Appendix H

METHODOLOGY FOR ESTIMATING QUANTITY OF SOIL AND DEBRIS CONTAMINATED WITH WOOD PRESERVING WASTES

Volume of Wood Preserving Remediation Waste Requiring Combustion Under the Phase IV Land Disposal Restrictions

In this Appendix, EPA presents a low-end and high-end estimate[1] of the quantity of wood preserving waste requiring additional combustion capacity using a revised version of a direct estimate approach.[2] EPA identified 21 RODs signed between 1991 and 1993 that contain information on soil and debris volumes at wood preserving sites. EPA used the information contained in these RODs, as well as the 30 RODs identified in the Beazer East analysis[3], to develop these estimates.[4] (See Attachment 1 to the February 14, 1997 memorandum included in this appendix.) EPA has excluded three wood preserving sites from this analysis, presented in Exhibit 1, because treatments other than combustion are indicated in the RODs for these sites and because they are contaminated only with chromium copper arsenate (CCA) and other metals; EPA has thus assumed that combustion would not be used to treat remediation wastes from these sites.

Exhibit 1
Wood Preserving Site RODs Contaminated Only with CCA or Other Metals

ROD Date	Site Name	Contaminants	Volume of Soil or Sediment Managed Ex-situ (yd^3)	Source
Sep-87	Palmetto Wood Preserving	CCA	19,900	Beazer
Sep-89	Burlington Northern, Montana	Metals	11,700	Beazer
Sep-91	Valley Wood Preserving	Metals	15,000	ICF

Using the Superfund RODs signed between 1986 and 1993, EPA constructed a direct estimate of the annual volume of soil and debris from wood preserving sites that might be combusted under the status quo and following the Phase I LDRs. To do this, EPA first directly summed the volumes of excavated soil and debris from RODs signed in the same year. Because remedial actions do not often begin immediately after the ROD signature date, but are delayed as the remedial design (RD) is completed, EPA had to develop an estimate of the time from signature of a ROD to the beginning of a remedial action (RA). The Brookings Institution estimates that it takes an average of approximately 18 months from the issuance of the ROD to complete the remedial design, after which the remedial action can begin.[5] For this analysis, EPA assumed a delay of two years from the issuance of the ROD to the beginning of remedial action.

Once remedial action begins, actual soil excavation can proceed relatively quickly. Small sites may be excavated within months, while large sites may take two or three years. The Brookings Institution estimates that the completion of a remedial action (other than long-term maintenance, such as groundwater pump and treat) takes an average of 25 months. For this analysis, EPA assumed that the excavations would take an average of two years. Thus, EPA estimates that the total period of time from the signing of a ROD to the completion of a remedial action is approximately four years. As a result of these two assumptions about remedial pace, a site associated with a ROD

[1] The terms "low-end" and "high-end" rather than lower bound and upper bound have been used to reflect the possibility that the actual quantities lie outside this range.

[2] For a detailed history of the methodology, see in this Appendix "Methodology and Data Sources for Estimating the Volume of Wood Preserving Waste Requiring Combustion Under the Phase IV Land Disposal Restrictions," memorandum to Bill Kline, EPA/OSW (cc: C. Pan Lee, EPA/OSW) from Scott Breffle and Jim Laurenson, ICF Incorporated, January 29, 1997 and "Updated Results for Estimating the Volume of Wood Preserving Waste Requiring Combustion Under the Phase IV Land Disposal Restrictions," memorandum to Bill Kline, EPA/OSW (cc: C. Pan Lee, EPA/OSW) from Scott Breffle and Jim Laurenson, ICF Incorporated, February 14, 1997.

[3] The table presented in the Beazer East comment includes 31 RODs. However, the two November 1986 RODs for Mid-South Wood Products appear to be duplicates.

[4] Information on these RODs is presented in Attachment 1 of the February 14, 1997 memorandum included in this Appendix (see footnote 2).

[5] Thomas W. Church and Robert T. Nakamura, Cleaning Up the Mess, Implementation Strategies in Superfund, The Brookings Institution, 1993, page 8.

signed in 1988, for example, would generate soil in 1990 and 1991 (i.e., in years two and three following the ROD date of signature.)

EPA has calculated a low-end and a high-end estimate for the volume of soil and debris requiring additional combustion capacity (i.e., the volume that will require combustion above and beyond the volume that is currently being combusted). To estimate the current (i.e., baseline or pre-LDR) volumes being combusted, EPA examined the RODs for volumes that were planned to be combusted and, using the assumptions about the remedial pace discussed above, distributed these volumes over the appropriate years. The results are presented in Exhibit 2. Because the most recent RODs used in this analysis were issued in 1993, the remedial actions have already been completed, based on the above assumptions. Nevertheless, the data can be used to project the future trend in annual volumes of soil and debris being excavated from wood preserving sites.

The second column of Exhibit 2 presents the total volume of soil and debris that was planned for combustion for each of the ROD years that EPA examined. The subsequent columns use the two assumptions discussed above regarding initiation and completion of remediation to estimate when

Exhibit 2
Annual Ex-Situ Soil and Debris Volumes from Wood Preserving Site Remedial Actions Planned for Combustion During 1989 to 1995

		Expected Annual Volume (cubic yards)						
ROD Signature Date	**Ex-Situ Volume (cubic yards)**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
1986	9,000	4,500						
1987	170,000	85,000	85,000					
1988	131,000		65,500	65,500				
1989	0			0	0			
1990	98,000				49,000	49,000		
1991	0					0	0	
1992	2,930						1,465	1,465
1993	24,930							12,465
Annual Volume		89,500	150,000	65,500	49,000	49,000	1,465	13,930
Average Annual Volume		59,842						

the volumes from each year ought to have been excavated and combusted. As Exhibit 2 shows, the projected annual volume ranges from 1,465 cubic yards in 1994 to 150,000 cubic yards in 1990. Because of the uncertainty associated with our assumptions about the remedial pace and the lack of any discernible trends to use for projections, EPA used the average annual volume to estimate the baseline volumes using combustion over the next two years. This baseline annual volume of soil and debris requiring combustion under the status quo is 59,842 cubic yards, resulting in a quantity of approximately 72,000 tons per year over the next two years (using a conversion factor of 1.2 tons per cubic yard).

To calculate the low-end estimate of the required additional combustion capacity, EPA estimated the portion of soil and debris planned for treatment using methods other than combustion prior to promulgation of the LDRs that would likely be combusted under the LDRs. Historically, media contaminated with dioxins and furans has been the most likely to be treated using combustion. For this rule, the UTS limits promulgated for organics and for dioxins and furans regulated in nonwastewater forms of F032 waste are based on the performance of combustion technologies. As discussed in the BDAT background document, EPA believes that non-thermal treatment

technologies may be optimized to meet the UTS limits within the context of a treatability variance under 268.44(h)[6], but that the feasibility of such treatment technologioes may require the use of treatment trains to meet the UTS standards. Optimizing treatments or developing treatment trains can take time. In addition, EPA believes that the alternative combustion treatment standard for dioxins and furans in F032 waste, because it waives the testing requirement, will provide a strong incentive to combust these wastes even if non-combustion treatment technologies are viable and effective alternatives. Because of this incentive, the possible time required to develop and optimize non-thermal tratment trains, and because treatability variances are not likely be immediately available following promulgation of the LDRs, EPA assumed that all soil and debris contaminated with dioxins and furans that is not currently being combusted would be combusted under the LDRs. The second column of Exhibit 3 presents these volumes of media contaminated with dioxins and furans by the year in which the ROD was signed. Using the above assumptions about remedial pace, Exhibit 3 distributes over the appropriate years the volumes of media that EPA assumes will shift to combustion. As with the baseline estimate, EPA used the average annual volume

Exhibit 3
Annual Ex-Situ Soil and Debris Volumes from Wood Preserving Site Remedial Actions
Expected to Shift to Combustion During 1989 to 1995

		Expected Annual Volume (cubic yards)						
ROD Signature Date	**Ex-Situ Volume (cubic yards)**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
1986	93,000	46,500						
1987	0	0	0					
1988	16,100		8,050	8,050				
1989	293,000			146,500	146,500			
1990	0				0	0		
1991	25,000					12,500	12,500	
1992	78,120						39,060	39,060
1993	254,650							127,325
Annual Volume		46,500	8,050	154,500	146,500	12,500	51,560	127,325
Average Annual Volume		83,721						

projected using this method to estimate a low-end additional required combustion capacity over the next two years. As seen on the last line of Exhibit 3, the additional required combustion capacity is estimated to be 83,721 cubic yards per year, resulting in a quantity of about 100,000 tons per year over the next two years.[7]

For the high-end estimate, rather than estimate what portion of soil and debris would shift to combustion, EPA assumed that the total volume of media (excluding media contaminated only with CCA and other metals) currently not being combusted would be combusted under the LDRs. As seen in Exhibit 4, the projected annual volume ranges from 55,100 in 1993 cubic yards to 505,750 cubic yards in 1989. As with the baseline and low-end estimates, EPA used the average annual volume projected using this method to estimate required combustion capacity over the next two years. As seen on the last line of Exhibit 4, this average annual volume of soil and debris potentially requiring additional combustion capacity is 217,594 cubic yards per year, resulting in a quantity of about 260,000 tons per year over the next two years.

[6] See Section 6.5 of Final Best Demonstrated Available Technology Background Document for Wood Preserving Wastes - F032, F034, and F035 for a discussion of the UTS limits and the performance of remedial treatment technologies.

[7] Given that this quantity only includes Superfund NPL sites, the quantity might properly be considered a lower-bound rather than a low-end estimate. See the next section.

Exhibit 4
Expected Annual Ex-Situ Soil and Debris Volumes During 1989 to 1995
from Wood Preserving Site Remedial Actions

		Expected Annual Volume (cubic yards)						
ROD Signature Date	**Ex-Situ Volume (cubic yards)**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
1986	1,011,500	505,750						
1987	0	0	0					
1988	231,200		115,600	115,600				
1989	338,700			169,350	169,350			
1990	85,200				42,600	42,600		
1991	25,000					12,500	12,500	
1992	104,520						52,260	52,260
1993	465,570							232,785
Annual Volume		505,750	115,600	284,950	211,950	55,100	64,760	285,045
Average Annual Volume		217,594						

Soil and debris from wood preserving sites is also likely to be generated during cleanup of non-NPL sites as well as from cleanups under programs other than Superfund, such as through RCRA corrective actions and closures, State cleanups, or voluntary cleanups. For example, Kerr-McGee has said that four of its seven facilities are undergoing RCRA corrective actions.[8] As a result, the quantity of soil and debris contaminated with the newly identified wood preserving wastes is likely to be much higher than the low-end estimate presented above. (See the February 14, 1997 memorandum in this appendix for a discussion of Beazer East's estimate). As discussed in Section 3.6.2 of this Background Document, however, EPA determined that the low-end estimate of required alternative treatment capacity was greater than available capacity, and therefore the Agency did not develop a high-end estimate of the quantity of soil and debris contaminated with newly identified wood preserving wastes that would require additional alternative treatment capacity.

Thus EPA calculates that between about 100,000 and 260,000 tons per year of contaminated soil and debris from wood preserving sites will require additional combustion capacity over the next two years

[8] See February 19, 1997 phone log in Appendix F detailing EPA discussions with Steve Ladner of Kerr-McGee.

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February 14, 1997

MEMORANDUM

TO: Bill Kline, EPA/OSW

CC: C. Pan Lee, EPA/OSW

FROM: Scott Breffle and Jim Laurenson

SUBJECT: Updated Results for Estimating the Volume of Wood Preserving Remediation Waste Requiring Combustion Under the Phase IV Land Disposal Restrictions

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We have completed our review and analysis of data on excavated soil, sediment, and debris[9] at wood preserving sites contained in Records of Decision (RODs) signed between 1991 and 1993. Based on these data and ROD data contained in the Beazer East comment, this memorandum presents a range of estimates of required combustion capacity for wood preserving wastes subject to the pending Phase IV land disposal restrictions (LDRs). The basic methodology and preliminary results for this analysis are described in two previous memoranda.[10]

Results

We have developed two ranges of estimates of the required alternative combustion capacity for wood preserving remediation wastes. Our first set of estimates includes several refinements of the Beazer East methodology such that we've now labeled it the "Beazer East-based" approach. This update also incorporates into the analysis the more recent ROD data that we have obtained. Our second set of estimates is calculated directly based on the excavated soil volume for all wood preserving RODs in each year and an estimate of the average duration of a Superfund remedial action. Each of these two ranges of estimates is discussed below.

Beazer East-Based Analysis

In our January 31, 1997 memorandum, we presented information on soil, sediment, and debris volumes for 9 of the 19 wood preserving sites RODs signed between 1991 and 1993 that we had identified. We have since identified two additional wood preserving site RODs and have examined the full text of all 21 RODs for information

[9] The excavated portion of the soil, sediment, and debris, and not the in-situ portion, is potentially subject to LDRs and thus combustion.

[10] "Methodology and Data Sources for Estimating the Volume of Wood Preserving Waste Requiring Combustion Under the Phase IV Land Disposal Restrictions, memorandum to Bill Kline, EPA/OSW (CC: C. Pan Lee, EPA/OSW) from Scott Breffle and Jim Laurenson, ICF, January 29, 1997; and "Preliminary Results for Estimating the Volume of Wood Preserving Remediation Waste Requiring Combustion Under the Phase IV Land Disposal Restrictions," memorandum to Bill Kline, EPA/OSW (CC: C. Pan Lee, EPA/OSW) from Scott Breffle and Jim Laurenson, ICF, January 31, 1997.

on soil, sediment, and debris volumes. The information contained in these RODs as well as the 30 RODs used in the Beazer East analysis[11] are presented in Attachment 1.

The methodology presented in the Beazer East comment to calculate the potential volume of soil, sediment, and debris requiring combustion was to calculate the average volume of these media managed ex-situ at each site and then extrapolate this average to the universe of wood preserving sites to obtain a total volume. Using RODs signed between 1986 and 1990, Beazer East reported an average volume per site of approximately 84,000 cubic yards. In our January 31, 1997 memorandum, we reported that the RODs signed between 1991 and 1993 also yielded an average of about 84,000 cubic yards, but cautioned that this average was based on only nine of the 19 RODs that we had identified. We have now completed review of these 19 RODs, as well as the two additional RODs recently identified, for information on the volume of soil, sediment, and debris managed ex-situ. For this analysis, we have excluded six wood preserving sites, presented in Exhibit 1, because treatments other than combustion are indicated in the RODs for these sites and because they are contaminated only with chromium copper arsenate (CCA) and other metals; we've thus assumed that combustion would not be used to treat remediation wastes from these sites.

Exhibit 1
Wood Preserving Site RODs Contaminated Only with CCA or Other Metals

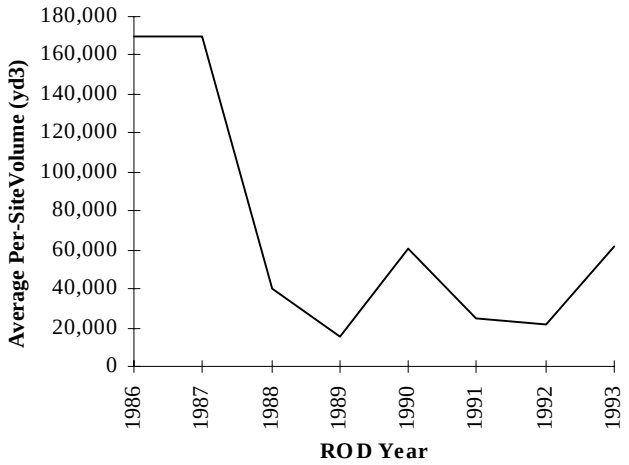
ROD Date	Site Name	Contaminants	Volume of Soil or Sediment Managed Ex-situ (yd^3)	Source
Sep-87	Palmetto Wood Preserving	CCA	19,900	Beazer
Jun-89	Cape Fear Wood Preserving	CCA	30,500	Beazer
Sep-89	United Creosoting	CCA	93,000	Beazer
Sep-89	Koppers, Oroville, CA	CCA	200,000	Beazer
Sep-89	Burlington Northern, Montana	Metals	11,700	Beazer
Sep-91	Valley Wood Preserving	Metals	15,000	ICF

The resulting average per-site volume of soil, sediment, and debris planned for ex-situ management each year is presented in Exhibit 2. As seen in Exhibit 2, the volumes of these media projected to be managed ex-situ were significantly higher in 1986 and 1987, at approximately 170,000 cubic yards per site, relative to subsequent years. Among the RODs signed in 1986 was one site with a projected ex-situ volume of soil of 800,000 cubic yards, as seen in Attachment 1. Only one wood preserving site ROD was signed in 1987, which planned for ex-situ management of 170,000 cubic yards.

The Beazer East comment projected an average volume of soil, sediment, and debris managed ex-situ at wood preserving sites of about 84,000 cubic yards per site. Removing the sites that are contaminated only with metals or CCA raises the average per site to about 87,500 cubic yards. As seen

[11] The table presented in the Beazer East comment includes 31 RODs. However, the two November 1986 RODs for Mid-South Wood Products appear to be duplicates.

Exhibit 2
Average Per-Site Volume of Soil, Sediment, and Debris Planned for Ex-Situ Management at Wood Preserving Sites



in Exhibit 3, when the RODs signed between 1991 and 1993 are incorporated, the average falls to about 70,000 cubic yards per site. The average volume for the RODs signed between 1991 and 1993 is even less, at about 44,000 cubic yards per site. When RODs back to 1988 are included (i.e., excluding 1986 and 1987), the average per-site volume remains at about 44,000 cubic yards. Therefore, using the assumption that the worst (i.e., largest remediation waste volume) wood preserving sites have been remediated, we used the 1988 to 1993 average to project to the universe of sites.

Exhibit 3
Average Per-Site Volume of Soil, Sediment, and Debris Projected for Ex-Situ Management

RODs Considered	Average Volume Projected to be Managed Ex-Situ per Site (cubic yards)
1986-1990	87,555
1986-1993	69,829
1991-1993	43,840
1988-1993	44,506

Using the average per-site volume of 44,500 cubic yards reduces Beazer East's estimate of the total volume potentially requiring combustion by almost half, from 85.3 million cubic yards to approximately 45.2 million cubic yards of soil, sediment, and debris.[12] As discussed in our previous memoranda, using this total to estimate the volume potentially requiring combustion over the next two years is still likely to be overestimated for two reasons. First, although long-term trends remain difficult to discern, Exhibit 2 indicates that the average per-site volumes requiring excavation may be declining. Thus, the eventual total of soil, sediment, and debris requiring excavation over all wood preserving sites is likely to be less than 45 million cubic yards. Second, there is no chance that all 45.2 million cubic yards will be excavated over the next two years. Nevertheless, if remediation of, say, a tenth of

[12] This calculation uses Beazer East's estimate that approximately 85 percent of the estimated 1,200 wood preserving sites will require excavation of contaminated soil and sediment as part of a cleanup remedy.

the sites were underway, and soil excavation were evenly distributed over the next ten years,[13] the volume potentially requiring combustion over the next two years would be approximately 450,000 cubic yards per year (45.2 million cubic yards x 0.1/10 years). Thus, the upper bound estimate of wood preserving soil, sediment, and debris requiring combustion during the next two years (using the Beazer East approach) is approximately 450,000 tons per year (using a conversion factor of 1 ton per cubic yard).

We next calculated a pre-LDR or baseline estimate using the Beazer East-based approach. Nine of the 51 RODs (17.6 percent) examined recommended combustion as the treatment method. The average volume per site of soil, sediment, and/or debris that requires combustion at these sites is 48,444 cubic yards. Using Beazer East's methodology, about 10 million cubic yards (1,200 sites x 0.176 x 48,444 cubic yards) of soil could require combustion. Once again, however, this volume is not likely to be seen in the next two years, and all future sites may not require the same level of remediation as current sites. If remediation of, say, a twentieth of the sites were underway, and soil excavation were evenly distributed over the next ten years, the baseline estimate of the volume potentially requiring combustion over the next two years would be approximately 50,000 cubic yards per year (10 million cubic yards x 0.05/10 years), or 50,000 tons per year.

To estimate the low-end quantity requiring additional combustion capacity, we developed a ratio of additional combustion over baseline combustion using all of the ROD data in Attachment 1 and an assumption similar to the one used more rigorously and described in more detail in the next section. Briefly, this assumption is that contaminated media planned for bioremediation, critical fluid extraction, or thermal desorption would need combustion under the LDRs, while media planned for other management would not be combusted. The calculated ratio is $894{,}090 yd^3 / 435{,}930 yd^3 = 2.05$, and therefore the estimated low-end quantity of soil, sediment, and debris contaminated with newly listed wood preserving wastes requiring additional combustion capacity is approximately 100,000 tons per year. Subtracting the baseline combustion quantity from the upper-bound combustion quantity results in an estimated high-end quantity of soil, sediment, and debris contaminated with newly listed wood preserving wastes requiring additional combustion capacity of approximately 400,000 tons per year.

Thus, the Beazer East approach, with our assumptions, results in a quantity of waste requiring additional combustion ranging between 100,000 and 400,000 tons per year over the next two years. The estimate generated by this approach is subject to many uncertainties, however. Beazer East's approach, as described in previous memoranda, assumes that all wood preserving sites will undergo remediation in the near future, and that the quantity of soil, sediment, and debris removed at each site will be similar to that removed at current wood preserving Superfund sites. Neither assumption is likely to be realized. We have tried to correct this assumption by assuming that remediation wastes will be generated by between a tenth and twentieth of the total number of wood preserving sites over the next ten years. This assumption itself is subject to significant uncertainty. In addition, the Beazer East methodology does not factor out of the analysis the current quantity of soil, sediment, and debris that requires combustion. This quantity is treated with current capacity, and should not be considered as part of the quantity that will require additional treatment capacity over the next two years. We therefore incorporated an assumption regarding this additional capacity. The approach described in the next section attempts to address these shortfalls more thoroughly.

Direct Estimation

As a supplement/replacement of the Beazer East methodology, we constructed a direct estimate of the annual volume of soil, sediment, and debris from wood preserving sites that might be combusted. To do this, we first directly summed the volumes of excavated soil, sediment, and debris from RODs signed in the same year. Because remedial actions do not often begin immediately after the ROD signature date, but are delayed as the remedial design (RD) is completed, we had to develop an estimate of the time from signature of a ROD to the beginning of a remedial action (RA). The Brookings Institution estimates that it takes an average of approximately 18 months from the issuance of the ROD to complete the remedial design, after which the remedial action can

[13] The average duration of remedial actions at nonfederal sites proposed to the Natioanl Priorities List (NPL) was reported as 9.6 years in "Analyzing the Duration of Cleanup at Sites on Superfund's National Prioroties List," March 1994, Congressional Budget Office.

begin.[14] For this analysis, we assumed a delay of 2 years from the issuance of the ROD to the beginning of remedial action.

Once remedial action begins, actual soil excavation can proceed relatively quickly. Small sites may be excavated within months, while large sites may take two or three years. The Brookings Institution estimates that the completion of a remedial action (other than long-term maintenance, such as groundwater pump and treat) takes an average of 25 months. For this analysis, we assumed that the excavations would take an average of two years. Thus, we estimate that the total period time from the signing of a ROD to the completion of a remedial action is approximately four years. As a result of these two assumptions about remedial pace, a site associated with a ROD signed in 1988 for example, would generate soil in 1990 and 1991 (i.e., in years two and three following the ROD date of signature.)

We have calculated a low-end and a high-end estimate for the volume of soil, sediment, and debris requiring additional combustion capacity (i.e., the volume that will require combustion above and beyond the volume that is currently being combusted). To estimate the current (i.e., baseline or pre-LDR) volumes being combusted, we examined the RODs for volumes that were planned to be combusted and, using the assumptions about the remedial pace discussed above, distributed these volumes over the appropriate years. The results are presented in Exhibit 5. Because the most recent RODs used in this analysis were issued in 1993, the remedial actions have already been completed, based on our assumptions. Nevertheless, the data can be used to project the trend in annual volumes of soil, sediment, and debris being excavated from wood preserving sites.

The second column of Exhibit 5 presents the total volume of soil, sediment, and debris that was planned for combustion for each of the ROD years that we examined. The subsequent columns use the two assumptions discussed above regarding initiation and completion of remediation to estimate when the volumes from each year ought to have been excavated and combusted. As Exhibit 5 shows, the projected annual volume ranges from 1,465 cubic yards in 1994 to 150,000 cubic yards in 1990. Because of the uncertainty associated with our assumptions about the remedial pace, we used the average annual volume projected using this method to estimate the baseline volumes using combustion over the next two years. This baseline annual volume of soil, sediment, and debris requiring combustion is 59,776 cubic yards, resulting in a quantity of approximately 60,000 tons per year over the next two years.

To calculate the low-end estimate of the required additional combustion capacity, we estimated the portion of soil, sediment, and debris planned for treatment using methods other than combustion that would be combusted under the LDRs. We based our estimate on the current treatment technology being applied to the media. We assumed that soil, sediment, or debris to be treated using bioremediation, critical fluid extraction, or thermal desorption would contain sufficient concentrations of wood preserving wastes such that combustion would be needed under the LDRs. In contrast, we assumed that soil, sediment, or debris to be managed using land disposal, soil washing, stabilization/solidification/ fixation would not be combusted under the LDRs. Based on our assumption about remedial pace, Exhibit 6 distributes over the appropriate years the volumes of media that we assume will shift to combustion. As with the baseline estimate, we used the average annual volume projected using this method to estimate a low-end additional required combustion capacity over the next two years. As seen on the last line of Exhibit 6, the additional required combustion capacity is estimated to be 90,186 cubic yards per year, resulting in a quantity of about 90,000 tons per year over the next two years.

[14] Thomas W. Church and Robert T. Nakamura, Cleaning Up the Mess, Implementation Strategies in Superfund, The Brookings Institution, 1993, page 8.

Exhibit 5
Annual Ex-Situ Soil, Sediment, and Debris Volumes from Wood Preserving Site Remedial Actions Planned for Combustion During 1989 to 1995

		Expected Annual Volume (cubic yards)						
ROD Signature Date	**Ex-Situ Volume (cubic yards)**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
1986	9,000	4,500						
1987	170,000	85,000	85,000					
1988	131,000		65,500	65,500				
1989	0			0	0			
1990	98,000				49,000	49,000		
1991	0					0	0	
1992	2,930						1,465	1,465
1993	25,000							12,500
Annual Volume		89,500	150,000	65,500	49,000	49,000	1,465	13,965
Average Annual Volume		59,776						

Exhibit 6
Annual Ex-Situ Soil, Sediment, and Debris Volumes from Wood Preserving Site Remedial Actions Expected to Shift to Combustion During 1989 to 1995

		Expected Annual Volume (cubic yards)						
ROD Signature Date	**Ex-Situ Volume (cubic yards)**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
1986	101,500	50,750						
1987	0	0	0					
1988	165,000		82,500	82,500				
1989	15,200			7,600	7,600			
1990	85,200				42,600	42,600		
1991	25,000					12,500	12,500	
1992	78,120						39,060	39,060
1993	424,070							212,035
Annual Volume		50,750	82,500	90,100	50,200	55,100	51,560	251,095
Average Annual Volume		90,186						

For the high-end estimate, rather than estimated what portion of soil, sediment, and debris would shift to combustion, we assumed that the total volume media (excluding media contaminated only with CCA and other metals) currently not being combusted would be combusted under the LDRs. As seen in Exhibit 7, the projected annual volume ranges from 50,200 in 1992 cubic yards to 505,750 cubic yards in 1989. As with the baseline and low-end estimates, we used the average annual volume projected using this method to estimate required combustion capacity over the next two years. As seen on the last line of Exhibit 7, this average annual volume of soil, sediment, and debris potentially requiring additional combustion capacity is 170,379 cubic yards per year, resulting in a quantity of about 170,000 tons per year over the next two years.

Thus, using direct estimation, we calculate that between about 90,000 and 170,000 tons per year of contaminated soil, sediment, and debris from wood preserving sites will require additional combustion capacity over the next two years. In comparison, our calculations and assumptions designed to improve the Beazer East approach

estimate that between about 100,000 and 400,000 tons per year of soil, sediment, and debris would require additional combustion over the next two years. Both ranges contain significant uncertainty, however. In addition to the caveats discussed previously, for example, both ranges depend on the assumption regarding planned treatments that are expected to shift to combustion under the LDRs. Some of these shifts may not occur and thus the amounts of additional required combustion capacity conceivably could be lower than estimated. On the other hand, land disposal, which for purposes of this analysis is not expected to shift to combustion, could actually indicate that constituent concentrations are very high such that combustion would be needed under LDRs. Other caveats involve the extent to which all remediation sites have been captured. For example, the Beazer East-based methodology accounts for non-ROD sites, while the current approach for the direct estimate does not.

Exhibit 7
Expected Annual Ex-Situ Soil, Sediment, and Debris Volumes During 1989 to 1995
from Wood Preserving Site Remedial Actions

		Expected Annual Volume (cubic yards)						
ROD Signature Date	**Ex-Situ Volume (cubic yards)**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
1986	1,011,500	505,750						
1987	0	0	0					
1988	231,200		115,600	115,600				
1989	15,200			7,600	7,600			
1990	85,200				42,600	42,600		
1991	25,000					12,500	12,500	
1992	104,520						52,260	52,260
1993	465,570							232,785
Annual Volume		505,750	115,600	123,200	50,200	55,100	64,760	285,045
Average Annual Volume		170,379						

Possible Next Steps

Several next steps could be taken to strengthen this analysis. For example:

- The assumptions regarding the length of time before remediation begins and ends following the ROD could be improved. Alternatively, a sensitivity analysis could be conducted to determine the relative importance of these parameters.

- The assumptions regarding which non-combusted wastes will shift to combustion could be examined. As indicated above, this assumption could be resulting in either an under- or over-estimation.

- The handling of the universe of sites, especially for the direct approach, could be improved to include non-ROD sites. Improvements here, however, would only increase the additional combustion required capacity.

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Please call Scott at (703) 934-3917 or Jim at (703) 934-3648 if you have any questions or comments on this memorandum.

Attachment 1
List of Wood Preserving Site Record's of Decision, 1985 to 1993

ROD Date	Site Name	Principal Contaminants	Volume of Soil or Sediment Managed Ex-situ (yd^3)	Treatment Method	Source	Comment
Sep-85	American Creosote, Pensacola, FL	PCP	0	NA	Beazer	No contaminated soil
May-86	Hocomonco Pond	Creosote	30,000	RCRA disposal	Beazer	
May-86	Reilly Tar, St. L, Minnesota	PAH	800,000	RCRA disposal	Beazer	
Jun-86	Burlington Northern Minnesota	Creosote	8,500	Bioreactor	Beazer	
Sep-86	Coleman	PCP	9,000	Incineration	Beazer	
Sep-86	United Creosoting	CCA, Dioxin	93,000	Critical fluid extraction	Beazer	
Nov-86	Mid-South Wood Products	PAH, PCP, CCA	80,000	RCRA disposal	Beazer	
Mar-87	Bayou Bonfouca	PAH	170,000	Incineration	Beazer	
Sep-87	Palmetto Wood Preserving	CCA	19,000	Soil Washing	Beazer	
Mar-88	L.A. Clarke & Sons	Creosote	112,000	Landfarming, Bioreactor	Beazer	
Apr-88	Brown Wood Preserving	Creosote, PCP	11,200	Land treatment, off-site disposal	Beazer	
Jun-88	N. Cavalcade Street	Creosote	0	NA	Beazer	22,300 cubic yards managed in-situ
Jun-88	Broderick Wood Products	PCP, Dioxins	31,000	Incineration	Beazer	
Jun-88	South Maryland Wood Treating	Creosote, PCP	100,000	Incineration	Beazer	
Sep-88	Selma Treating	CCA, Dioxins, Furans	16,100	Stabilization	Beazer	
Sep-88	Koppers/Texarkana	PCP, CCA	19,400	Soil Washing	Beazer	
Sep-88	S. Cavalcade Street	CCA, PAH	19,500	Soil Washing	Beazer	
Sep-88	American Creosote, Jackson, TN	PCP	23,000	Bioreactor	Beazer	
Dec-88	Libby GW (Champion Int.)	Metals, VOCs	30,000	Bioreactor	Beazer	
Jun-89	Koppers, Galesburg	PCP	15,200	Bioreactor	Beazer	
Jun-89	Cape Fear Wood Preserving	CCA	30,500	Soil Washing	Beazer	
Sep-89	Havertown PCP	PCP	0	Unknown	Beazer	Undetermined volume (out of 40,000 cy of soil)
Sep-89	Burlington Northern, Montana	Metals	11,700	Bioreactors	Beazer	
Sep-89	United Creosoting	CCA	93,000	Critical fluid extraction	Beazer	
Sep-89	Koppers, Oroville, CA	CCA	200,000	Soil Washing	Beazer	
Sep-90	American Creosote, Pensacola, FL	PCP	0	NA	Beazer	No contaminated soil
Sep-90	Baxter/Union Pacific Tie	Creosote, PCP	0	Not defined	Beazer	Undetermined volume (out of 700,000 cy of soil)
Sep-90	Arkwood, Inc.	PCP, PNA, Dioxins	21,000	Incineration	Beazer	
Sep-90	Texarkana Wood Pres. Co.	PCP, Creosote	77,000	Incineration	Beazer	
Sep-90	Moss-Am. Kerr McGee Oil	PAH	85,200	Bioreactor	Beazer	
Sep-91	Macgillis & Gibbs Co/Bell Lumber & Pole	PCP, PAHs, metals	0	NA	ICF	Sludge only (100,000 gallons)
Sep-91	Havertown PCP Site	PCP, PAHs, metals, VOCs	0	NA	ICF	Groundwater
Sep-91	Valley Wood Preserving	Metals	15,000	Fixation	ICF	

ROD Date	Site Name	Principal Contaminants	Volume of Soil or Sediment Managed Ex-situ (yd^3)	Treatment Method	Source	Comment
Sep-91	Saunders Supply Co.	Dioxins, PCP, metals	25,000	Low temp thermal desorption, off-site disposal	ICF	
Mar-92	Koppers Co., Inc. Texarkana	PCP, VOCs, PAHs, metals	19,400	Soil washing	ICF	Range of 3,300 to 19,400 cy reported.
Mar-92	Broderick Wood Products	VOCs, PAHs, dioxins, metals	59,120	Bioremediation	ICF	
Jun-92	Reilly Tar & Chemical (Indianapolis)	VOCs, other organics	0	NA	ICF	Groundwater
Jul-92	Benfield Industries, Inc.	VOCs, PAHs, metals	0	NA	ICF	No data
Sep-92	Joseph Forest Products	Metals, inorganics	0	NA	ICF	No data
Sep-92	Wyckoff Co./Eagle Harbor	PAHs, metals	7,000	Dredge, land disposal	ICF	Range of 1,000 to 7,000 cy reported.
Sep-92	Idaho Pole Co	Dioxins, PAHs, inorganics	19,000	Bioremediation	ICF	
Dec-92	Koppers Morrisville Plant	Dioxins, phenols	2,930	Incineration	ICF	
Feb-93	Popile, Inc.	Creosote, PCP	165,000	Biological land treatment	ICF	
Apr-93	American Creosote Works	PAHs, phenols	25,000	Incinerate (tars and sludge)	ICF	
Jun-93	Renkotil VA Wood Pres. Div.	VOCs, PAHs, metals, dioxin	70	Incineration (K001)	ICF	
Jun-93	Renkotil VA Wood Pres. Div.	VOCs, PAHs, metals, dioxin	5,150	Low temperature thermal desorption	ICF	
Jun-93	Renkotil VA Wood Pres. Div.	VOCs, PAHs, metals, dioxin	7,200	Excavate and consolidate	ICF	
Jun-93	American Crossarm & Conduit	PCP, PAH, dioxin	34,300	Solidification and disposal	ICF	
Sep-93	Reilly Tar & Chemical (St. Louis Park)	PAHs	0	NA	ICF	Groundwater
Sep-93	Reilly Tar & Chemical (Indianapolis)	VOCs, organics	45,920	Low temperature thermal desorption	ICF	
Sep-93	Montana Pole and Treating	PAHs, organics, metals	208,000	Bioremediation	ICF	

January 29, 1997

MEMORANDUM

TO: Bill Kline, EPA/OSW

CC: C. Pan Lee, EPA/OSW

FROM: Scott Breffle and Jim Laurenson

SUBJECT: Methodology and Data Sources for Estimating the Volume of Wood Preserving Waste Requiring Combustion Under the Phase IV Land Disposal Restrictions

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This memorandum presents our methodology and data sources for refining the estimates of required combustion capacity for wood preserving wastes subject to the pending Phase IV land disposal restrictions (LDRs). We plan to have preliminary results by Thursday or Friday of this week.

1. Methodology

We are refining the estimate of soil contaminated with newly listed wood preserving wastes (presented in Section 3.4 of the draft wood preserving capacity background document) in three ways:

1. updating the projected volumes of excavated wood preserving wastes that were presented in response to the ANPRM by Beazer East, Incorporated[15] using more recent Superfund Records of Decision (RODs);

2. refining the Beazer East methodology by estimating the annual excavated soil and sediment volumes directly, based on the excavated soil volume for all RODs in each year and an estimate of the average duration of a Superfund remedial action; and

3. incorporating new data obtained from the Biennial Reporting System (BRS) and other commenter data.

1.1 Update of Beazer East Estimate

To update the estimate of wood preserving wastes potentially requiring combustion, we are first duplicating the methodology of Beazer East using more recent ROD data. The Beazer East analysis used RODs from 1982 to 1990. We will incorporate RODs from wood preserving sites from 1991 to the most recent RODs that are obtainable. The basic methodology used by Beazer East is as follows:

1. Determine the number and percentage of wood preserving site RODs examined that have contaminated soil and sediment (i.e., excluding sites with only contaminated ground water);

2. Determine the number and percentage of wood preserving site RODs that have contaminated soil and sediment that will undergo excavation;[16]

3. Calculate the total volume (across all RODs) of wood preserving site soil and sediment to be excavated;

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[15] "Wood Treating Review Project," memorandum to Beazer East, Inc. from National Environmental Technology Applications Corporation, December 2, 1991, RCRA Docket No. CSP-00020.A.

[16] It is the excavated portion of the soil and sediment that is potentially subject to LDRs and thus combustion.

4. Based on steps 2 and 3, calculate the average volume to be excavated per site among those wood preserving sites requiring soil and sediment excavation; and

5. Based on an estimate of total number of wood preserving sites in the United States, extrapolate to a national total waste quantity using the percentage of sites with contaminated soil and sediment, the percentage of sites requiring excavation, and the average volume per site (i.e., step 1*step 2*step 4*the total number of wood preserving sites in the United States).

This methodology produces an upper-bound estimate (and possibly an unreasonable upper-bound estimate; see Section 1.2) of total soil and sediment requiring combustion by assuming that all soil and sediment that is managed ex-situ, including the portion that undergoes non-thermal treatment, will need to be combusted. In addition, this methodology essentially assumes that all wood preserving sites in the United States will generate excavated remediation volumes similar to volumes excavated at current Superfund sites, and that these remediations will occur in the near future.

Our revised estimate may differ from that provided by Beazer East because more recent RODs may indicate that more or less volume is being treated ex-situ. For example, the earlier Superfund RODs could have addressed sites that are larger or more contaminated than sites addressed by more recent RODs. As a result, future volumes of soil and sediment that require combustion may be less than that projected by Beazer East. We may be able to refine the upper-bound volume requiring combustion by estimating the fraction of currently excavated soils and sediments that may be treated by methods other than combustion to meet the LDRs. For example, wood preserving sites that are contaminated with only F035 wastes (i.e., inorganics) will not use combustion as a treatment method. These volumes of F035 wastes can be subtracted from the upper-bound estimate. The RODs that are being reviewed will generally contain data on current treatment methods.

Next, we plan to estimate the subset of the total volume of soil and sediment that will require treatment within the next two years. That is, many of the sites represented by the RODs likely have already excavated and treated their soils and sediments, while some sites are likely to take longer than the two-year variance window to implement that portion of the ROD. Analysis conducted for the Hazardous Waste Identification Rule for Contaminated Media (HWIR-Media) has generated estimates of the total volume and number of Superfund sites expected to be remediated annually over the next five years. This information, in conjunction with an estimate of the relative proportion of wood preserving site RODs to the total number of RODs, can be used to estimate the volume of excavated soil and sediment that will require treatment within the next two years.

A lower-bound estimate of the total required combustion capacity will be estimated by assuming that, at a minimum, all volumes currently being excavated and combusted will continue to be treated in that manner after the LDRs are effective. We may be able to refine this lower-bound volume by adding soil and sediment to this volume using assumptions about what proportion of waste undergoing non-thermal treatment will require combustion.

Finally, another possible refinement includes subtracting possible K001 and D037 wastes undergoing combustion from the upper-bound and lower-bound estimates.

1.2 Directly Estimate the Annual Volume of Soil and Sediment Excavated from Wood Preserving Sites

As a supplement to—and possbly a replacement of[17]—the Beazer East methodology, we will use the data from the previous analysis (Section 1.1) to construct a direct estimate of the annual volume of soil and sediment expected to be excavated from wood preserving sites. To do this, we will directly sum the volume of excavated soil and sediment from RODs signed in the same year. Because Superfund remediation actions are likely to span more than one year, however, each annual volume will be spread over an appropriate number of years. The final estimate

[17] A detailed review of the Beazer East methodology indicates that several unreasonable assumptions have been used to estimate total soils. For example, Beazer East essentially assumes that all wood preserving sites will undergo remediation in the near future, and that the quantity of soil removed at each site will be similar to that removed at current wood preserving Superfund sites. Neither assumption is likely to be realized.

of the annual volume of excavated soil and sediment from wood preserving sites will be a sum of the volumes from remedial actions begun in the recent past years as well as the current year. We will use data contained in the HWIR-Media proposed rule (which came from a Report to Congress on the Superfund Program) to estimate the average length of Superfund remedial actions.

2. Data Sources

2.1 Records of Decision

We have currently identified approximately 20 RODs signed between 1991 and 1993 that address contamination at wood preserving sites, or sites where wood preserving operations were conducted. We are in the process of extracting from these RODs information on volumes of soil and sediment, and the recommended treatment methods. These RODs are contained on a March 1995 CD-ROM disc[18] that ICF possesses.

More recent RODs can be obtained by purchasing a newer version of the above CD-ROM disc ($325). Alternatively, we plan to investigate the quality of information that can be obtained through on-line databases such as the Right to Know Network (RTK-Net), which houses the CERCLA Superfund Information System (CERCLIS) and National Priority List (NPL) databases.

2.2 BRS WR Form

We are currently reviewing data submitted on the BRS waste received (WR) form in an effort to refine the estimates of soil and sediment requiring treatment. The WR form will provide information on wood preserving wastes received from off-site, and may capture volumes of wood preserving wastes that were not reported on the BRS GM form, such as wastes from small quantity generators or wastes that were assigned the wrong treatment method by the generator. A tally of the total quantity of wood preserving wastes requiring land disposal will provide an upper-bound estimate of wood preserving wastes requiring treatment under the LDRs.

2.3 Corrective Action

Information on the volumes of soil and sediment from RCRA corrective actions is limited. While RCRIS theoretically contains data on volumes at RCRA corrective action sites, in practice that data are frequently missing from the files or are ambiguous. Furthermore, based on a brief review of the Corrective Action Regulatory Impact Analysis database, relatively few wood preserving sites appear to be undergoing RCRA corrective action compared to Superfund remediation. We therefore propose at this time to not use corrective action data to estimate soil and sediment volume potentially subject to combustion.

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Please call Scott at (703) 934-3917 or Jim at (703) 934-3648 if you have any questions or comments on this memorandum.

[18] EPA Superfund Records of Decision on CD-ROM, National Technical Information Service (NTIS), PB95-593551FCD, March 1995.