APPENDIX A

Summary of Screening and Detailed Analysis for Wood Treater Sites With Contaminated Soils, Sediments, and Sludges

TABLE OF CONTENTS

SUMMARY OF INITIAL SCREENING PHASE FOR WOOD TREATER SITES

Remedial Technology or Treatment	# of FSs Technology Was Considered[1]	# of FSs Technology Passed Screening	# of FSs Technology Was Screened Out	# of FSs Where Criterion Contributed to Screening Out[2]		
				Cost	Effectiveness	Implementability
I. Institutional Controls						
A. Restrictions/Monitoring	23	22	1		1	
II. Containment						
A. Capping	42	28	14	5	5	9
1. unspecified	5	5	0			
2. asphalt/concrete	10	4	6	2	3	2
3. soil/bentonite/clay	13	8	5	2		5
4. multi-layer cover system	14	11	3	1	2	2
B. Closure-In-Place/On-Site Encapsulation/Vaults	10	4	6	1	3	5
C. Temporary On-Site Storage Pile	9	7	2			
D. Long-Term On-Site Landfill	16	9	7	1	2	5
III. Immobilization						
A. Solidification/Stabilization	23	15	8	2	7	4
IV. Treatment						
A. Biological Treatments	54	18	36	1	28	19
1. *in situ* bioremediation	18	5	13		12	9
2. *ex situ* bioremediation	15	8	7		6	3

SUMMARY OF INITIAL SCREENING PHASE FOR WOOD TREATER SITES
(continued)

Remedial Technology or Treatment	# of FSs Technology Was Considered[1]	# of FSs Technology Passed Screening	# of FSs Technology Was Screened Out	# of FSs Where Criterion Contributed to Screening Out[2]		
				Cost	Effectiveness	Implementability
3. off-site landfarming	4	0	4	1	2	3
4. soil/slurry bioreactor	12	5	7		3	2
5. anaerobic treatment	4	0	4		4	1
6. other	1	0	1		1	1
B. Other Thermal Treatments	49	9	40	7	23	20
1. thermal desorption	10	5	5	1	3	1
2. pyrolysis	9	0	9		5	5
3. vitrification	14	2	12	4	8	9
4. wet air oxidation	5	0	5		3	2
5. infrared treatment	9	2	7	2	2	1
6. other	2	0	2		2	2
C. Incineration	43	26	17	9	4	11
1. on-site	23	15	8	3	3	5
2. off-site	20	11	9	6	1	6
D. Chemical Treatments	30	10	20	7	13	12
1. dechlorination	12	4	8	3	5	4
2. solvent extraction	14	6	8	4	4	6
3. other	4	0	4		4	2

SUMMARY OF INITIAL SCREENING PHASE FOR WOOD TREATER SITES
(continued)

Remedial Technology or Treatment	# of FSs Technology Was Considered[1]	# of FSs Technology Passed Screening	# of FSs Technology Was Screened Out	# of FSs Where Criterion Contributed to Screening Out[2]		
				Cost	Effectiveness	Implementability
E. Physical Treatments	42	12	30	5	21	13
1. soil flushing (*in situ*)	14	5	9	1	8	5
2. soil washing (*ex situ*)	19	7	12	2	7	3
3. attenuation	2	0	2	1	1	2
4. aeration/soil venting	5	0	5	1	3	2
5. macro-encapsulation/ overpacking	1	0	1		1	
6. other	1	0	1		1	1
V. Off-Site Options						
A. Off-Site RCRA Facility	23	19	4	3	1	2
B. Off-Site Sanitary Landfill	3	1	2		1	1
C. Off-Site Recycle/Reuse Facility	3	1	2		1	1

[1] Because several specific technologies within a general technology group (e.g., capping: unspecified capping, asphalt/concrete caps, soil/bentonite/clay caps, and multi-layer cover systems) were considered for each site, the total number of FSs in which a technology group was considered may be greater than 25.

[2] FSs may indicate more than one criterion for screening out a technology. Also, some FSs did not fully explain the criteria for screening out a technology. Therefore, the totals for these screening criteria may not be equal to the number of FSs in which a technology was screened out.

SUMMARY OF DETAILED ANALYSIS PHASE FOR WOOD TREATER SITES

Remedial Technology or Treatment	**# of FSs/RODs Technology Was Considered[1]**	**# of FSs/RODs Technology Was Selected[2]**	**# of FSs/RODs Technology Was Not Selected**	**# of FSs/RODs Where Criterion Contributed to Non-Selection[3]**						
				Overall Protectiveness	**Compliance w/Federal ARARs**	**Reduction of Toxicity, Mobility, & Volume**	**Long-Term Effectiveness / Permanence**	**Short-Term Effectiveness**	**Implementability**	**Cost**
I. Institutional Controls										
A. Restrictions/ Monitoring	22	22	0							
II. Containment										
A. Capping	28	13	15	7	3	12	7	1	3	3
1. unspecified	5	2	3	1	1	2	1	1	1	1
2. asphalt/ concrete	4	2	2	1		2	1			
3. soil/bentonite/ clay	8	4	4	2	1	3	2			1
4. multi-layer cover system	11	5	6	3	1	5	3		2	1
B. Closure-In-Place/On-Site Encapsulation/ Vault	4	3	1			1	1		1	
C. Temporary On-Site Storage Pile	7	6	1	1		1				1
D. Long-Term On-Site Landfill	9	1	8	1	2	3	1	1	4	2
III. Immobilization										

SUMMARY OF DETAILED ANALYSIS PHASE FOR WOOD TREATER SITES
(continued)

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]						
				Overall Protectiveness	Compliance w/Federal ARARs	Reduction of Toxicity, Mobility, & Volume	Long-Term Effectiveness / Permanence	Short-Term Effectiveness	Implementability	Cost
A. Solidification/ Stabilization	15	11	4			3	1	1	1	1
IV. Treatment										
A. Biological Treatments	18	9	9	1		2	5	3	5	1
1. *in situ* bioremediation	5	2	3	1			3	1	1	
2. *ex situ* bioremediation	8	5	3			1	2	2	2	
3. soil/slurry bioreactor	5	2	3			1			2	1
B. Other Thermal Treatments	9	2	7			2	2	2	4	2
1. thermal desorption	5	2	3					2	1	1
2. vitrification	2	0	2			2	2		2	1
3. infrared treatment	2	0	2						1	

SUMMARY OF DETAILED ANALYSIS PHASE FOR WOOD TREATER SITES (continued)

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]						
				Overall Protectiveness	Compliance w/Federal ARARs	Reduction of Toxicity, Mobility, & Volume	Long-Term Effectiveness / Permanence	Short-Term Effectiveness	Implementability	Cost
C. Incineration	26	7	19	1	1	3	4	7	12	14
1. on-site	15	3	12	1	1	2	2	4	6	8
2. off-site	11	4	7			1	2	3	6	6
D. Chemical Treatment	10	5	5			2			2	2
1. solvent extraction	6	2	4			1			2	2
2. dechlorination	4	3	1			1				
E. Physical Treatment	12	6	6	1		1	3		4	1
1. soil flushing	5	1	4	1			3		3	1
2. soil washing	7	5	2			1			1	

SUMMARY OF DETAILED ANALYSIS PHASE FOR WOOD TREATER SITES (continued)

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]						
				Overall Protectiveness	Compliance w/Federal ARARs	Reduction of Toxicity, Mobility, & Volume	Long-Term Effectiveness / Permanence	Short-Term Effectiveness	Implementability	Cost
V. Off-Site Options										
A. Off-Site RCRA Landfill	19	10	9	2	1	1	1		6	2
B. Off-Site Sanitary Landfill	1	0	1							
C. Off-Site Reclamation/ Recycling	1	1	0							

[1] Because several specific technologies within a general technology group (e.g., capping: unspecified capping, asphalt/concrete caps, soil/bentonite/clay caps, and multi-layer cover systems) were considered for each site, the total number of FSs/RODs in which a technology group was considered may be greater than 25.

[2] The total number of remedial technologies selected is greater than 25 because treatment trains consisting of several different technologies were selected at most sites. For example, the selection of an overall remedy may have included the selection of institutional controls to control direct contact exposure, bioremediation to treat organic contamination (including soil washing), and immobilization to address inorganic contamination.

[3] Information on state and community concerns was not included in this analysis because FSs do not contain this information, and RODs generally only reference supporting documentation (i.e., state concurrence letters and responsiveness summaries). FSs and RODs may indicate more than one criterion for non-selection of a technology. Therefore, the totals for these non-selection criteria may not be equal to the number of FSs/RODs in which a technology was not selected.

APPENDIX B

Technology-Specific Summary Tables

TABLE OF CONTENTS

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
I. Institutional Controls									
A. Restrictions/Monitoring	23	22	1			Won't satisfy remedial objectives	1		
II. Containment/Immobilization									
A. Capping									
1. unspecified	5	5	0						
2. asphalt/concrete	10	4	6	Capital and O & M costs higher than some other alternatives Relatively high cost	2	Oxidation, viscous deformation, and chemical compatibility all lessen the effectiveness of asphalt caps; susceptible to cracking	3	Not implementable in some areas	2
3. soil/bentonite/clay	13	8	5	Very high operation and maintenance costs Less costly, equally effective materials are available for capping	2			Not practical in all areas (e.g., traffic, physical site constraints) May not attain ARARs Clay alone difficult to maintain	5
4. multi-layer cover system	14	11	3	Higher cost than asphalt cap	1	High water table Longer short-term exposure time; can't treat subsurface soils via soil flushing with the cap in place	2	May not attain ARARs Requires additional excavation and grading to accommodate the larger cap	2

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
B. Closure-In-Place/On-Site Encapsulation	10	4	6	Not cost-effective compared to capping	1	No reduction in toxicity or volume of contaminants Not effective for chlorinated organic carbons at site concentrations Long-term effectiveness unknown	3	Landfilling below the site's 3 foot groundwater table is not recommended Potential for liner failure May not meet RCRA siting performance standards On-site storage pile preferable Requires highly specialized labor and equipment; LDR restrictions	5
C. Temporary On-Site Storage Pile	9	7	2						
D. Long-term On-Site Landfill	16	9	7	Very high cost	1	Long-term risk minimized, but not eliminated Removal would expose contaminated subsoil. Not needed in conjunction with soil washing because this treatment is permanent	2	Waste would need to be pretreated due to regulations RCRA and/or state requirements; high water table; close proximity to a public water supply; and the present use of site as an active business Requires RCRA approval, which may be difficult for on-site disposal of dioxins Not applicable due to limited off-site contamination Not implementable due to site geological conditions	5

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
III. Immobilization									
A. Solidification/Stabilization	23	15	8	May incur O & M costs for the application of surface sealants Costs more than landfill	2	Time and stress of log deck operation may cause erosion and release of particulate arsenic Possible interferences from oil Not appropriate for organic contaminants Not effective for dioxins Unable to adequately immobilize contaminants (fine-grained deposits and debris and wood chips prevalent) Elevated pH has shown to increase mobility of some compounds, such as PCP	7	Future use of site restricted Not applicable because of excessive fine particles, wood chips present, and varied stratigraphy Non-conducive site conditions (impermeable soils, shallow depth to ground water) Not possible to dispose of fixated mass on-site	4
IV. Treatment									
A. Biological Treatments	54	18	36		1		28		19

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
1. *in situ* bioremediation	18	5	13			Effectiveness will be hampered by non-homogeneity and low permeability of soil Not proven effective on one or more of the following: PCP, hot spots, LNAPL plumes, heavy metals, carcinogenic PAHs, chlorinated hydrocarbons, dioxins, chlorinated dioxins, and/or furans Does not address low concentration of some contaminants Might increase metals toxicity and leachability; metals interfere with the process High metal concentrations and cold winter temperatures may inhibit process; undesirable degradation by-products may be produced	12	*In situ* pretreatment not feasible Development of an effective "seed" population may be difficult Non-conducive site conditions (e.g., impermeable soils, shallow depth to ground water, hot spots) ARARs may restrict injection of chemicals or wastewater into the ground Requires more specialized, less available equipment than other biological treatments Need additional treatment technologies to address additional problems; difficult to achieve blending because of sludge consistency	9

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
2. *ex situ* bioremediation	15	8	7			Not proven effective against dioxins, furans, carcinogenic PAHs, chlorinated dioxins, and/or multi-ring PAHs May be difficult to obtain the cleanup goals set by the risk assessment Exposes site-workers and neighbors to volatized organics; inorganics are likely to remain; produces harmful by-products; does not comply with ARARs for PAHs and metals	6	Seasonal high water table renders landfarming unsuitable Long treatment time due to limits on available land Metals at the site may prove toxic to the microorganisms; inability to degrade PAHs and metals suggests sludge residual risk levels may remain above acceptable levels; sludge consistency presents difficulties; unknown amount of time required for site remediation	3
3. off-site landfarming	4	0	4	Extensive transport, handling, and monitoring costs	1	Not proven effective against dioxins and/or heavy metals	2	Requires large off-site land area Requires long treatment periods LDRs may prevent implementation	3
4. soil/slurry bioreactor	12	5	7			Not proven effective against dioxins or heavy metals Surface biological treatment most representative	3	Adequate space may not be available to set up the large reactors or numerous mobile units that are needed; requires long-term, intensive O & M Fine-grained nature of soils may make slurry bioreactor effluent difficult to settle	2

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
5. anaerobic treatment	4	0	4			Aerobic PAH biodegradation is more effective Range of organics that are capable of anaerobic degradation is limited Not proven effective against dioxins, chlorinated dioxins, furans, and/or multi-ring PAHs	4	Not technically feasible	1
6. other	1	0	1			Aerobic biodegradation is more effective; not as effective as stimulation of indigenous organisms	1	Still largely experimental	1
B. Other Thermal Treatments	49	9	40		7		21		20
1. thermal desorption	10	5	5	Research and development expenditures offset energy savings; overall, more expensive than incineration	1	Will not remove non-volatiles and refractory organics Not applicable to dioxins and dibenzofurans	3	Requires post treatment of off gases	1

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
2. pyrolysis	9	0	9			Not effective for dioxins or COCs Not a well-proven technology; effectiveness not demonstrated at CERCLA sites	5	Not a well developed technology AER cannot accept sludge-type material; electric pyrolyzer has not been tested on dioxin or PCBs Manufacturer has not developed the technology past the pilot stage at this time; uncertainty as to time of commercial availability Requires relatively sophisticated equipment	5

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
3. vitrification	14	2	12	High costs Energy and capital intensive implementation	4	Effectiveness hindered by absence of sandy soil, presence of high water table, and presence of debris and wood chips Fine grained and silty surface soils decrease effectiveness Relatively new technology requiring special equipment and significant electrical supplies Fails to meet 99.99% DRE requirements; not a well-proven technology Would not be effective in treating fine-grained soils	7	Implementation would require significant site preparation (e.g., lower water table, remove debris) High soil water content, wood fragments in fill, and high water table prevent implementation Relatively new technology requiring special equipment and significant electrical supplies Not implementable due to shallow ground water and/or lack of permeable soils at site Not feasible due to extent of contamination; treatment units are not available for handling soils Generally unavailable Causes significant worker risk because of extremely high voltages during implementation	9
4. wet air oxidation	5	0	5			Not effective on solid waste streams or heavy metals Not recommended for halogenated organic aromatics	3	Not technically feasible Limited information for hazardous waste application	2

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
5. infrared treatment	9	2	7	High costs Higher than other thermal incineration technologies	2	Fails to meet 99.99% DRE requirements Rotary kiln most representative	2	Still in the development phase, which results in higher costs and lower processing rates	1
6. other	2	0	2			Not well suited for large volumes of soil; not effective for dioxins; metal content in the waste stream must be limited; molten glass generally inappropriate for soils because of their high ash content	1	Implementability of the advanced electric reactor technology would be difficult since commercial units are not available; mobile/transportable units are not available for fixed and multiple hearth technologies; molten glass is currently at an innovative stage No units available for treating soils	2

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
C. Incineration	43	26	17		9		4		11
1. on-site	23	15	8	High costs Not cost-effective relative to other on-site treatment technologies (e.g., thermal processing)	3	Not effective for heavy metal contaminants Not demonstrated as an effective method for the treatment/destruction of dioxins Flame reactor type still in developmental stage; not well-proven in soils containing low concentrations of chromium and arsenic	3	Potential for metal oxide emissions Requires installation of or access to an on-site incinerator Significant community opposition could be expected because of the close proximity of residential homes to the site Mobile rotary kiln type requires time and preparation for transport; small site size may present some operational difficulties; mobile circulating fluidized bed type is the least transportable of any of the incineration technologies Site soils present operational concerns; difficult to keep the bed materials fluid	5

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
2. off-site	20	11	9	High costs Given the quantity of soil, not cost-effective relative to on-site treatment Significantly high hauling and disposal costs because the nearest facility is 600 miles away Relatively high because of transportation, packaging, and treatment expenses; not cost competitive with on-site incineration Approximately 6 times more expensive than on-site incineration (due to transportation and off-site disposal costs)	6	Not effective for heavy metal contaminants	1	Potential for metal oxide emissions Requires transportation, and risks are associated with transportation Due to high levels of arsenic, chromium, and copper in the site soils, incineration facilities may impose restrictions on soil acceptance; soils must be packaged in containers, and uncertainty exists about the processing capacity for large quantities of soil Volume of soil exceeds available incinerator capacity; no facilities could accept waste containing dioxins Preference for on-site treatment	6

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
D. Chemical Treatments	30	9	21		7		13		12
1. dechlorination	12	4	8	High costs	3	Highly-chlorinated dioxins may be converted to more toxic, less chlorinated dioxins (creates a hazardous waste stream) Has not been adequately demonstrated on PCP, dioxins, and/or PAHs Process still in development stage	5	Requires installation of on-site equipment or transportation to a permitted facility Scale-up for site remediation still has to be tested Heavy metals in soil cause a problem in handling dewatering liquids Difficult to contact sludge constituents with solvent	4

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
2. solvent extraction	14	6	8	High capital and O&M costs Costs more than incineration Costs twice as much as biotreatment High energy costs	4	Hard to select an effective solvent due to complex mixture of soil contaminants; the fine fraction of the soil (which doesn't separate well from the solvent) may remain contaminated Dense sludge does not permit adequate contact May not achieve remediation goals; process performance is specific to site and solvent Not a well proven technology	4	Only applicable for oils removal from sludges/soils Commercial availability limited Low permeability and high clay/silt content of soils limit effectiveness for dioxins Innovative, untested alternative requiring very specialized equipment and personnel Requires extensive R&D; need to find way to recycle recovered oils; uncertain regulatory status Requires soil to be finely ground and treated as an aqueous solution; very difficult to implement with heterogeneous soils	6

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
3. other	4	0	4			Stream-enhanced vacuum extraction would not achieve cleanup goals for metals and dioxins; low permeability of soil and variable soil conditions reduces steam contact and overall effectiveness for PCP removal Steam/air stripping would not achieve cleanup goals for metals or dioxins; technology not well demonstrated or understood Steam stripping, soil vapor extraction, and chemical reduction not effective for PAHs and metals Alkaline hydrolysis/ supercritical oxidation data on sludge treatment unavailable; no pilot scale data; not proven on dioxins	4	Availability of commercial equipment may be limited due to the emerging status of this technology for soil treatment Steam stripping, soil vapor extraction, and chemical reduction not applicable to organic substances	2
E. Physical Treatments	42	12	30		5		21		13

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
1. soil flushing	14	5	9	Higher costs than capping	1	Less effective than capping due to depth of contaminated soil Potential ground-water contamination from flushing agents Low removal rates of semi-volatiles in low permeability soils Not effective on non- highly water soluble contaminants/PAHs Strong acids for leaching heavy metals may cause increased contaminant migration Not effective in non-homogeneous (e.g., high amounts of silts and clays) or low permeability soils Solvents for leaching both organics/heavy metals unavailable	8	Uncertain implementability High partition coefficient/low permeability of soils (e.g., high clay/silt content) makes collection of added solvents difficult Implementation of an effective extraction system difficult with shallow ground-water table Implementability could be hindered by ARARs restricting the injection of chemicals into the ground	5

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
2. soil washing	19	7	12	High capital costs Higher residual volumes than solvent extraction and therefore higher costs	2	Not efficient on fine grain soils; limited effectiveness for dioxin; doesn't remove low concentrations of arsenic and chromium Lack of overall demonstrated effectiveness Strong acid required to leach heavy metals; tightly absorbed metals not removed efficiently Separated silt/clay has higher concentrations of contaminants than the original feed soil More effective for metals; generates secondary liquid waste with organics Low recovery rate with variable wastes and clay soils containing semi-volatiles	7	Produces large volumes of sludge Requires extensive equipment; requires vapor recovery and treatment as well as solvent recovery and treatment of washing fluid Requires high degree of integrated design, including bench and pilot tests; produces hazardous wash water, which requires treatment/disposal; difficult to remove fine soil particles from washing fluid	3
3. attenuation (mixing with clean soil)	2	0	2	Contaminated area is too extensive for process	1	No reduction in toxicity, mobility, or volume; not a permanent solution; generally limited to the upper two feet of soil	1	Treatment would be necessary below the maximum effective depth of two feet	2

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
4. aeration/soil venting	5	0	5	Higher costs than *in situ* surface bioremediation	1	Not effective for shallow, impermeable surface/subsurface soil Only effective for VOCs; not effective for COCs	3	Not technically feasible Dense sludge is not permeable enough to permit vapor diffusion	2
5. macro-encapsulation/ overpacking	1	0	1			Potential leaching problems from presence of a free liquid product; may present risks to local public health and environment	1		
6. other	1	0	1			Continuous evaporation technology effectiveness unproven	1	Continuous evaporation implementability unproven	1

TECHNOLOGY-SPECIFIC SUMMARY TABLES
I. SCREENING PHASE • WOOD TREATER SITES (Continued)

REMEDIAL TECHNOLOGY OR TREATMENT	# of FSs Where Technology was Considered	# of FSs Technology Passed Screening	# of FSs Technology Screened Out	COST	# FSs	EFFECTIVENESS	# FSs	IMPLEMENTABILITY	# FSs
IV. Off-Site Options									
A. Off-Site RCRA Facility	23	19	4	High costs High costs associated with hauling Higher cost than on-site RCRA landfill	3	Subsoil that would be left exposed in the excavation contains equal or even greater arsenic concentrations than the excavated soil	1	Based on land ban regulations, may not be acceptable Uncertainty about the availability of a disposal facility permitted to accept CERCLA wastes at the time of remediation	2
B. Off-Site Sanitary Landfill	3	1	2					Obtaining a permit for this action would be impeded by the LDRs Sanitary landfills would not accept the site soils	2
C. Off-Site Recycle/Reuse Facility	3	1	2			No useable product would be recovered	1	Process not identified that recovers useful constituents	1

TECHNOLOGY-SPECIFIC SUMMARY TABLES
II. DETAILED ANALYSIS PHASE • WOOD TREATER SITES

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	**Compliance with ARARs**	#	**Reduction of TMV**	#	**Long-Term Effectiveness**	#	**Short-Term Effectiveness**	#	**Implement.**	#	**Cost**	#
I. Institutional Controls																	
A. Restrictions/ Monitoring	22[4]	22	0														
II. Containment																	
A. Capping	28	13	15		7		3		12		8		1		3		3
1. unspecified	5	2	3	Doesn't prevent leaching of contaminants	1	Fails to meet ARAR for RCRA closure	1	No reduction in TMV Does not satisfy statutory preference for treatment	2	Routine maintenance required; heavy equipment traffic may cause upheaval; rate of gravel addition may exceed the settling rate, requiring a future gravel removal action	1	Generates dust, requiring use of masks or water spray suppression for workers	1	Interrupts continuing on-site operations	1	Higher cost than institutional actions	1
2. asphalt/ concrete	4	2	2	Would not be protective considering assumed future land use	1			No direct reduction in T or V of hexavalent chromium or arsenic-impacted soil Contaminants may migrate underneath the cap as a result of flooding	2	May not be effective in the long-term considering assumed future land use (e.g., removal of cap); may not be permanent Not permanent solution; may not provide long-term effectiveness as the cap deteriorates	2						

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
3. soil/bentonite/ clay	8	4	4	Lowest overall protection Ground water would possibly continue to be impacted	2	Potential issues with LDRs	1	M reduced, but not T and V Minimal reduction in TMV No reduction in M of contaminants below ground-water table; no reduction in T or V of any contaminants	3	Only effective as cap remains intact Doesn't achieve same level of long-term effectiveness and permanence as treatment alternatives because the cap requires long-term maintenance and monitoring	2					Maint-enance costs for an indef-inite amount of time	1
4. multi-layer cover system	11	5	6	Lowest overall protection Interim, non-permanent remedy Not entirely protective when used alone	3	Potential issues with LDRs	1	M reduced, but not T and V No reduction in T, M or V	5	Only effective as cap remains intact Contaminated soil remains at the site Long-term maintenance required; potential for further migration exists	3			Long-term maintenance and ground-water monitoring required Interrupts continuing on-site operations	2	Higher cost than instit-ional actions	1
B. Closure-In-Place/On-Site Encapsulation/ Vault	4	3	1					No reduction in T or V	1	Contaminated soil remains at the site	1			Intensive effort to excavate	1		

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
C. Temporary On-Site Storage Pile	7	6	1	Less overall protection	1			M reduced, but not T and V	1							Un-known future treat-ment costs	1
D. Long-Term On-Site Landfill	9	1	8	Less overall protection	1	Potential issues with LDRs Doesn't meet preference for treatment	2	M reduced, but not T and V	3	Not a permanent remedy because wastes remain on-site	1	Risk of exposure to contaminants	1	Disposal issues Site permits may be difficult to obtain Restrictions on landfilling wood treater wastes Permits to dispose sludge may be needed	4	High cost, (e.g., oper-ation and maint-eance) Costs more than off-site RCRA landfill	2
III. Immobilization																	
A. Solidification/ Stabilization	15	11	4					Doesn't reduce V Increases V	3	Testing required to determine risks associated with solidified sludge; adequacy and reliability unknown until testing is complete	1	Process could cause greater quantity of dust to become airborne	1	Cap may have to be removed if S/S process is ineffective or if infiltration system needs repair	1	High cost	1

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
IV. Treatment																	
A. Biological Treatments	18	9	9		1				2		5		3		4		1
1. *in situ* bioremediation	5[7]	2	3	Doesn't include an engineered containment structure and doesn't feasibly treat subsurface soils	1					Control of residual risk would be more dependant on institutional controls than reliable engineered controls Not effective on dioxins or in low permeability soils; inadequate for soil in the vadose zone; not a well-proven technology May not be as effective as thermal treatment with dioxin-contaminated soils; not a well proven technology	3	Long time required for bacterial culture growth	1	Involves a degree of risk because of innovative nature; low permeability of soils at the site inhibits implementation	1		

TECHNOLOGY-SPECIFIC SUMMARY TABLES
II. DETAILED ANALYSIS PHASE • WOOD TREATER SITES (Continued)

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
2. *ex situ* bioremediation	8	5	3					Does not significantly reduce the toxicity of dioxins, although some reduction in PAHs would occur; volume of soils containing dioxin above human health levels would actually increase	1	Not a well proven technology. Requires lab/pilot-scale studies to determine effectiveness Biological upset is possible because of environmental shocks	2	Increases the short-term health risks because of increased handling of excavated material over a prolonged implementation period May result in odors downwind of site; potential for worker exposure from direct contact and dust inhalation could be greatest because workers would till soil periodically for several years; longest time required to achieve remedial action goals	2	Involves a degree of risk because of innovative nature Difficult to implement because of space constraints	2		

TECHNOLOGY-SPECIFIC SUMMARY TABLES
II. DETAILED ANALYSIS PHASE • WOOD TREATER SITES (Continued)

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
3. soil/slurry bioreactor	5[8]	2	3					Contaminant concentrations in silty/clay underflow (from soil washing step) may reduce effectiveness	1					Potential problems processing woody debris	1	More costly than LTUs	1
B. Other Thermal Treatments	9	2	7						2		2		2		4		2
1. thermal desorption	5[6]	2	3									Potential for air emissions; greatest potential for exposure because ineffective treatment would result in potential off site transport of hazardous contaminants Potential toxic gas emissions	2	Not implementable because of large contaminated soil volumes; relatively complex process that requires specialized equipment and knowledge	1	Costs much higher than biorem-edia-tion	1

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
2. vitrification	2	0	2					Treatability testing would be required to evaluate effectiveness for destruction of organics and immobilization of inorganics No reduction in volume	2	Effectiveness would be difficult to monitor during treatment; difficult to implement adequate QA/QC procedures for *in situ* processes Not a well proven technology	2			Requires special equipment and trained personnel; equipment is available through only one vendor Involves a degree of risk because of innovative nature; requires longer implementation period and bench/pilot scale studies	2	Higher cost than incin-eration	1
3. infrared treatment	2	0	2											Exposure to emissions; mobile incinerators not readily available and delays may result in obtaining a unit; extensive construction requirements; requires test burn and meeting RCRA performance standards; low administrative feasibility	1		

TECHNOLOGY-SPECIFIC SUMMARY TABLES
II. DETAILED ANALYSIS PHASE • WOOD TREATER SITES (Continued)

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
C. Incineration	26	7	19		1		1		3		3		7		12		14

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	**Compliance with ARARs**	#	**Reduction of TMV**	#	**Long-Term Effectiveness**	#	**Short-Term Effectiveness**	#	**Implement.**	#	**Cost**	#
1. on-site	15	3	12	Production of dioxins if not maintained properly	1	Test burns required to determine incineration impact on environment; uncertainty associated w/disposal of ash	1	Addresses treatment of organic contaminants but not heavy metals; metal mobility in ash may increase No reduction in mobility of contaminants Does not reduce T or V for metals	2	Landfill management of incineration ash is required Not a permanent solution for metals	2	Air pollution and landfilling of ash could cause serious environmental impacts May cause air pollution problems Temporary decrease in air quality -- could result in a steam plume and potential odors	4	Public opposition Delay in implementation may occur because of air pollution and landfill capacity problems Requires extensive demonstration of combustion efficiencies Mobile rotary kiln technology not readily available Utilities must be relocated; also community opposes incineration Requires test burn; takes longest to complete; community opposition Limited off-site incinerator capacity No identified compliant	6	High cost High capital costs High O&M costs Costs 3 times more than soil wash, bio, and S/S; not feasible for larger amounts of soils Highest cost of all options	8

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
2. off-site	11	4	7			Test burns required to determine incineration impact on environment; uncertainty associated w/disposal of ash	1			Landfill management of incineration ash is required	1	Air pollution and land-filling of ash could cause serious environmental impacts; vehicle transport of contaminants presents a hazard Increases short-term health risks due to increased handling and increased traffic by trucks transporting soils off-site Risks involved in hauling wastes 1,800 miles to site	3	Delay in implementation may occur because of air pollution and landfill capacity problems Commercial facilities may refuse to accept contaminated soils from Superfund sites because of capacity limitations; only a small number of facilities accept wastes Facility under consideration has been cited for non-compliance Requires test burn; takes longest to complete; community opposition	6	Very high transport costs High maintenance costs High cost	6

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	**Compliance with ARARs**	#	**Reduction of TMV**	#	**Long-Term Effectiveness**	#	**Short-Term Effectiveness**	#	**Implement.**	#	**Cost**	#
D. Chemical Treatment	10	5	5						2						2		2
1. solvent extraction	6	2	4					Overall waste volume may increase due to effluent production	1					Difficulties were encountered in previous attempts with this treatment process Limited number of qualified vendors	2	High cost	2
2. dechlorination	4	3[9]	1					Will not meet action levels for PAHs	1								

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
E. Physical Treatment	12	6	6		1				1		3				4		1
1. soil flushing (*in situ*)	5	1	4	Might cause spreading of LNAPL	1					Uncertain long-term effectiveness Not a well proven technology May not be effective in the long term	3			Soil heterogeneities and low hydraulic conductivity might limit efficiency; uncertain technical difficulties due to innovative status Involves a degree of risk because of innovative nature; low permeability of soils at site inhibit implementation Site conditions may limit effectiveness	3	$0.6 million more than *in situ* bioremed-iation	1
2. soil washing	7	5	2					No reduction in toxicity	1					Requires extensive design/ treatability studies; uncertainties remain over the application to the contaminants	1		

TECHNOLOGY-SPECIFIC SUMMARY TABLES
II. DETAILED ANALYSIS PHASE • WOOD TREATER SITES (Continued)

Remedial Technology or Treatment	# of FSs/RODs Technology Was Considered[1]	# of FSs/RODs Technology Was Selected[2]	# of FSs/RODs Technology Was Not Selected	# of FSs/RODs Where Criterion Contributed to Non-Selection[3]													
				Overall Protectiveness	#	Compliance with ARARs	#	Reduction of TMV	#	Long-Term Effectiveness	#	Short-Term Effectiveness	#	Implement.	#	Cost	#
V. Off-Site Options																	
A. Off-Site RCRA Landfill	19	10	9	Potential contamination at the new disposal site Contaminants are not destroyed	2	Potential issues with LDRs	1	Does not reduce volume, toxicity, or mobility	1	Not a permanent solution	1			Landfill may be unavailable Future LDRs may cause disposal problems Landfill capacity may be inadequate Requires NCP analysis Preference for on-site treatment No identified compliant facilities for land disposal of wood treater wastes	6	High trans-port costs High costs	2
B. Off-Site Sanitary Landfill	1	0	1														
C. Off-Site Reclamation/ Recycling	1	1	0														

[1] Because several specific technologies within a general technology group (e.g., capping: unspecified capping, asphalt/concrete caps, soil/bentonite/clay caps, and multi-layer cover systems) were considered for each site, the total number of FSs/RODs in which a technology group was considered may be greater than 25.

[2] The total number of remedial technologies selected is greater than 25 because treatment trains consisting of several different technologies were selected at most sites. For example, the selection of an overall remedy may have included the selection of institutional controls to control direct contact exposure, bioremediation to treat organic contamination (including soil washing), and immobilization to address inorganic contamination.

[3] Information on state and community concerns was not included in this analysis because FSs do not contain this information, and RODs generally only reference supporting documentation (i.e., state concurrence letters and responsiveness summaries). FSs and RODs may indicate more than one criterion for non-selection of a technology. Therefore, the totals for these non-selection criteria may not be equal to the number of FSs/RODs in which a technology was not selected.

[4] American Creosote, TN chose only immediate remedial actions for an emergency response; the more permanent actions considered in the RI/FS (i.e., soil/clay cap, solidification, above ground vault, on-site incineration, solvent extraction, soil flushing, and off-site RCRA landfill) were not initially "screened out" per se, but also were not carried over into the detailed analysis phase. Note also that Southern Maryland's final detailed analysis is incomplete.

[5] Brown Wood Preserving, FL will reconsider on-site incineration as a "passed" remedy if the land treatment solution does not achieve the desired cleanup levels for the appropriate organic contaminants within the time allowed.

[6] Cape Fear Wood Preserving, NC will keep thermal desorption as a secondary remedy if the preferred remedy (biological degradation) doesn't achieve the cleanup goals.

[7] Even though the American Creosote Works, FL ROD states that bioremediation was screened out, bioremediation treatability studies will still be conducted.

[8] Even though the American Creosote Works, FL ROD states that the soil/slurry bioreactor technology was screened out, treatability studies will still be conducted on this technology. No reason was provided for screening out this technology.

[9] Koppers, NC retained dechlorination as a secondary option (dechlorination is not a primary option because it requires pilot studies, remediation takes the longest to complete using this technology, and this technology is the most costly).