	ND <0.002	t <0.010	t <0.010	t <0.010	t <0.010	< 0.0043	< 0.01
Zinc	mg/l	t <0.020	0.021	t <0.020	0.31	0.027	0.038	0.069	0.31
Pentachlorophenol	mg/l	ND <0.018	ND <0.180	ND <0.180	ND <0.018	ND <0.018	ND <0.017	< 0.036	< 0.18
Naphthalene	mg/l	0.11	ND <0.0004	t <0.100	0.11	ND <0.0008	ND <0.0012	0.045	0.11
Benzo(a)Pyrene	mg/l	ND <0.0008	ND <0.0085	ND <0.0084	ND <0.0008	ND <0.0008	ND <0.0008	< 0.0017	< 0.0085

Treated Wood Accepted?	No

NOTES:
t = trace present above method detection limit, but below reporting limit indicated
NA = Not Analyzed
ND = Not Detected
Half the reporting limit for "not detected" and "trace" values is used in calculating the mean
mg/L = parts per million (ppm)
[a] Estimated from limited sample

Overall - Metals

Landfills Accepting Treated Wood Waste

Units: mg/L	Rock Creek		Ostrom		Hay Road		Western		Buena Vista		McKittrick		Vasco Road			
	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Arsenic	0.014	0.053	0.021	0.027	0.031	0.089	0.015	0.03	0.01	0.012	**0.051**	0.073	0.016	0.042	0.034	0.089
Chromium	<0.005	<0.010	0.028	0.058	0.0044	0.1	<0.005	<0.01	0.0071	0.01	0.035	0.073	0.019	0.11	0.015	0.110
Cr VI	<0.0025	<0.005	0.021	0.12	0.0036	0.016	0.012	0.026	<0.0025	<0.005	NA	NA	NA	NA	0.008	0.120
Copper	0.0059	0.012	0.0094	0.026	0.013	0.083	<0.005	<0.01	<0.005	<0.01	<0.015	0.05	0.0076	0.11	0.009	0.110
Zinc	0.027	0.12	0.081	0.19	0.057	0.6	<0.020	0.021	0.1	0.19	0.089	0.173	0.025	0.36	0.057	0.600

Landfills Not Accepting Treated Wood Waste

Units: mg/L	Fink		Yolo		Kiefer			
	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Arsenic	0.05	0.13	0.016	0.021	0.013	0.027	0.046	0.130
Chromium	0.01	0.02	0.034	0.1	<0.0042	<0.01	0.016	0.100
Cr VI	0.0051	0.01	<0.0015	<0.006	<0.0025	<0.005	0.003	0.010
Copper	0.004	0.005	<0.0043	<0.01	<0.0042	<0.01	0.004	0.005
Zinc	0.01	0.027	0.0069	0.31	<0.0067	<0.02	0.008	0.310

Appendix III: Report References

Rock Creek Landfill Reports

Third and Fourth Quarter 2001 Semi-Annual,
2001 Annual and Five-Year Constituent of Concern
Monitoring Report
Rock Creek Solid Waste Facility
Calaveras County, CA
Prepared for
Calaveras County Public Works Department
Prepared By
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January 2002

Third and Fourth Quarter 2002 Semi-Annual,
2002 Annual Monitoring Report
Rock Creek Solid Waste Facility
Calaveras County, CA
Prepared for
Calaveras County Public Works Department
Prepared By
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January 2003

Third and Fourth Quarter 2003 Semi-Annual,
2003 Annual Monitoring Report
Rock Creek Solid Waste Facility
Calaveras County, CA
Prepared for
Calaveras County Public Works Department
Prepared By
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January 2004

Fink Road Landfill
2001 Fourth Quarter and Annual
Environmental Monitoring Summary Report
Fink Road Landfill
Stanislaus County, CA
Prepared for
Stanislaus County
Department of Public Works
1100 H Street
Modesto, CA 95354
Prepared by
Kleinfelder, Inc.
3077 Fite Circle
Sacramento, CA 94827
January 31, 2002

2002 Fourth Quarter and Annual
Environmental Monitoring Summary Report
Fink Road Landfill
Stanislaus County, CA
Prepared for
Stanislaus County
Department of Public Works
1100 H Street
Modesto, CA 95354
Prepared by
Kleinfelder, Inc.
3077 Fite Circle
Sacramento, CA 94827
January 31, 2003

2001 Fourth Quarter and Annual
Environmental Monitoring Summary Report
Fink Road Landfill
Stanislaus County, CA
Prepared for
Stanislaus County
Department of Public Works
1100 H Street
Modesto, CA 95354
Prepared by
Kleinfelder, Inc.
3077 Fite Circle
Sacramento, CA 94827
January 30, 2004

Ostrom Road Sanitary Landfill

2001 Fourth Quarter, 2001 Annual and Five-Year Constituent of Concern Monitoring Report
Ostrom Road Sanitary Landfill
Yuba County, California
Prepared for
Yuba Sutter Disposal, Inc.
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2002

2002 Fourth Quarter and Annual Monitoring Report
Ostrom Road Landfill
Yuba County, California
Prepared for
Norcal Waste Systems Ostrom Road Landfill, Inc.
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2003

2003 Fourth Quarter and Annual Monitoring Report
Ostrom Road Landfill
Yuba County, California
Prepared for
Norcal Waste Systems Ostrom Road Landfill, Inc.
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2004

Hay Road

Second Semi-Annual and 2001Annual Monitoring Report
Hay Road Landfill
Solano County, CA
Prepared for
Hay Road Landfill and Norcal Waste Systems, Inc
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2002

Second Semi-Annual and Annual 2002 Monitoring Report
Norcal Waste Systems Hay Road Landfill
Solano County, CA
Prepared for
Norcal Waste Systems Hay Road Landfill, Inc
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2003

Second Semi-Annual and Annual 2003 Monitoring Report
Norcal Waste Systems Hay Road Landfill
Solano County, CA
Prepared for
Norcal Waste Systems Hay Road Landfill, Inc
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2004

Western Regional Sanitary Landfill

Fourth Quarter and Annual 2001 Monitoring Report
Western Regional Sanitary Landfill
Placer County, CA
Prepared for
Golder Associates, Inc. and Western Placer Waste Management Authority
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2002

Fourth Quarter and Annual 2002 Monitoring Report
Western Regional Sanitary Landfill
Placer County, CA
Prepared for
Golder Associates, Inc. and Western Placer Waste Management Authority
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2003

Fourth Quarter and Annual 2003 Monitoring Report
Western Regional Sanitary Landfill
Placer County, CA
Prepared for
Golder Associates, Inc. and Western Placer Waste Management Authority
Prepared by
Conor Pacific
2580 Wyandotte Street
Mountain View, CA 94043
January, 2004

Buena Vista Landfill

Quarter Monitoring Report for Fourth Quarter 2001
and Annual 2001 Monitoring Report
Buena Vista Landfill
Amador County, CA
Prepared for:
County of Amador
Waste Management Division
Prepared by:
Jacobson Helgoth Consultants
718 Sutter Street, Suite 208
Folsom, California 94630
January, 2002

Monitoring Report for Fourth Quarter 2002
and Annual 2002 Monitoring Report
Buena Vista Landfill
Amador County, CA
Prepared for:
County of Amador
Waste Management Division
Prepared by:
Jacobson Helgoth Consultants
718 Sutter Street, Suite 208
Folsom, California 94630
January, 2003

Semi-Annual Monitoring Report, Third and Fourth Quarter 2003
and Annual 2003 Monitoring Report
Buena Vista Landfill
Amador County, CA
Prepared for:
County of Amador
Waste Management Division
Prepared by:
Jacobson Helgoth Consultants
718 Sutter Street, Suite 208
Folsom, California 94630
January, 2004

McKittrick Landfill

Monitoring and Reporting Program Order No. 99-125
D.3.a., LCRS Monitoring
Waste Management
McKittrick Waste Treatment Site
March 27, 2001

Annual LCRS and Unsaturated Zone Sampling and Analysis Report
Liquid Waste Management, Inc.
McKittrick Waste Treatment Site
June 21, 2002

Annual LCRS and Unsaturated Zone Sampling and Analysis Report
Liquid Waste Management, Inc.
McKittrick Waste Treatment Site
June 26, 2003

Kiefer Landfill

Kiefer Landfill Water Monitoring Report
Annual - 2001
Sacramento County California
Prepared by: Public Works Agency
Department of Waste Management and Recycling
January, 2002

Second Semiannual and Annual 2002 Monitoring Report
Kiefer Landfill
Sacramento County California
Prepared by: Sacramento County Public Works Agency
Department of Waste Management and Recycling
9850 Goethe Road
Sacramento, CA 95827
January, 2003

Second Semiannual and Annual 2003 Monitoring Report
Kiefer Landfill
Sacramento County California
Prepared by: Sacramento County Public Works Agency
Department of Waste Management and Recycling
9850 Goethe Road
Sacramento, CA 95827
January, 2004

Yolo County Central Landfill

Second Semester and Annual 2000 Monitoring Report and
Five Year Constituents of Concern Report
Yolo County Central Landfill
Water Quality Monitoring Program
California Regional Water Quality Control Board
Monitoring and Reporting Program No. 00-134
Prepared by: Yolo County Planning and Public Works Department
Division of Integrated Waste Management
292 West Beamer Street
Woodland, CA 95695
February 21, 2001

Second Semester and Annual 2001 Monitoring Report
Yolo County Central Landfill
Monitoring and Reporting Program No. 00-134
Prepared by: Yolo County Planning and Public Works Department
Division of Integrated Waste Management
292 West Beamer Street
Woodland, CA 95695

Second Semester and Annual 2002 Monitoring Report
Yolo County Central Landfill
Water Quality Monitoring Program
California Regional Water Quality Control Board
Monitoring and Reporting Program No. 00-134
Prepared by: Yolo County Planning and Public Works Department
Division of Integrated Waste Management
292 West Beamer Street
Woodland, CA 95695
February 6, 2003