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secondary wastewater treatment system as characterized by the average of the best 50 percent of the existing mills in the subcategory.

(3) Option Selected, Pollutants Regulated, and Costs. EPA is promulgating NSPS for the Bleached Papergrade Kraft and Soda subcategory for toxic and nonconventional pollutants based on the NSPS option equivalent to BAT Option B. EPA has determined that Option B technology represents the best demonstrated control technology, process, operating method, or other alternative available at this time. The toxic and nonconventional pollutants regulated by NSPS are the same as those regulated by BAT. For further discussion of the NSPS model technology, the Supplemental Technical Development Document, DCN 14487.

EPA rejected as possible NSPS technologies the technologies that have not been demonstrated to achieve full market pulp specifications. EPA knows of two ECF bleach lines using ozone-based bleaching in the U.S. One line uses an OZE_oDD bleach sequence to bleach hardwood to 83 GE brightness (less than 82 ISO). The other line uses an OZE_oD bleach sequence to bleach softwood to 84 ISO, somewhat less than full market brightness. EPA collected data from this line that confirm that OZE_oD bleaching results in much lower water use and pollutant loadings than either Option A or Option B. Because of this level of performance, EPA strongly encourages further development of ozone-based bleaching sequences—as part of either ECF or TCF sequences. It is possible that lines using ozone-based bleaching sequences will achieve the AOX limits promulgated as part of the Voluntary Advanced Technology Incentives Program, which is described in Section IX of this Notice.

With respect to TCF bleaching processes, several non-U.S. mills have reported the production of TCF softwood kraft pulp at full market brightness. However, EPA's data are not sufficient to confirm that TCF bleaching processes are technically demonstrated for the full range of market products currently served by the kraft process. EPA is also unable to define a segment of the Bleached Papergrade Kraft and Soda subcategory for which TCF bleaching processes are known to be technically feasible and thus could be the basis for NSPS. EPA believes that progress being made in developing TCF bleaching processes is substantial, however, and that additional data may demonstrate that TCF processes are indeed available for the full range of market products. To this end, elsewhere in today's **Federal Register** Notice, EPA is inviting additional data and comment on the full range of market specifications currently being achieved for TCF kraft pulp (e.g., brightness, strength, and cleanliness). EPA will evaluate whether the performance of this technology will result in greater removals than the performance of the NSPS technology option being selected today. Depending on these findings, EPA will determine whether to propose revisions to NSPS based upon TCF and, if appropriate, flow reduction technologies.

In addition to NSPS relating to the Voluntary Advanced Technology Incentives Program, which is discussed below in this section, EPA is also promulgating alternative NSPS for Bleached Papergrade Kraft and Soda mills voluntarily choosing to use TCF technologies. See 40 CFR 430.25(b)(2).

For the conventional pollutants BOD_5 and TSS, EPA is basing NSPS upon the best available demonstrated performance of a secondary wastewater treatment system as characterized by the average of the best 50 percent of the existing mills in the subcategory. EPA has determined that the performance of the single best mill does not account for all sources of process-related variability in conventional pollutant generation and treatability expected in the entire subcategory, including raw materials (i.e., furnish), process operations, and final products. In selecting the final NSPS technology basis for conventional pollutants, EPA found it necessary to consider the secondary wastewater treatment performance of the best 50 percent of the existing mills in this subcategory in order to ensure that the resulting standards reflect the full range of processes and raw materials to produce the full range of products covered by this subcategory. For further discussion, see the Supplemental Technical Development Document, DCN 14487, and DCN 14497, Vol. I and II.

EPA is not revising NSPS for pH for subpart B; however, for the convenience of the permit writer, EPA has recodified the 1982 NSPS for pH as part of the table of newly promulgated NSPS for toxic, non-conventional, and other conventional pollutants. See 40 CFR 430.25(b).

In selecting its model NSPS technologies, EPA considered all of the factors specified in CWA section 306, including the cost of achieving effluent reductions. The incremental capital cost of complying with the selected NSPS for all pollutants, as compared to the costs of complying with standards based on the next best technology, BAT Option A, is only 0.5 to 2.0 percent of the total capital cost of constructing either a new source fiber line at an existing mill or a new greenfield mill. Moreover, the process technologies that form the basis for NSPS result in lower pollutant loadings requiring biological treatment. Loadings of BOD_5 from a bleach line employing NSPS will be approximately 30 percent lower than loadings from a conventional bleach line. Compared to the cost of treating wastewater from a conventional bleach line to meet current BPT/BCT effluent limitations guidelines, the cost of treating wastewater from a NSPS bleach line to meet NSPS for conventional pollutants will be the same or lower. Finally, as of mid-1995 there are 14 existing mills representing approximately 16 percent of the bleached papergrade kraft production that employ the Option B technology. For these reasons, EPA concludes that the costs of complying with NSPS for toxic, non-conventional or conventional pollutants do not present a barrier to entry. See the Supplemental Technical Development Document, DCN 14487. See also Section VIII and Chapter 6 of the Economic Analysis, DCN 14649.

The Agency also considered energy requirements and other non-water quality environmental impacts for the selected NSPS option. EPA concluded that increased chemical recovery and reduced energy consumption and operating costs would occur for this option. EPA also concluded that non-water quality environmental impacts were only marginally different than for the selected BAT technology option and are acceptable. Thus, EPA concluded that none of the statutory factors justified selecting a different NSPS model technology than the one chosen. See Section VII. See also the Supplemental Technical Development Document, DCN 14487.

EPA is also promulgating NSPS as part of the Voluntary Advanced Technology Incentives Program with standards set at the Tier II and Tier III levels. See 40 CFR 430.25(c). For a discussion of this program, see Section IX. A new source may choose to enroll in the Voluntary Advanced Technology Incentives Program at the Tier II or Tier III NSPS level and therefore to commit to achieve those standards at the time it commences operation. Alternatively, a new source may choose to commence operation at the compulsory NSPS level and then later enroll in the Incentives Program at the Tier II or Tier III level as an existing source, or enroll in the Incentives Program once Tier II or Tier III limitations are achieved.

Finally, EPA notes that the previously promulgated NSPS for the biocides pentachlorophenol and trichlorophenol

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continue to apply to all new sources. See 40 CFR 430.25(d).

(4) Limitations and Point of Compliance Monitoring. EPA is promulgating NSPS for dioxin, furan, chloroform, the 12 chlorinated phenolic pollutants, and AOX for Subpart B at the levels set forth in Tables VI–5 and VI–6 for BAT Option B. See 40 CFR 430.25(b)(1). For a discussion of EPA's development of those standards (presented in the context of possible BAT limitations derived from Option B technologies), see Section VI.B.5.a(4). The numerical values of today's NSPS for BOD5 and TSS for the Bleached Papergrade Kraft and Soda subcategory have been revised from those provided in the July notice. For a discussion of these changes, see the Statistical Support Document, DCN 14496. The final NSPS for BOD_5, TSS and pH are presented in Table VI–7 below.

TABLE VI–7.—NEW SOURCE PERFORMANCE STANDARDS FOR CONVENTIONAL POLLUTANTS FOR THE BLEACHED PAPERGRADE KRAFT AND SODA SUBCATEGORY

NSPS			
Pollutant or pollutant property	Continuous dischargers		Non-continuous dischargers
	Maximum for any 1 day (kg/kkg)	Monthly average (kg/kkg)	Annual average (kg/kkg)
BOD5	4.52	2.41	1.73
TSS	8.47	3.86	2.72
pH	(1)	(1)	(1)

1 Within the range of 5.0 to 9.0 at all times.

EPA is requiring mills to demonstrate compliance with the NSPS for dioxin, furan, chloroform and the 12 chlorinated phenolic pollutants inside the discharger's facility at the point where the wastewater containing those pollutants leaves the bleach plant. See 40 CFR 430.25(e). EPA bases this decision on the reasons discussed in Section VI.B.5.a(6) for BAT limitations. EPA is not specifying a point of compliance monitoring for AOX, BOD_5, TSS, pH, or the biocides.

c. Pretreatment Standards for Existing Sources (PSES) and Pretreatment Standards for New Sources (PSNS). (1) Background. EPA proposed the same technology option for PSES as it did for BAT. This proposed option would have set PSES for the same pollutants controlled by BAT. For new indirect discharging facilities, EPA proposed that PSNS be set equal to NSPS for the toxic and nonconventional pollutants. At proposal, EPA also discussed three options for implementing the pretreatment standards. See 58 FR at 66123–25. EPA also solicited comment on whether pretreatment standards for BOD_5 and TSS were warranted to ensure that pass-through of these and other pollutants (e.g., AOX) did not occur.

(2) Pass-through Analysis for PSES and PSNS. EPA promulgates pretreatment standards for pollutants that pass through or interfere with POTWs. EPA performed a pass-through analysis as part of this rulemaking, which is summarized below. See also the Supplemental Technical Development Document, DCN 14487. EPA has determined for subpart B mills that dioxin, furan, chloroform, the 12 chlorinated phenolic pollutants, and AOX pass through POTWs. Therefore, the Agency is promulgating PSES and PSNS for these pollutants. See 40 CFR 430.26(a)(1) and 430.27(a)(1).

EPA's record shows that both direct discharging mills and POTWs accepting wastewaters from pulp and paper mills in the Bleached Papergrade Kraft and Soda subcategory operate secondary biological treatment systems. The indirect discharging mills in this subcategory contribute the majority of the pollutant loading and up to 90 percent of the flow to these POTWs. (EPA refers to these POTWs as ''industrial POTWs.'') EPA has reviewed data available in the record for BOD_5 and TSS, among other pollutants, and has determined that the biological treatment systems at these POTWs are comparable to the biological treatment systems operated by direct discharging mills in subpart B. See the Supplemental Technical Development Document, DCN 14487.

EPA reviewed all available data in the record to conduct a pass-through analysis. EPA compared the percent of removals achieved by subpart B mills implementing the BAT technologies to the percent of the same pollutants removed by the industrial POTWs receiving effluent from subpart B mills. EPA's record shows that dioxin and furan are not removed by biological treatment systems and so are not removed by the POTW. Therefore, these pollutants pass through untreated and are discharged to receiving streams, where dioxin and furan bioaccumulate in aquatic organisms. EPA bases this conclusion on data reported in the ''104-Mill Study,'' which EPA undertook in cooperation with industry in 1988/89. That study shows that direct discharging bleached papergrade kraft and soda mills operating secondary biological treatment systems (without the addition of bleach plant process controls) discharge dioxin and furan in detectable quantities. When mills in that subcategory later implemented bleach plant process changes and controls comparable to the model BAT technologies considered in promulgating today's BAT effluent limitations guidelines, the data show that dioxin and furan discharges dropped below the minimum level at which those pollutants can be reliably measured. This was the case even where there was no concurrent change to the secondary biological treatment systems. (Indeed, EPA's candidate BAT technologies assume secondary biological treatment systems operating at the 1989 level). Because, as discussed above, the industrial POTWs receiving effluent from bleached papergrade kraft and soda mills operate biological treatment systems that are comparable to those operated by direct discharging mills in the ''104-Mill Study,'' EPA concluded that subpart B mills implementing the selected in-plant BAT model technology achieve substantially greater reductions of dioxin and furan than industrial POTWs can achieve from effluent not subject to BAT-level process controls. EPA finds that in the absence of PSES equivalent to BAT levels of control, dioxin and furan would pass through POTWs. EPA also believes that the presence of these pollutants in the POTWs' secondary

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sludge could possibly interfere with their sludge disposal options.

For chloroform, EPA also evaluated the removal efficiencies achieved by POTWs by comparing the removals achieved by direct discharging mills using BAT process technologies to the removals achieved by POTWs receiving effluent from subpart B mills. The record shows that, without the BAT process changes, a very high percentage of chloroform volatilizes from collection, conveyance, and aeration systems. EPA has consistently refused in these circumstances to regard such transfers of pollutants from wastewater to air as treatment. See, e.g., 59 FR 50638, 50665 (Sept. 28, 1993) (pesticides chemicals guidelines); 58 FR 36872, 36886–88 (July 9, 1993)(organic chemicals, plastics, and synthetic fibers guidelines). Therefore, because of this volatilization of chloroform in the absence of bleach plant process changes, the quantity of chloroform actually available to be removed by the POTWs' secondary treatment works is less than the quantity of that pollutant removed by the direct discharger employing BAT. Accordingly, EPA concludes that there is pass-through of chloroform in the absence of pretreatment standards for this pollutant, as well as unacceptable non-water quality environmental impacts from air emissions. For a detailed discussion of chloroform volatilization, see Section 8.8 of the Supplemental Technical Development Document, DCN 14487, and the Air Docket, No. A–92–40, Item IV–A–8.

EPA's determination that the chlorinated phenolic pollutants pass through the POTW is based on data in the record showing that the selected BAT process technology option (Option A) reduces all 12 of the chlorinated phenolic pollutants to concentrations less than minimum levels for these pollutants in bleach plant wastewaters, prior to end-of-pipe biological wastewater treatment systems. While biological wastewater treatment systems comparable to POTW treatment systems have been found to remove a portion of these chlorinated phenolic pollutants, the removals achieved are less than the removals achieved by the BAT process changes alone. Therefore, because overall chlorinated phenolic pollutant removals with implementation of the model BAT technologies are substantially greater than removals achieved by POTWs, chlorinated phenolic pollutants pass through POTWs.

EPA has also determined that AOX passes through. EPA bases this conclusion on its review of all available data regarding removals of AOX achieved by industrial POTWs that receive a majority of their flow or a majority of their BOD_5 or TSS loadings from indirect dischargers covered by subpart B. Although the data show that the performance of these POTWs in removing AOX is comparable to the performance of end-of-pipe biological treatment systems operated by direct dischargers in this subcategory, the data also show that direct dischargers meeting limitations based on the model BAT technology consistently achieve far greater AOX removals than biological treatment alone can achieve (e.g., at a POTW). (See the Supplemental Technical Development Document, DCN 14487.) Therefore, in the absence of pretreatment standards analogous to BAT, the affected POTWs receiving pulp and paper wastewaters cannot achieve the same overall removals of AOX as achieved by direct dischargers complying with the BAT limitations for AOX. The same is also true when considering removals achieved by new sources complying with NSPS. Therefore, contrary to the preliminary finding in the July 1996 Notice, EPA concludes that AOX passes through POTWs and is setting pretreatment standards for AOX for new and existing indirect discharging mills. See 40 CFR 430.26(a) and 430.27(a).

The pretreatment standards promulgated today for AOX are equivalent to the AOX loadings present in the bleach plant wastewaters of mills employing the BAT/NSPS technologies prior to biological treatment systems at direct discharging mills. EPA expects that removals achieved by indirect dischargers employing the PSES or PSNS model technology, in combination with removals achieved by biological treatment systems at POTWs, will be comparable to the removals achieved by direct dischargers complying with BAT limitations or NSPS.

In reviewing the information available in the record for the pollutants BOD_5 and TSS, EPA concluded that pollutant reductions attained by direct dischargers' biological wastewater treatment systems and by POTWs accepting similar wastewaters are comparable and that pass-through of these pollutants does not occur. As a result, EPA is not promulgating national PSES or PSNS for BOD_5 and TSS for the Bleached Papergrade Kraft and Soda subcategory. Other regulatory authorities may determine, based on a site-specific review of treatment system performance, that locally imposed limits are necessary to prevent the POTW from violating its NPDES permit. See 40 CFR 403.5.

(3) Options Considered. In this final rule, EPA considered the same process technology options and best management practices for PSES and PSNS as it did for BAT and NSPS. In a change from the proposal, EPA did not consider for PSES/PSNS the biological treatment technology that forms part of the candidate BAT and NSPS technologies. Since proposal, EPA has made new findings with respect to the pass-through of BOD_5 and TSS. EPA has also received comments indicating that the lack of sufficient land for the installation of biological treatment at some indirect dischargers makes such systems infeasible and unavailable. This finding, combined with EPA's finding that biological wastewater treatment systems at POTWs treating pulp and paper wastewaters are comparable to the biological wastewater treatment systems operated by direct discharging mills in subpart B, has lead EPA to conclude that biological wastewater treatment should not be included as part of the PSES or PSNS candidate technologies.

(4) Effluent Reductions. As discussed in Section VI.B.5.a.(3) above, after proposal EPA recalculated the effluent reductions attributable to its PSES technology options using a new baseline of mid-1995. See the Supplemental Technical Development Document, DCN 14487.

Table VI–8 shows the estimated baseline and the reduction from baseline expected if the presented options were implemented by all the existing indirect discharging mills in the subcategory (i.e., those mills to which PSES will apply).

TABLE VI–8.—BASELINE DISCHARGES AND ESTIMATED REDUCTIONS OF POLLUTANTS FOR BLEACHED PAPERGRADE KRAFT AND SODA MILLS FOR TECHNOLOGY OPTIONS CONSIDERED[a]

Pollutant parameter	Units	Baseline discharge	Estimated reductions: Option A	Estimated reductions: Option B	Estimated Reductions: TCF
2,3,7,8–TCDD	g/yr	1.25	0.92	1.00	1.25

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TABLE VI–8.—BASELINE DISCHARGES AND ESTIMATED REDUCTIONS OF POLLUTANTS FOR BLEACHED PAPERGRADE KRAFT AND SODA MILLS FOR TECHNOLOGY OPTIONS CONSIDERED[a]—Continued

Pollutant parameter	Units	Baseline discharge	Estimated reductions: Option A	Estimated reductions: Option B	Estimated Reductions: TCF
2,3,7,8–TCDF	g/yr	9.47	8.94	9.04	9.47
Chloroform	kkg/yr	4.89	4.28	4.28	4.89
12 Chlorinated phenolic pollutants	kkg/yr	3.58	2.81	2.97	3.58
AOX	kkg/yr	3,010	2,100	2,600	3,010

[a] The TCF calculations assumed that chlorinated pollutants will not be present. For all other calculations, EPA assumed that pollutants reported as ''not detected'' were present in a concentration equivalent to one-half the minimum level of the analytical method.

(5) PSES/PSNS Option Selection. EPA is promulgating PSES and PSNS for dioxin, furan, chloroform, 12 chlorinated phenolic pollutants, and AOX based on the process technologies that form the bases for BAT and NSPS, respectively.

The Agency considered the age, size, processes, other engineering factors, and non-water quality environmental impacts pertinent to Subpart B mills in developing PSES/PSNS. None of these factors provided any basis for establishing different PSES/PSNS. EPA has no data to suggest that the combination of technologies upon which today's PSES/PSNS are based results in unacceptable non-water quality environmental impacts.

Because the costs of the selected BAT and PSES model technologies are attributable solely to process changes, the costs for an existing indirect-discharging bleached papergrade kraft and soda mill to comply with PSES are comparable to a similar direct-discharging bleached papergrade kraft and soda mill. See Section VI.B.5.a(2). As discussed in Section VI.B.5.a(5), EPA found PSES based on BAT Option A to be economically achievable. Similarly, EPA considered the cost of the PSNS technology for new mills (based on BAT Option B) and determined that such costs do not present a barrier to entry, as reflected in the barrier to entry discussion for NSPS in Section VI.B.5.b(3).

The rationale for choosing BAT Option A as the basis for PSES is set forth in Section VI.B.5.a(5). The rationale for selecting NSPS Option B as PSNS is the same as that provided in Section VI.B.5.b for selecting that model technology as the basis for NSPS for this subcategory. Although for the reasons set forth in those sections EPA is not selecting TCF bleaching processes as the model technology for PSES or PSNS, EPA nevertheless is promulgating voluntary alternative pretreatment standards based on TCF bleaching processes in order to encourage mills to use those processes when possible. See 40 CFR 430.26(a)(2) and 430.27(a)(2).

The pretreatment standards for the Bleached Papergrade Kraft and Soda subcategory also include best management practices. See 40 CFR 430.03. These regulations are described in Section VI.B.7. For a discussion of the pass through of pollutants controlled by BMPs, see Section VI.B.7. In addition, the previously promulgated PSES and PSNS for former subparts G, H, I and P for the biocides pentachlorophenol and trichlorophenol continue to apply unless the discharger certifies that it does not use those compounds as biocides. See 40 CFR 430.26(b) and 430.27(b).

(6) Limitations. With the exception of AOX, the limitations promulgated as PSES for Subpart B are identical to those promulgated as BAT limitations for this subpart. See 40 CFR 430.26(a)(1). For a discussion of the development of those pretreatment standards see Section VI.B.5.a(4).

EPA found that while end-of-pipe biological treatment systems at industrial POTWs and at direct dischargers achieve comparable removals of AOX, the total AOX removals achieved by direct discharging mills are greater because of the process changes that are part of the model BAT/PSES technologies. Therefore, EPA has established AOX pretreatment standards based on the performance of process changes alone (biological treatment is not a component of PSES/PSNS). EPA has developed AOX limits for PSES based on bleach plant data for eight mills that employ the process technologies incorporated in Option A. These pretreatment standards are presented in Table VI–9.

TABLE VI–9.—BLEACHED PAPERGRADE KRAFT AND SODA SUBCATEGORY PSES AOX LIMITATIONS

Pollutant parameter	Daily maximum limitation (kg/kkg)	Monthly average limitation (kg/kkg)
AOX	2.64	1.41

Similarly, with the exception of AOX, the PSNS promulgated for Subpart B for toxic and nonconventional pollutants are identical to the NSPS promulgated for this subpart. See 40 CFR 430.27(a)(1). For a discussion of the development of those pretreatment standards, see Section VI.B.5.a(4). EPA has developed AOX limits for PSNS based on bleach plant data for six mills that employ the process technologies incorporated in Option B. These pretreatment standards are presented in Table VI–10.

TABLE VI–10.—BLEACHED PAPERGRADE KRAFT AND SODA SUBCATEGORY PSNS AOX LIMITATIONS

Pollutant parameter	Daily maximum limitation (kg/kkg)	Monthly average limitation (kg/kkg)
AOX	1.16	0.814

(7) Point of Compliance Monitoring. For many of the same reasons set forth in Section VI.B.5.a(6) above in connection with EPA's decision to specify an in-plant point of compliance monitoring for many of the BAT parameters, EPA is requiring indirect discharging mills subject to Subpart B to demonstrate compliance with pretreatment standards for dioxin, furan, chloroform, the chlorinated phenolic pollutants, and AOX at the bleach plant. See 40 CFR 430.26(c) and 430.27(c). As is the case for direct dischargers, data for indirect discharging mills show that standards imposed at the point of discharge to the POTW would make it impractical for the permitting authority to assure that

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the indirect discharger is achieving removal of the pollutants as required by the pretreatment standards. Moreover, EPA is concerned that dioxin and furan, even when present in nondetectable amounts at the point of discharge to the POTW, could pass through the POTW and accumulate in the biosolids, thus possibly interfering with the beneficial reuse of that biosolids material. The extent to which sludge can be beneficially reused is the subject of a separate ongoing rulemaking under CWA Section 405. Finally, under EPA's regulations, indirect dischargers are prohibited from substituting dilution for treatment, except where dilution is expressly authorized by the applicable pretreatment standard. See 40 CFR 403.6(d). (That is not the case here.) This prohibition theoretically could be enforced on a pollutant-by-pollutant, case-by-case basis. However, EPA is concerned that such a solution to the effluent's detection and dilution problems may impose an unnecessary financial and technical burden on POTWs.

At the time of proposal, EPA proposed that compliance with PSES/PSNS AOX limitations would be demonstrated at the point of discharge to the POTW. Since biological treatment is no longer part of the model technology for PSES/PSNS, AOX limitations based upon the performance of the PSES/PSNS technology are more appropriately set, and compliance demonstrated, at the bleach plant, prior to mixing with other wastestreams. This will reduce the burden on the pretreatment authority in implementing the PSES/PSNS limitations, as no additional allowance will need to be factored into the AOX limitations that would apply due to sources of AOX beyond the bleach plant. In this respect, the decision to establish in-plant points of compliance monitoring for all PSES/PSNS regulated parameters also furthers the goals of the Unfunded Mandates Reform Act. For all of these reasons, EPA is establishing in-plant points of compliance monitoring for PSES/PSNS on a nationwide level.

6. Papergrade Sulfite Subcategory

a. Segmentation of the Papergrade Sulfite Subcategory. In this final rule, EPA is dividing the Papergrade Sulfite subcategory into three segments to better reflect product considerations, the variation in manufacturing processes, and the demonstration of pollution prevention process changes within the category for the purpose of establishing BAT, NSPS, PSES, and PSNS. EPA's reasons for doing so are discussed in the July 1996 Notice, 61 FR at 36844–45, and in paragraphs b(1)–(2) below. EPA is promulgating final effluent limitations guidelines and standards for each segment. The three segments are:

(1) Production of pulp and paper at papergrade sulfite mills that use an acidic cooking liquor of calcium, magnesium, or sodium sulfite, unless those mills are specialty grade sulfite mills. See 40 CFR 430.51(c)(1). Mills in this segment are ''calcium-, magnesium-, or sodium-based sulfite mills;''

(2) Production of pulp and paper at papergrade sulfite mills that use an acidic cooking liquor of ammonium sulfite, unless those mills are specialty grade sulfite mills. See 40 CFR 430.51(c)(2). Mills in this segment are ''ammonium-based sulfite mills;'' and

(3) Production of pulp and paper at specialty grade sulfite mills, or ''specialty grade sulfite mills.'' Specialty grade sulfite mills are those mills where a significant portion of production is characterized by pulp with a high percentage of alpha cellulose and high brightness sufficient to produce end products such as plastic molding compounds, saturating and laminating products, and photographic papers. EPA considers a significant portion of production to be 25 percent or more. The specialty grade segment also includes those mills where a major portion of production is 91 ISO brightness and above. EPA considers a major portion of production to be 50 percent or more.

See 40 CFR 430.51(c)(3). In order to determine whether a sulfite mill belongs in the specialty grade segment, permitting authorities should consider the expected production mix over the full permit term. For mills that are converting to production in the specialty grade segment, EPA expects these mills will be subject to these limits prior to the time that these mills achieve the production mixes described above.

b. BAT. (1) Options Considered. EPA had proposed BAT effluent limitations for AOX and COD for the entire Papergrade Sulfite subcategory based on totally chlorine-free bleaching processes. Totally chlorine-free (TCF) bleaching processes are bleaching operations that are performed without the use of chlorine, sodium or calcium hypochlorite, chlorine dioxide, chlorine monoxide, or any other chlorine-containing compound. After concluding that the proposed technology was not demonstrated for the full range of products produced by mills using ammonium sulfite cooking liquor or for specialty grade products, EPA segmented the subcategory and considered other BAT options as set forth below. EPA also included for all segments the performance of existing secondary biological wastewater treatment as part of the basis for nonconventional and conventional pollutant effluent limitations and NSPS. For a more detailed discussion of these options, see the Supplemental Technical Development Document, DCN 14487.

(i) Calcium-, Magnesium-, or Sodium-Based Sulfite Mills. The technology option considered for papergrade sulfite products made by this segment was TCF bleaching, as proposed. See 58 FR at 66114–15. Existing TCF mills in this segment produce the same products they had been able to produce using elemental chlorine-free (ECF) bleaching processes, at up to 91 ISO brightness. Therefore, EPA did not consider ECF bleaching as a technology option for this segment, because, while technically available and economically achievable, it was not the best such technology for this segment.

(ii) Ammonium-Based Sulfite Mills. The technology options considered for this segment were TCF bleaching and ECF bleaching. ECF bleaching is any process for bleaching pulps that does not employ elemental chlorine or hypochlorite. There are numerous variations of ECF bleaching processes. The ECF process considered for the ammonium-based segment includes peroxide-enhanced extraction.

(iii) Specialty Grade Sulfite Mills. The technology bases considered for this segment were TCF bleaching and ECF bleaching. The ECF process considered for the specialty grade segment includes oxygen- and peroxide-enhanced extraction.

(2) Selection of BAT Technologies. In evaluating and selecting BAT technologies for the segments in this subcategory, EPA considered the age, size, processes, other engineering factors, and non-water quality environmental impacts pertinent to Subpart E mills. None of these factors provided a basis for selecting different BAT technologies. For each segment, EPA selected the best technology available to produce the products in each segment. Each of the selected BAT technologies is economically achievable and has no unacceptable adverse non-water quality environmental impacts. See the Supplemental Technical Development Document, DCN 14487. The reasons discussed below also support EPA's decision to select the BAT model technology for each segment as the basis for PSES for that segment.

(i) Calcium-, Magnesium-, or Sodium-Based Sulfite Mills. As proposed, EPA has concluded that TCF bleaching is the

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appropriate technology basis for BAT limitations for the calcium-, magnesium-, or sodium-based segment of the Papergrade Sulfite subcategory. (The following discussion also applies to PSES.) For this segment, TCF technology consists of oxygen- and peroxide-enhanced extraction, followed by peroxide bleaching, and with all chlorine-containing compounds eliminated (e.g., elemental chlorine, hypochlorite, chlorine monoxide, etc.). Although still TCF, the bleaching sequence is a change from proposal, when TCF bleaching was based on an oxygen stage with peroxide addition, followed by a peroxide bleaching stage. This change to the TCF bleaching sequence reflects the more common approach to TCF bleaching within this segment of the Papergrade Sulfite subcategory and also reflects the technology basis of the mill from which TCF performance data have been collected. EPA also included pulp cleaning to ensure that existing product quality specifications would continue to be achieved. EPA has selected this technology because it is technically available and economically achievable for mills in this segment.

In evaluating the technical availability of TCF processes for this segment, EPA developed a database of mills in the United States and Europe that produce pulp using TCF bleaching technology. There is at least one mill in the United States and 13 in Europe using acid cooking liquors of calcium, magnesium, or sodium sulfite that are using TCF bleaching processes. Among them, these mills produce a full range of paper products at up to 91 ISO brightness using TCF bleaching. These mills are able to produce the same products using TCF technology that they produced prior to converting to TCF, with no negative impact on product quality. EPA has incorporated pulp cleaners as an element of TCF technology to ensure that pulp quality requirements are maintained. See the Supplemental Technical Development Document, DCN 14487. For these reasons, EPA concluded that TCF bleaching is technically available for the calcium-, magnesium-, or sodium-based segment. See the record at section 21.2.1. (As noted above, EPA has established a separate segment for specialty grade sulfite mills using these cooking liquors.)

In order to evaluate the economic achievability of TCF bleaching for this segment, EPA considered the costs that existing mills would incur to convert to TCF processes. However, costs for secondary biological treatment systems have not been included because these systems already are in place at direct discharging mills. (This is true for the other papergrade sulfite segments as well.) As part of that analysis, EPA also included the costs of complying with today's BMP regulations. Because of the small size of this segment, EPA is not disclosing here the estimated capital costs, operation and maintenance costs, or post-tax annualized costs for this segment in order to protect confidential business information. However, EPA has determined that no mills are projected to close and no firms are projected to fail as a result of today's BAT limitations and PSES for this segment. This result obtains both when the impacts of today's BAT/PSES are considered together with the impacts of compliance with the MACT I costs, and when they are considered alone. Therefore, EPA has concluded that TCF bleaching is economically achievable for the calcium-, magnesium-, or sodium-based sulfite pulp segment. See DCN 14376 and DCN 14388 (both CBI).

For these reasons, EPA has selected the model TCF bleaching processes described above as the basis for BAT limitations and PSES for the calcium-, magnesium-, or sodium-based sulfite pulp segment.

(ii) Ammonium-Based Sulfite Mills. EPA had proposed BAT based on TCF bleaching technology for all mills in the Papergrade Sulfite subcategory, including those mills using ammonium-based acidic cooking liquor. EPA received comments and data challenging the applicability of TCF bleaching to ammonium-based sulfite mills. After reviewing these comments and data, EPA concluded that TCF bleaching is not demonstrated and may not be feasible for the full range of products produced by ammonium-based sulfite mills in the United States. See DCN 14497, Vol. I. (The following discussion also applies to PSES for this segment.)

This conclusion is based primarily on the greater difficulty in bleaching ammonium-based sulfite pulps (especially those pulps derived from softwood) without the use of chlorine-containing compounds compared to other sulfite pulps, and the inability to maintain product specifications for certain products within this segment using TCF bleaching. TCF bleaching has not been demonstrated for products with a high percentage of ammonium-based sulfite pulp that also require low dirt count and high strength. Laboratory scale data submitted by a firm producing such products indicate that such products can be produced with elemental chlorine-free (ECF) technologies. See DCN 14497, Vol. I, DCN 14494, and DCN 14118 in the record at Section 21.11.3.

Therefore, for papergrade sulfite mills using an acidic cooking liquor of ammonium sulfite, EPA is promulgating BAT limitations and PSES based on an ECF bleaching technology. The technology basis for BAT limitations for this segment is use of dioxin- and furan-precursor-free defoamers, complete (100 percent) substitution of chlorine dioxide for elemental chlorine, peroxide-enhanced extraction, and elimination of hypochlorite. ECF bleaching also includes high shear mixing to ensure adequate mixing of pulp and bleaching chemicals. This technology basis reflects the results of laboratory trials showing the ability to produce the full range of products manufactured by mills in the ammonium segment, with acceptable final product characteristics. See the record at section 30.11, DCN 14497, Vol. I, and DCN 14494. (The only exception is specialty grade sulfite mills using ammonium cooking liquors.)

EPA is also promulgating voluntary alternative BAT limitations and PSES based on TCF bleaching processes in order to encourage mills to use this technology whenever it is consistent with their product mix. See 40 CFR 430.54(a)(2) and 430.56(a)(2). Alternative TCF limitations are also available for new sources in this segment.

In addition to finding that the ECF bleaching process described above is technically available for the ammonium-based segment, EPA has also determined that it is economically achievable. In order to evaluate the economic achievability of ECF bleaching for this segment, EPA considered the costs that existing mills would incur to convert to the ECF process under consideration. As part of that analysis, EPA also included the costs of complying with today's BMP regulations. Because of the small size of this segment, EPA is not disclosing here the estimated capital costs, operation and maintenance costs, or post-tax annualized costs for this segment in order to protect confidential business information. However, EPA has determined that no mills are projected to close and no firms are projected to fail as a result of today's BAT limitations and PSES for this segment. This result obtains both when the impacts of today's BAT/PSES are considered together with the impacts of compliance with the MACT I costs, and when they are considered alone. Therefore, EPA has concluded that ECF bleaching is economically achievable for the ammonium-based segment. See DCN 14376 and DCN 14388 (both CBI).

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For the foregoing reasons, EPA has selected the model ECF bleaching processes described above as the basis for BAT limitations and PSES for the ammonium-based segment.

(iii) Specialty Grade Sulfite Mills

EPA received comments and data indicating that key pulp and product characteristics for specialty grade sulfite pulps have not been achieved using TCF bleaching technologies. Firms producing specialty grade pulps indicate that required product characteristics are achievable using certain ECF bleaching technologies. See the record at sections 19.1 and 21.11.6; DCN 25502; DCN 20071a8; DCN 14497, Vol. I; and DCN 14494. As indicated in the July 1996 Notice, EPA has continued to monitor research efforts of specialty grade pulp producers in the field of pollution-preventing process changes. These research efforts have progressed to the point where data are available at this time to promulgate limitations for this segment for dioxin, furan, and chlorinated phenolic pollutants. For specialty grade sulfite mills, the technology basis for limitations is use of dioxin- and furan-precursor-free defoamers, complete (100 percent) substitution of chlorine dioxide for elemental chlorine, oxygen- and peroxide-enhanced extraction, and elimination of hypochlorite. ECF bleaching also includes high shear mixing to ensure adequate mixing of pulp and bleaching chemicals. This technology basis reflects the results of laboratory trials showing the ability to produce the full range of products manufactured by specialty grade mills, with acceptable final product characteristics. (This discussion also applies to PSES for this segment.)

EPA is also promulgating voluntary alternative BAT limitations based on TCF bleaching processes in order to encourage mills to use this technology whenever it is consistent with their product mix. See 40 CFR 430.54(a)(3) and 430.56(a)(3). Alternative TCF limitations are also available for new sources in this segment.

In addition to finding that the ECF bleaching process described above is technically available for the specialty grade segment, EPA has also determined that it is economically achievable. In order to evaluate the economic achievability of ECF bleaching for this segment, EPA considered the costs that the one mill currently in this segment would incur to convert to ECF processes. As part of that analysis, EPA also included the costs of complying with today's BMP regulations. Because of the small size of this segment, EPA is not disclosing here the estimated capital costs, operation and maintenance costs, or post-tax annualized costs for this segment in order to protect confidential business information. However, EPA has determined that the sole existing mill in this segment is not projected to close, nor is its firm projected to fail, as a result of today's BAT limitations and PSES for this segment. This result obtains both when the impacts of today's BAT/PSES are considered together with the impacts of compliance with the MACT I costs, and when they are considered alone. Therefore, EPA has concluded that ECF bleaching is economically achievable for the specialty grade segment. See DCN 14376 and DCN 14388 (both CBI).

For the foregoing reasons, EPA has selected the model ECF bleaching process described above as the basis for BAT limitations and PSES for the specialty grade segment.

(3) Pollutant Parameters Regulated for Each Segment. (i) Calcium-, Magnesium-, or Sodium-Based Sulfite Mills. Because the Agency is promulgating BAT effluent limitations for this segment based on TCF bleaching technology, the maximum reduction in the discharge of chlorinated pollutants from bleaching operations will be achieved. This is because no chlorine or chlorine-containing bleaching chemicals are used and, hence, no chlorinated pollutants are generated during bleaching. For this reason, EPA is not setting effluent limitations for dioxin, furan, chloroform, or the 12 specified chlorinated phenolic pollutants for TCF bleaching. However, EPA is setting limitations on AOX (expressed as a level below the Minimum Level identified in today's analytical method for AOX) for mills in the calcium-, magnesium-, or sodium-based sulfite pulp segment of the Papergrade Sulfite subcategory in order to reflect the performance of TCF bleaching processes. See 40 CFR 430.54(a)(1). EPA is reserving promulgation of COD limitations for this segment until such time that sufficient performance data are available because the performance of the BAT technology basis on this parameter cannot be accurately predicted from laboratory-scale data.

(ii) Ammonium-Based Sulfite Mills. EPA is promulgating effluent limitations for dioxin, furan, and 12 chlorinated phenolic pollutants for the ammonium-based segment. See 40 CFR 430.54(a)(2). EPA is reserving promulgation of chloroform limitations, AOX limitations, and COD limitations for this segment until such time that sufficient performance data are available because the performance of the BAT technology basis on these parameters cannot be accurately predicted from laboratory-scale data. One mill is currently installing, on a full scale, the promulgated BAT technology basis. EPA expects to have data to develop chloroform, AOX, and COD limitations for this segment once this installation is complete, the mill is operating the new equipment in a routine manner, and appropriate samples are collected and analyzed.

(iii) Specialty Grade Sulfite Mills. EPA is promulgating effluent limitations for dioxin, furan, and 12 chlorinated phenolic pollutants for the specialty grade segment, based on laboratory scale data. See 40 CFR 430.54(a)(3). EPA is reserving promulgation of chloroform, AOX, and COD limitations for this segment until such time that sufficient full scale performance data are available because the performance of the BAT technology basis on these parameters cannot be accurately predicted from laboratory scale data.

(4) Costs. As discussed in the July 1996 Notice, EPA revised its cost estimates for mills in the Papergrade Sulfite subcategory by using the revised bleaching sequences outlined in paragraph (2) above. EPA also updated equipment cost curves and unit operating costs. See 61 FR at 36845. The detailed basis of these revised cost estimates are provided in the record.

The following cost estimates reflect the total costs that mills in the Papergrade Sulfite subcategory are likely to incur as a result of today's BAT limitations, PSES, and BMP regulations, and are the bases for EPA's economic impact analyses discussed in paragraph (2) above. For this subcategory, EPA's estimated capital costs are $73.8 million, operation and maintenance costs are $7 million, and post-tax annualized costs are $9.8 million. (The general and administrative costs discussed in Section VIII.B.1.c are already included here.) See Section VIII for additional discussion of costs and economic impacts.

(5) Effluent Reductions. EPA has updated the calculation of effluent reductions for each papergrade sulfite mill, adjusting the baseline to mid-1995. EPA used methodology similar to that used for the Bleached Papergrade Kraft and Soda subcategory. As a result of the BAT limitations and PSES promulgated today, EPA estimates that for the Papergrade Sulfite subcategory, discharges of dioxin and furan will be reduced by seven grams to less than one gram per year. (EPA expects no discharges of dioxin and furan from TCF bleaching.) Total discharges of chlorinated phenolic pollutants will be

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reduced by 1,770 kilograms to 240 kilograms per year. As a result of the TCF limitations and PSES on mills in the calcium-, magnesium-, or sodium-based sulfite segment and as an incidental result of implementing the ECF model technology by direct and indirect discharging mills in the other two segments, discharges of AOX will be reduced by 4,010 metric tons to 370 metric tons per year. For a discussion of the environmental benefits resulting from these reductions, see Section VIII.G.2, and Chapter 8 of the Economic Analysis, DCN 14649.

(6) Development of Limitations. All of the limitations and standards promulgated today for Subpart E are expressed as ''<ML.'' ''ML'' is an abbreviation for the Minimum Level identified in § 430.01(i) for the analytical methods that EPA uses to measure pollutant levels. For a more detailed discussion of ML limitations, see section VI.B.5.a.(4)(c).

In addition to the new effluent limitations guidelines and standards for each papergrade sulfite segment promulgated today and discussed immediately below, mills in the Papergrade Sulfite subcategory continue to be subject to existing limitations for pentachlorophenol and trichlorophenol. See 40 CFR 430.54(b), 430.55(c), 430.56(b), 430.57(b). These mills continue to have the opportunity to be exempt from these limitations and standards if they certify to the permitting or pretreatment authority that they are not using these chemicals as biocides. *Id*. For a discussion of these pollutants, see Section VI.B.3.f.

(i) Calcium-, Magnesium-, or Sodium-Based Sulfite Mills. Limitations for this segment were developed based on data from sampling at a European papergrade sulfite facility. (EPA did not set limitations based on performance data from the TCF U.S. mill in this segment because that mill produces sulfite pulp using hardwood furnish, which is easier to bleach than softwood sulfite pulp.) AOX was not measured at the end-of-pipe at the European facility so the AOX limitation is based on the transfer of data collected at the bleach plant effluent within that facility. This transfer is appropriate because the technology basis for the limitations, TCF bleaching, reduces AOX to concentrations below the method minimum level prior to any potential biological wastewater treatment. Therefore, since AOX is not detected above the minimum analytical level in bleach plant effluent, it should not be detected in final treated effluent.

(ii) Ammonium-Based Sulfite Mills. EPA is promulgating limitations for dioxin, furan, and 12 chlorinated phenolic pollutants for this segment. These limitations are expressed as ''<ML.'' EPA based these limitations on industry-developed laboratory data for ECF bleaching trials supplied by an ammonium-based papergrade sulfite mill and the results from full-scale sampling at a magnesium-based sulfite mill using ECF bleaching technology. EPA was able to apply the data from the magnesium-based sulfite mill to the ammonium-based segment because ECF bleaching at magnesium-based mills will result in similar wastewater characteristics as ECF bleaching at ammonium-based mills because ECF bleaching chemistry is comparable between the two chemical bases. EPA is reserving AOX, COD, and chloroform limitations for this segment.

(iii) Specialty Grade Sulfite Pulps. EPA is promulgating limitations for dioxin, furan, and 12 chlorinated phenolic pollutants. These limitations are expressed as ''<ML.'' The chlorinated phenolic limitations for this segment were developed from laboratory data for an ECF bleaching trial supplied by a specialty-grade sulfite mill. Data for dioxin and furan were not collected as part of this ECF bleaching trial because the mill researchers fully expected, based on the body of previous ECF bleaching research performed on sulfite pulp, that dioxin and furan would not be detected and therefore did not need analysis. For the purpose of establishing limitations for dioxin and furan in this segment, EPA is transferring laboratory data for ECF bleaching trials supplied by an ammonium-based papergrade sulfite mill. The transfer of limitations for dioxin and furan to this segment is supported by published reports that ECF bleaching of sulfite pulp will result in values of dioxin and furan in bleach plant effluent at levels below the minimum levels identified for the appropriate analytical methods. The transfer is further supported by the low levels of AOX measured (0.253 kg/ODMT) in the bleaching effluent from the specialty grade, laboratory-scale ECF bleaching trial. This AOX level suggests minimal chlorinated organics are formed during ECF bleaching of specialty grade pulp. For these reasons, EPA does not expect dioxin and furan to be present at or above the minimum level for these pollutants and is setting the limitations accordingly. EPA is reserving AOX, COD, and chloroform limitations for this segment until it has sufficient data upon which to base the limitations, because the performance of the BAT technology basis on these parameters cannot be accurately predicted from laboratory scale data.

(7) Point of Compliance Monitoring. EPA is requiring mills in the ammonium-based sulfite and specialty grade sulfite segments to demonstrate compliance with the BAT limitations on dioxin, furan, and the 12 chlorinated phenolic pollutants inside the discharger's facility at the point where the wastewater containing those pollutants leaves the bleach plant. See 40 CFR 430.54(c). EPA bases this decision on the reasons discussed in Section VI.B.5.a(6) for the Bleached Papergrade Kraft and Soda subcategory. Unless otherwise determined by the permit writer, mills in the calcium-, magnesium-, and sodium-based sulfite segment may demonstrate compliance with the BAT limitations for AOX at the end of the pipe.

c. NSPS. EPA is promulgating new source performance standards for each segment of the Papergrade Sulfite subcategory. See 40 CFR 430.55. The technology bases of NSPS for toxic and nonconventional pollutants for the three segments of the Papergrade Sulfite subcategory are the same as the model BAT technologies for those segments. For calcium-, magnesium-, or sodium-based sulfite mills, TCF bleaching technology is the technology basis for NSPS. ECF bleaching is the basis of NSPS for mills in the ammonium and specialty products segments because TCF bleaching has not been demonstrated for the full range of products made by mills in these segments. The toxic and nonconventional pollutants regulated, the limitations, and the points of compliance monitoring for NSPS for each segment are also the same as for BAT for those segments.

EPA proposed NSPS for conventional pollutants based on best demonstrated end-of-pipe secondary wastewater treatment. The treatment system with the lowest long-term average BOD_5 discharge was used to characterize the best demonstrated performance. EPA concluded that data in the record is not representative of the performance that can be achieved in the Papergrade Sulfite subcategory as a whole. For this reason, the new source performance standards for conventional pollutants promulgated today for each segment of the Papergrade Sulfite subcategory are the same as those promulgated in the 1982 NSPS regulation. See 47 FR 52006, 52036 (Nov. 18, 1982) (for former Subpart O); 48 FR 13176, 13177 (Mar. 30, 1983) (for former Subpart J).

In selecting its NSPS technology, EPA considered all of the factors specified in CWA section 306, including the cost of

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achieving effluent reductions. The selected NSPS technologies are presently being employed at mills in each segment of this subcategory. Moreover, the cost of the NSPS technology is an insignificant fraction of the capital cost of a new mill (less than one percent). Finally, EPA has determined that the costs of including the selected NSPS technologies at a new source are substantially less on a per-ton basis than the costs of retrofitting existing mills. See Chapter 6 of the Economic Analysis document (DCN 14649). Therefore, EPA has concluded that such costs do not present a barrier to entry. The Agency also considered energy requirements and other non-water quality environmental impacts for the selected NSPS options and concluded that these impacts were no greater than for the selected BAT technology options and are acceptable. See the Supplemental Technical Development Document, DCN 14487. EPA therefore concluded that the NSPS technology bases selected for each segment of the papergrade sulfite segment constitutes the best available demonstrated control technology for that segment.

d. Pretreatment Standards. EPA is promulgating pretreatment standards for new and existing sources for three segments of the Papergrade Sulfite subcategory based on the BAT and NSPS technologies selected for each segment. In determining PSES, EPA considered the age, size, processes, other engineering factors, and non-water quality environmental impacts pertinent to Subpart E mills. None of these factors provided a basis for selecting different PSES technologies. For each segment, EPA selected the best technology available to produce the products in each segment. Each of the selected PSES technologies is economically achievable and has no unacceptable adverse non-water quality impacts. With respect to PSNS for these segments, EPA concluded that the selected technologies represent the best available demonstrated control technologies that are capable of producing each segment's products. EPA also concluded that there was no barrier to entry for the reasons set forth in section VI.B.6.c. above for NSPS for this subcategory.

In order to determine which pollutants to regulate under PSES and PSNS, EPA used the same pass-through analysis it employed for the Bleached Papergrade Kraft and Soda subcategory described in section VI.B.5.c(2) above. EPA concluded that dioxin, furan, and the 12 chlorinated phenolic pollutants pass through or interfere with POTW operations for the ammonium and specialty grade segments for the reasons set forth in section VI.B.5.c(2) for Subpart B. This reasoning applies because the BAT/PSES model technologies for Subparts B and E are both based on ECF process technologies; the same is also true for the NSPS/PSNS technologies (although in neither subpart does the model pretreatment technology include secondary biological wastewater treatment). Based on its pass-through determination, EPA is promulgating national pretreatment standards for new and existing sources for those pollutants for those segments. These standards are expressed as ''<ML.'' See Section VI.B.5.a(4)(c). With respect to chloroform, COD, and AOX in the ammonium and specialty grade segments of the Papergrade Sulfite subcategory, EPA has insufficient data at this time upon which to make pass-through determinations or to set pretreatment standards. Therefore, EPA will decide whether and how to regulate these pollutants for those segments when data become available.

For the calcium-, magnesium-, or sodium-based segment, the best available technology basis is TCF bleaching. Because no chlorine or chlorine-containing bleaching chemicals are used, no chlorinated pollutants are generated during bleaching. Therefore, EPA is not establishing pretreatment standards for dioxin, furan, chloroform, and the 12 chlorinated phenolic pollutants for this segment. With respect to AOX in the calcium-, magnesium-, or sodium-based segment, EPA finds that TCF bleaching will reduce AOX discharge loads from the 1 to 3 kg/metric ton typically found at baseline to less than minimum levels, even at indirect discharging facilities with no on-site biological treatment. This reduction is greater than 99 percent, which far exceeds the AOX reduction that can be demonstrated by POTW treatment. Therefore, EPA concludes that AOX passes through for this segment and is promulgating PSES and PSNS for AOX, with the limitation expressed as less than the minimum level, or ''<ML.'' See 40 CFR 430.56(a)(1) and 430.57(a)(1).

With respect to COD in the calcium-, magnesium-, or sodium-based segment, EPA has insufficient data at this time upon which to make a pass-through determination or to set pretreatment standards. Therefore, EPA will decide whether and how to regulate COD for this segment when data become available.

The pretreatment standards for all segments of the Papergrade Sulfite subcategory also include best management practices. See 40 CFR 430.03. These requirements are described below in Section VI.B.7.

EPA is requiring mills to demonstrate compliance with PSES and PSNS on dioxin, furan, and the 12 chlorinated phenolic pollutants for the ammonium-based sulfite and specialty grade sulfite segments inside the discharger's facility at the point where the wastewater containing those pollutants leaves the bleach plant. EPA bases this decision on the reasons discussed in Section VI.B.5.a(6) for the Bleached Papergrade Kraft and Soda subcategory.

7. Best Management Practices

The regulations promulgated today include provisions requiring mills with pulp production in the Bleached Papergrade Kraft and Soda subcategory (Subpart B) and the Papergrade Sulfite subcategory (Subpart E) to implement BMPs to prevent or otherwise contain leaks and spills of spent pulping liquor, soap, and turpentine and to control intentional diversions of those materials. These BMPs apply to direct and indirect discharging mills within these subcategories and are intended to reduce mill wastewater loadings of non-chlorinated toxic compounds and hazardous substances. For direct dischargers, EPA is authorized to establish BMPs for those pollutants under CWA section 304(e). The same BMPs will also remove, as an incidental matter, significant loadings of color and certain oxygen-demanding substances in pulping liquors that are not readily degraded by biological treatment. EPA also expects incidental reductions in conventional water pollutants and certain air pollutants as a result of the BMPs. To the extent these pollutants are present in the wastestreams subject to section 304(e), EPA has authority under that section to regulate them. In addition, EPA has independent authority under CWA sections 402(a) and 501(a) and 40 CFR 122.44(k) to require direct dischargers to implement BMPs for pollutants not subject to section 304(e). To impose these BMPs on indirect dischargers, EPA relies on section 307 (b) and (c). Finally, EPA is authorized to impose the BMP monitoring requirements under section 308(a).

EPA has determined that these BMPs are necessary because the materials controlled by these practices, if spilled or otherwise lost, can interfere with wastewater treatment operations and lead to increased discharges of toxic, nonconventional, and conventional pollutants. The practices included in this rule are known to reduce the amount of spent pulping liquor discharged to wastewater treatment

systems and to reduce the cost of process operation through increased chemical recovery. The BMPs summarized below are discussed in detail in the Technical Support Document for Best Management Practices for Spent Pulping Liquor Management, Spill Prevention and Control, DCN 14489 (hereafter ''BMP Technical Support Document'').

Under this regulation, mills must implement the BMPs codified at section 430.03(c). BMP requirements for new and existing direct dischargers apply when incorporated as special conditions in NPDES permits, consistent with CWA sections 304(e) and 402(a). BMP requirements for new and existing indirect dischargers are pretreatment standards; therefore, they are self-implementing. The BMPs are:

(1) Return of spilled or diverted spent pulping liquors, soap, and turpentine to the pulping and recovery processes to the maximum extent practicable as determined by the mill; recovery of such materials outside the process; or discharge of spilled or diverted material at a rate that does not disrupt the receiving wastewater treatment system;

(2) Inspection and repair programs to identify and repair leaking equipment items;

(3) Operation of continuous, automatic spill detection systems that the mill determines are necessary to detect and control leaks, spills, and intentional diversions of spent pulping liquor, soap, and turpentine. Examples of such systems are high level monitors and alarms on storage tanks; process area conductivity (or pH) monitors and alarms; and process area sewer, process wastewater, and wastewater treatment plant conductivity (or pH) monitors and alarms;

(4) Employee training for those personnel responsible for operating, maintaining, or supervising the operation and maintenance of equipment items in spent pulping liquor, soap, and turpentine service;

(5) Preparation of brief reports that evaluate spills of spent pulping liquor, soap, or turpentine that are not contained at the immediate process area and intentional diversions of spent pulping liquor, soap, or turpentine that are not contained at the immediate process area, (this requirement takes effect on the date an OMB control number is issued);

(6) A program to review any planned modifications to the pulping and chemical recovery facilities and any construction activities in the pulping and chemical recovery areas before these activities commence to prevent leaks and spills during construction;

(7) Secondary containment for spent pulping liquor bulk storage tanks. As an alternative, mills may substitute an annual tank integrity testing program, if coupled with other containment or diversion structures, in place of secondary containment;

(8) Secondary containment for turpentine bulk storage tanks;

(9) Curbing, diking, or other means of isolating soap and turpentine processing and loading areas from the wastewater treatment facilities; and

(10) Wastewater monitoring to detect leaks and spills, to track the effectiveness of the BMPs, and to detect trends in spent pulping liquor losses.

In addition, § 430.03(d) requires each mill to prepare a BMP Plan, based on a detailed engineering review of the mill's pulping and recovery operations, that specifies: (1) The procedures and the practices to be employed by the mill to meet the BMP requirements listed above, as tailored to recognize site-specific conditions; (2) the construction the mill determines is necessary to meet the BMP requirements, including a schedule for such construction; and (3) the monitoring program that will be used to meet the BMP requirements. This requirement takes effect April 15, 1999 see 40 CFR 430.03(j)(1)(i), or the date an OMB control number for this requirement is issued, whichever is later. See 40 CFR 430.03(a)(2).

Each mill must also certify to the appropriate permitting or pretreatment authority that it has prepared the Plan in accordance with the BMP regulation. See 40 CFR 430.03(f). The mill is not required to obtain approval of the BMP Plan by the permitting or pretreatment authority. *Id.* The permitting or pretreatment authority at its discretion, however, may conduct a review of the BMP Plan, BMP Plan amendments, and BMP Plan implementation.

Finally, section 430.03(h) requires mills to establish action levels (a measure of daily pollutant loading) that, when exceeded, trigger investigative and corrective action (depending on the action level exceeded) to reduce the wastewater treatment system influent mass loading. This requirement takes effect April 15, 1999 see 40 CFR 430.03.(j)(1)(iii), or the date an OMB control number for this requirement is issued, whichever is later. The purpose of the action levels is to provide a framework for monitoring the performance and effectiveness of BMPs on a continuing basis and to establish an early warning system so that mills can detect trends in spent pulping liquor, soap, and turpentine losses that might not be obvious from other sources. Under the regulation, a mill has considerable flexibility to choose its monitoring parameter. For more discussion of action levels, see the BMP Technical Support Document, DCN 14489. EPA had considered requiring all mills to employ specific statistical action levels. See 61 FR at 36847. EPA rejected this approach because it was concerned that such action levels might fail to trigger appropriate investigative and corrective actions for some mills, while being too restrictive for other mills. Instead, EPA determined that authorizing mills to choose their own monitoring parameters and to set their own action levels better accounts for the variability in organic loadings at different mills and differences in treatment plant effectiveness and evaporator capacity, among other mill-specific factors. This flexibility thus ensures that the action levels reflect the actual performance of mill-specific BMPs and procedures. In this way, EPA believes the action levels will better achieve the spill and leak control objectives of the BMP requirements. Exceedances of the action levels will not constitute violations of an NPDES permit or pretreatment standard. See 40 CFR 430.03(i)(3). However, a mill that fails to take corrective action as soon as practicable in response to the exceedances will be violating its NPDES permit or pretreatment standard. *Id.*

As set forth in § 430.03(j), the following deadlines apply: Existing indirect dischargers are required to prepare BMP Plans and implement all BMPs that do not require the construction of containment or diversion structures or the installation of monitoring and alarm systems no later than April 15, 1999. Operation of any new or upgraded continuous, automatic monitoring systems that the mill determines to be necessary (other than those associated with construction of new containment or diversion structures) must commence no later than April 17, 2000. The mill must complete construction and commence operation of any spent pulping liquor, collection, containment, diversion, or other facilities, including any associated continuous monitoring systems, necessary to fully implement BMPs by April 16, 2001. Existing indirect dischargers must establish the initial action levels by April 15, 1999, and the revised action levels as soon as possible after fully implementing the BMPs, but not later than January 15, 2002. The requirements to develop the BMP Plan and to perform other record-keeping and reporting requirements do not apply until OMB has approved the associated

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information collection request. See 40 CFR 430.03(a)(2).

NPDES permits must require existing direct discharging mills to meet the same deadlines specified for existing indirect dischargers which is calculated from the date of publication. See 40 CFR 430.03(j)(1). If the applicable deadline has passed at the time the NPDES permit containing the BMP requirement is issued, the NPDES permit must require immediate compliance with the BMP requirement. *Id*. EPA believes this is appropriate because the record shows that mills can implement the substantive requirements of the BMPs—which are well-known within the industry today—without significant uncertainty or difficulty. In addition, timely implementation will avert the adverse environmental effects of uncontrolled leaks, spills, and intentional diversions. Finally, the affected mills have been on notice for several years that these requirements would likely be imposed and therefore should not be prejudiced by prompt compliance obligations. EPA expects that the compliance date for full implementation of the BMP requirements will not extend beyond five years from the effective date of the final rule because EPA expects NPDES permits for those mills to be reissued on a timely basis. With the exception of the requirement to establish action levels, which must occur not later than 12 months after commencing discharge, new direct and indirect discharging mills must prepare the BMP Plan and implement all BMPs upon commencing discharge. See 40 CFR 430.03(j)(2).

EPA believes it is reasonable to require existing indirect dischargers to establish revised action levels by January 15, 2002 and to require all new sources to establish action levels no later than 12 months after commencing discharge. These requirements apply only after full implementation of the required BMPs and reflect the amount of time EPA believes is necessary for mills to collect monitoring data regarding the effectiveness of these newly implemented practices and to perform the statistical analysis to develop the required action levels. Because the required action levels are intended to reflect normal mill operating conditions using the BMPs, they cannot be established prior to the implementation of the BMPs or, in the case of new sources, prior to commencing discharge. For a discussion of EPA's basis for the other deadlines in this rule, see the BMP Technical Support Document, DCN 14489.

The proposed regulations had included provisions for leak and spill prevention, containment, and control through the use of BMPs. See 58 FR at 66078. The comments received by EPA on the proposed rule and subsequent **Federal Register** notices generally supported the use of BMPs, but a number of comments challenged EPA's compliance cost estimates and claimed that certain requirements were too prescriptive. In particular, industry asserted:

- The requirement to develop BMPs should be limited to spent pulping liquor (e.g., kraft black liquor, sulfite red liquors) and should exclude kraft green and white liquors and fresh sulfite pulping liquors;
- The proposed regulation was overly prescriptive in general and, in particular, the requirement for secondary containment was unnecessary to meet the objectives of the proposed regulation;
- EPA underestimated the costs for implementing BMPs;
- EPA lacks the authority to establish BMPs to control pollutants that are not identified as toxic under CWA section 307(a) or hazardous under CWA section 311; and
- EPA lacks the authority to impose BMPs on indirect dischargers.

In response to comments, EPA undertook several initiatives to understand industry's concerns about the proposed BMP requirements; to better understand the status of the industry with respect to pulping liquor management and spill prevention and control; and to better assess the BMP compliance costs. To supplement its understanding of industry's spent pulping liquor management and spill prevention and control practices, EPA visited more than 25 chemical pulp mills in the United States and 15 mills in Canada and Europe following its 1993 proposal. These mills included bleached and unbleached kraft mills and papergrade sulfite mills (see Docket Sections 21.5.1 and 21.5.3). EPA also reviewed the results of the NCASI BMP questionnaire distributed to the industry. Questionnaire responses were received from approximately 70 bleached and unbleached kraft, soda, and sulfite mills. Through this NCASI questionnaire EPA received a substantial amount of additional information about mill practices and costs for equipment, monitoring systems, and facility modifications (see Docket Section 21.1.3). In addition, EPA held detailed discussions with stakeholders regarding options for BMPs and associated costs. Much of this information was included in the Docket and made available to the public in conjunction with the Notice of Data Availability published in the **Federal Register** on July 5, 1995 (60 FR 34938). Additional information related to development of the BMP requirements, including changes in the wording and organization of the proposed rule, was discussed in the July 1996 Notice. See 61 FR at 36835.

Based on the information and data received since proposal, EPA revised the scope of the BMP requirements to focus on control of spent pulping liquor, turpentine, and soap. The BMP requirements were restructured to allow greater flexibility in how BMPs are implemented to address site-specific circumstances in achieving meaningful prevention and control of leaks and spills. EPA also reorganized the regulatory text from that presented in the record for the July 1996 Notice to provide greater ease of use by mill operators and permit writers, and to clarify the intent of particular BMP requirements. The most significant changes since proposal are discussed below.

In December 1993, EPA proposed BMPs for seven subcategories of the pulp, paper, and paperboard industry (58 FR at 66078), all of which chemically pulp wood and non-wood fibers. EPA still believes BMPs are appropriate for each of these chemical pulping subcategories; however, to be consistent with the effluent limitations guidelines and standards promulgated in this final rule, the BMPs promulgated today are applicable only to the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories. EPA expects to promulgate BMPs for the remaining five chemical pulping subcategories [(Subparts A (Dissolving Kraft), C (Unbleached Kraft), D (Dissolving Sulfite), F (Semi-chemical), and H (Non-wood Chemical Pulp)] as it promulgates new effluent limitations guidelines and standards for these subcategories. Until new regulations for Subparts A, C, D, F, and H are promulgated, permit writers may wish to use the BMP regulations in this rule as a guide to issuing permits containing BMPs based on best professional judgment for mills with production covered by these other subparts. See CWA Section 402(a)(1); 40 CFR 122.44(k). POTWs may need to impose BMPs as local limits to facilities in these subcategories. See 40 CFR 403.5.

The BMP provisions in the proposed rule were structured to apply to all pulping liquors. In response to comments, EPA has revised the scope of the BMPs and for the final rule is limiting the BMP applicability to spent pulping liquors, turpentine, and soap. EPA has determined that spent pulping

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liquors contain toxic components and that these materials, if uncontrolled, pass through or interfere with the operation of POTWs and may interfere with industrial wastewater treatment systems at mills that discharge directly to surface waters. EPA has excluded green, white and other intermediate pulping liquors (e.g., fresh sulfite pulping liquors) from this BMP rule because the data in the record does not indicate that these materials pass through wastewater treatment systems. Turpentine and soap are included in the BMP rule because, if spilled or lost, these materials can interfere with wastewater treatment operations and lead to increased discharges of toxic, nonconventional, and conventional pollutants.

In December 1993, EPA proposed to require mills to provide secondary containment for all pulping liquor bulk storage tanks. EPA has since determined that spill prevention can be adequately achieved for spent pulping liquor bulk storage tanks by substituting annual tank integrity testing and other containment or diversion structures (e.g., curbs and berms) in place of secondary containment. The final rule provides flexibility for mills to choose either secondary containment or annual tank integrity testing, coupled with other containment or diversion structures, to comply with this requirement for spent pulping liquor bulk storage tanks. See 40 CFR 430.03(c)(7). EPA determined that secondary containment should be required at all times for turpentine bulk storage tanks because of the extreme toxic effects a turpentine spill would have on the biological treatment system, and because the size of turpentine bulk storage tanks is such that secondary containment is easily achieved. In fact, EPA has found that most mills already provide secondary containment for their turpentine bulk storage tanks. No secondary containment is required for soap bulk storage tanks.

As discussed in the July 1996 Notice, EPA also proposed adding a requirement to the BMP regulation that would require mills to implement a monitoring program for the purpose of detecting leaks and spills, tracking the effectiveness of the BMPs, and detecting trends in spent pulping liquor losses. EPA proposed requiring mills to monitor wastewater treatment system influent for a short-term measure of organic content that can be completed on a daily basis (e.g., Chemical Oxygen Demand (COD) or Total Organic Carbon (TOC)). EPA has promulgated this requirement (see 40 CFR 430.03 (h) and (i)), but in response to comments, EPA is also allowing mills to use an alternative parameter related to spent pulping liquor losses that can be measured continuously and averaged over 24 hours (e.g., specific conductivity or color). See 40 CFR 430.03(h)(2)(i). In conjunction with this monitoring, mills are required by today's regulation to establish action levels (using the measure of daily pollutant loading) that, when exceeded, trigger investigative and corrective action, as appropriate, to reduce the wastewater treatment system influent mass loading. See 40 CFR 430.03(h).

The proposed rule would have required certification of the BMP plan by a registered professional engineer (P.E.) and approval by the mill manager. The intent of the proposed P.E. certification was to assure preparation of a comprehensive BMP Plan that is tailored to the site-specific circumstances at the mill. Industry commented that many mills have no registered professional engineers on site. For mills without a P.E. onsite, the proposed requirement would result in the plan being certified by someone not involved with the mill on a daily basis, and someone not responsible for its operation. EPA has determined that requiring certification by a P.E. is unnecessarily prescriptive and may have unintended results. The final regulation deletes the requirement for certification by a registered P.E. and now requires the BMP Plan to be reviewed by the senior technical manager at the mill and approved and signed by the mill manager. See 40 CFR 430.03(f).

The regulation was proposed to be self-implementing for both direct and indirect dischargers. EPA has revised the regulation to make it clear that BMPs imposed on direct dischargers are not self-implementing, but rather apply only when incorporated into NPDES permits. See 40 CFR 430.03(j). This is consistent with CWA sections 304(e) and 402. The final regulation remains self-implementing for indirect dischargers. *Id*.

The final regulation extends compliance schedules for plan preparation and plan implementation to grant more time for the preparation of the initial BMP Plan and installation of monitoring and alarm systems. Based on information supplied by industry regarding the time required in past efforts to develop spill prevention programs, EPA determined that 12 months was reasonable to complete the development of the BMP Plan and includes that deadline in the regulation. Similarly, EPA determined that it is reasonable to require mills to commence operation of any new monitoring systems no later than 24 months following publication of the final rule. This compliance date provides sufficient time between BMP Plan preparation and operation of new monitoring systems (i.e., 12 months) to allow implementation of BMPs in a rational and effective manner.

The final BMP regulation is less prescriptive than proposed with regard to inspection, repair and log-keeping requirements. While many of the elements included in the proposed rule remain, EPA determined that the specificity of the language in the proposed regulation could be redundant to existing practices in place at some mills and be unnecessarily burdensome. EPA believes the language in the final rule will achieve the same results as it intended in the proposed rule while allowing mills to use existing maintenance and repair tracking systems to fulfill the requirement. See 40 CFR 430.03(c).

As discussed in the July 1996 Notice, EPA used the information obtained since proposal to revise its cost estimates for BMPs. See 61 FR at 36840. At proposal, EPA's estimated costs were based on the reported total project costs for two older bleached kraft mills to install spill prevention and control systems. After adjusting the costs to reflect the size of a ''typical'' mill, EPA then assumed that these costs reflected the average cost incurred by bleached papergrade kraft and soda and papergrade sulfite mills to install BMPs. EPA then imputed to some mills compliance costs less than that average cost depending on the extent EPA judged they had implemented BMPs (see Technical Support Document for Proposed Best Management Practices Programs: Pulping Liquor Management, Spill Prevention and Control, November 1993. Docket Section 17.4, DCN 08307).

EPA improved its estimates of industry-wide costs for compliance with the BMP requirements in the final rule, compared to the cost methodology used for the proposed regulation. These changes were discussed in the July 1996 Notice and in the accompanying Draft Technical Support Document for Best Management Practices Programs: Spent Pulping Liquor Management, Spill Prevention and Control, May 1996 (DCN 13894). EPA's supplemental mill visits and the NCASI survey responses have resulted in a more accurate status of the existing BMP infrastructure and programs at mills. This information was used to create model BMP mill requirements for each level of mill complexity and to classify mills by complexity level. EPA then used data

provided by the industry in comments and the NCASI survey to develop unit costs for major equipment items, facility modifications, monitoring systems and BMP Plan preparation, rather than using the total project costs reported by two mills as was done at proposal. Finally, EPA incorporated the estimates of net operating and maintenance costs of BMPs into the BAT/PSES cost model. The cost model tracked the impacts of increased pulping liquor recovery on the evaporators and chemical recovery system and determined the need for equipment upgrades resulting from the combined effect of BAT/PSES process changes and BMPs. The savings from reduced load on the wastewater treatment system and increased recovery of fiber, chemicals and energy were subtracted from the BMP operating costs (i.e., increased evaporation energy, tank integrity testing, operator training, and O&M costs for new equipment).

EPA disagrees with comments asserting that EPA lacks authority to establish BMPs for pollutants that are not identified as toxic under CWA section 307(a) or hazardous under CWA section 311. First, the non-toxic and non-hazardous pollutants controlled by these BMPs are found in the same wastestreams bearing pollutants specifically identified as toxic pollutants or hazardous substances under sections 307(a) and 311 and implementing regulations. Although reductions of these pollutants are significant in environmental effect, their control is incidental to the control of all the pollutants subject to section 304(e). Second, EPA has independent authority under section 402(a)(1) to establish NPDES permit conditions, including BMPs, for any pollutant when such conditions are necessary to carry out the provisions of the statute. See 40 CFR 122.44(k). This authority operates independently of section 304(e). Indeed, when Congress enacted section 304(e) specifically for toxic pollutants and hazardous substances, it acknowledged that section 402(a)(1) already provided authority for imposing BMPs in NPDES permits. See Statement of Sen. Muskie (Dec. 15, 1977), reprinted in Legislative History of the Clean Water Act of 1977, at 453. EPA's authority to establish permit conditions under section 402(a)(1) is very broad. See *NRDC* v. *Costle*, 568 F.2d 1369, 1380 (D.C. Cir. 1977). EPA has determined that mills without an adequate BMP program, such as that codified today, may experience undetected and uncontrolled leaks and spills that could disrupt the efficiency of their treatment systems, thus resulting in exceedances of the BAT limitations and NSPS promulgated today for subparts B and E. Moreover, the BMPs control pollutants that are not explicitly regulated under BAT and NSPS. Therefore, EPA determined that BMPs applicable to all pollutants in a mill's spent pulping liquor, turpentine, and soap were necessary in order to carry out the purposes of the Clean Water Act and hence are authorized under section 402(a)(1) and 40 CFR 122.44(k). Similarly, as discussed below, BMPs are authorized as pretreatment standards for pollutants in the spent pulping liquor, turpentine, and soap when they pass through or interfere with POTW operations.

Some commenters also objected to EPA's decision to establish the BMP program by regulation rather than deferring to the case-by-case determinations of permit writers. EPA agrees that a requirement to establish and implement BMPs of the type required by this rule could be imposed on a case-by-case basis under CWA section 402(a)(1) and 40 CFR 122.44(k). However, EPA rejected this approach for a number of reasons. First, section 304(e) expressly authorizes EPA to promulgate BMPs by regulation on a categorical basis. The spent pulping liquors, soap, and turpentine covered by these BMPs contain numerous toxic pollutants and hazardous substances subject to section 304(e) and hence may be controlled by regulation. Moreover, EPA determined that implementing the BMP program by regulation is necessary to ensure that each pulp and paper mill with pulp production in subparts B or E implements the type of BMPs that EPA has determined are fundamental to an effective BMP program for this industry. While the BMP regulation is intended to provide considerable flexibility to mills in designing their BMP programs, EPA has also determined that the various BMPs specified in the regulation are necessary to assure uniform and fair application of the requirements. Finally, EPA believes that the regulation represents an appropriate and efficient use of its technical expertise and resources that, when exercised at the national level, will relieve permit writers of the burden of implementing this aspect of the Clean Water Act on a case-by-case basis.

EPA also disagrees with comments asserting that EPA lacks authority to impose BMPs on indirect discharges. These BMPs are pretreatment standards under section 307(b) and (c). Pretreatment standards for new and existing sources under section 307 are designed to prevent the discharge of pollutants that pass through POTWs or that interfere with or are otherwise incompatible with treatment processes or sludge disposal methods at POTWs. To determine whether pollutants associated with spent kraft and sulfite pulping liquors, soap, and turpentine that are indirectly discharged by mills with pulp production in subparts B or E interfere with POTW operations or pass through untreated, EPA reviewed data collected from 1988 through 1992 at a POTW that receives effluent from a bleached papergrade kraft mill. Prior to 1990–91, the mill had virtually no facilities for control and collection of spent pulping liquor leaks and spills. POTW discharge monitoring records show the fully treated effluent exhibited consistent chronic toxicity to Daphnia from April 1988 until June 1991. The data further show that the toxic effects of the POTW's effluent have been reduced since implementation by the mill of effective spent pulping liquor management and spill prevention and control. These effluent toxicity effects can be related to the wood extractive components that are measurable by COD and are found in leaks and spills of spent kraft and sulfite pulping liquors that interfere with the performance of biological treatment systems and allow toxic pollutants to pass through inadequately treated. Indeed, evidence of such interference and pass-through was found in data from this mill and the POTW, which showed higher mass effluent loadings for COD, TSS and BOD_5 before the mill implemented a BMP program. After the BMP program was implemented, mass effluent loadings of these pollutants were reduced. Data for COD, in particular, indicated that short-term interference of POTW operations previously observed at higher COD levels was being mitigated. EPA also bases its pass-through finding on an incident occurring in 1993 at a different mill where an intentional diversion of spent pulping liquor debilitated the mill's secondary treatment system and killed fish in the receiving waters. These data led EPA to conclude that inadequate management and control of leaks and spills of spent pulping liquor, soap, and turpentine interfered with POTW operations and caused pass-through of pollutants. Because direct discharging mills using these BMPs achieve very high removals and because POTWs cannot achieve similar removals in the absence of BMPs employed by the indirect discharger, EPA has determined that pollutants in spent pulping liquor, soap, and turpentine, in the absence of controls on leaks, spills, and intentional diversions, can cause disruption and interference and do indeed pass through

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at POTWs. For this reason, EPA is including as part of its pretreatment standards the requirement that indirect discharging mills implement BMPs in accordance with this regulation.

8. Regulatory Implementation for Effluent Limitations Guidelines and Standards

a. Applicability of Effluent Limitations Guidelines and Standards. Effluent limitations act as a primary mechanism to control discharges of pollutants to waters of the United States. These limitations are applied to individual mills through NPDES permits issued by EPA or authorized States under section 402 of the CWA. In addition, the pretreatment standards are directly applicable to indirect dischargers. Once today's regulations become effective, the effluent limitations and standards for the appropriate subcategory must be applied in all Federal and State NPDES permits issued to direct dischargers affected by this rule. See Section 301(b)(2), 402(a). This section describes the applicability of these limitations and standards to process and other wastewaters generated by the mills in the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories, defines new sources subject to today's NSPS and PSNS, defines non-continuous dischargers and the applicable limitations, and describes the retention of the previously promulgated limitations and standards.

(1) Applicability of Limitations to Process and Other Wastewaters. The effluent limitations guidelines and standards for the pulp and paper industry apply to discharges of process wastewaters directly associated with the manufacturing of pulp and paper. See 40 CFR 430.00. EPA proposed a definition of process wastewater as any water that, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product. The proposed definition specifically included boiler blowdown; wastewaters from water treatment and other utility operations; blowdown from high rate (e.g., greater than 98 percent) recycled non-contact cooling water systems to the extent they are mixed and co-treated with other process wastewaters; and stormwaters from the immediate process areas to the extent they are mixed and co-treated with other process wastewaters. The proposed definition specifically provided that contaminated groundwaters from on-site or off-site groundwater remediation projects would not be process wastewaters. EPA proposed to require separate permitting for the discharge of such groundwaters. The proposed definition also specifically excluded certain process materials from the definition of process wastewater. These process materials included: Green liquor at any liquor solids level; white liquor at any liquor solids level; black liquor at any liquor solids level resulting from processing knots and screen rejects; black liquor after any degree of concentration in the kraft or soda chemical recovery process; reconstituted sulfite and semi-chemical pulping liquors prior to use; any pulping liquor at any liquor solids level resulting from spills or intentional diversions from the process; lime mud and magnesium oxide; pulp stock; bleach chemical solutions prior to use; and papermaking additives prior to use (e.g., alum, starch and size, clays and coatings). The proposed regulation then would have prohibited the discharge of these materials into POTWs or waters of the United States without an NPDES permit or other authorization.

In this final rule, EPA is promulgating a definition of process wastewater applicable to subparts B and E. In response to the comments opposing the exclusion of these process materials, EPA revised the proposed definition of process wastewaters to eliminate the exclusion of the named process materials. See 40 CFR 430.01(m). The proposed language would have effectively required ''closed cycle'' mills, which was not EPA's intent. The exclusion of contaminated groundwater has been retained. Because the quantity and quality of such groundwaters are likely to be highly variable on a site-specific basis, the Agency concluded that their discharge to surface waters should be regulated separately from, or in addition to, process wastewaters on a case-by-case basis. EPA also has included leachate wastewaters from landfills owned and operated by mills generating wastes associated with manufacturing or processing subject to subparts B and E, where these leachate wastewaters are commingled with other process wastewaters. These leachate wastewaters typically comprise a very small proportion of the total volume received in end-of-pipe wastewater treatment facilities. In cases where the volumes or pollutants found in leachate wastewaters are of concern, permit writers may develop individual permit limitations on a case-by-case basis. EPA's definition continues to define process wastewater in terms of manufacturing or processing. EPA has promulgated a subcategory-specific definition of process wastewater in order to clarify the applicability of subparts B and E and to assist permit writers and pretreatment authorities in developing limitations and standards. The effluent limitations guidelines and standards promulgated today do not apply to discharges that are not associated with manufacturing or processing. Any mill wishing to discharge such wastewaters would need to obtain authorization in an NPDES permit or individual control mechanism administered by a POTW.

EPA's use of the term ''during manufacturing or processing'' should not be taken to exclude wastewaters generated during routine maintenance, including maintenance occurring during a scheduled temporary mill shut-down. Maintenance wastewaters were not explicitly excluded from the definition of process wastewater at proposal, nor are they excluded from the definition promulgated today. Wastewaters generated during routine maintenance are a result of pulp manufacturing processes and as such are included in the definition of process wastewater.

(2) Definition of New Source. In today's rule, EPA is promulgating a definition of ''new source'' applicable to Part 430, subparts B and E. See 40 CFR 430.01(j). This definition restates the definition set forth in 40 CFR 122.29(b)(1), but with the additional reference to certain process changes that, in and of themselves, would not cause a mill to become a new source. See 40 CFR 430.01(j)(2). EPA intends that permit writers will consult the specific ''new source'' criteria in Part 430, rather than the more general criteria set forth in 40 CFR 122.29(b)(1) and 403 when determining whether pulp and paper mills subject to subparts B or E are new sources. The other provisions of 40 CFR 122.29 continue to apply to these subparts, as do 40 CFR 122.2 and 40 CFR 403.3(k). The definition of ''new source'' in Part 430 does not affect the definition of ''new source'' for purposes of the NESHAP portion of these integrated rules.

EPA is aware that application of the definitions in Part 122 to pulp and paper mills in the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories has sometimes caused controversy, leading to disagreement between the permitting authority and the facility whether a particular change at the mill triggers NSPS or PSNS. EPA is promulgating a definition of ''new source'' specifically for subparts B and E in order to set forth the specific factors relevant to a new source determination for covered mills and thus, EPA hopes, to end the disputes regarding a mill's

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new source status. Indeed, the decision to promulgate subcategory-specific criteria in this rule is specifically contemplated by the general criteria codified at 40 CFR 122.29(b)(1). EPA believes this tailored definition is particularly important in view of the Voluntary Advanced Technology Incentives Program EPA is also promulgating today for subpart B mills. Through the Voluntary Advanced Technology Incentives Program, EPA is encouraging mills to install new process technologies and even to redesign bleach plant operations in order to achieve effluent reductions beyond those required at the baseline BAT level. EPA does not want existing mills that voluntarily choose to participate in the Voluntary Advanced Technology Incentives Program to be required to meet NSPS simply as a consequence of that election. Therefore, by promulgating a definition of ''new source'' specifically for subparts B and E, EPA hopes not only to clarify application of the Part 122 definitions but also to provide certainty to subpart B mills choosing to participate in the Voluntary Advanced Technology Incentives Program that they will not inadvertently become a new source, which would subject them to compulsory NSPS.

For the convenience of the permit writer, the definition of new source being codified in part 430 restates the three criteria already codified in § 122.29(b)(1). The first criterion provides that a source is a new source if it is constructed at a site at which no other source is located. Section 430.01 (j)(1)(i); see 40 CFR 122.29(b)(1)(i). As applied to part 430, this criterion is intended to ensure that a greenfield mill is characterized as a new source and hence is subject to NSPS or PSNS.

The second criterion specified in today's definition of new source incorporates the language of 40 CFR 122.29(b)(1)(ii) with two additions. First, it provides that a fiber line that totally replaces an existing fiber line is a new source (unless that fiber line is enrolled in the Voluntary Advanced Technology Incentives Program). Second, it includes a list of modifications that would not trigger the new source definition if made by subpart B or E mills. See 40 CFR 430.01(j)(1)(ii) and (2). This criterion provides essentially that a fiber line that is modified to comply with baseline BAT effluent limitations or that is totally rebuilt to comply with Advanced Technology BAT limitations is not a new source. (A fiber line is a series of operations employed to convert wood or other fibrous raw material into pulp. If the final product is bleached pulp, the fiber line encompasses pulping, de-knotting, brownstock washing, pulp screening, centrifugal cleaning, and multiple bleaching and washing stages.)

Among the changes specified in the regulation that alone do not cause an existing fiber line at a mill to be considered a new source are: Upgrades of existing pulping operations; upgrades or replacement of pulp screening and washing operations; installation of extended cooking and/or oxygen delignification systems or other post-digester, pre-bleaching delignification systems; and bleach plant modifications including changes in methods or amounts of chemical applications, new chemical applications, installation of new bleaching towers to facilitate replacement of sodium or calcium hypochlorite, and installation of new pulp washing systems. 40 CFR 430.01(j)(2)(i)–(iv). By expressly excluding these process modifications from the new source definition, EPA thus allows a mill to implement the baseline BAT/PSES technologies without triggering NSPS or PSNS. EPA believes that interpreting process modifications that are designed to achieve compliance with baseline BAT/PSES limitations as an existing source modification is consistent with Congress' intentions in the Clean Water Act concerning the respective roles of standards for existing and new sources.

As discussed in more detail below in connection with the third new source criterion, EPA believes it is appropriate to define a new fiber line as a new source because the construction of the new fiber line (whether to supplement or replace an existing fiber line) presents the type of pollution prevention opportunities customarily represented by NSPS. However, EPA believes it is also appropriate to treat the replacement fiber line as an existing source if that fiber line is enrolled in the Voluntary Advanced Technology Incentives Program. See 40 CFR 430.01(j)(2)(v). EPA has decided to do this because requiring the new fiber line to meet baseline NSPS requirements would defeat the purpose of the Voluntary Advanced Technology Incentives Program by undercutting the more environmentally protective pollution prevention opportunities and limitations associated with that program. In the first place, Advanced Technology BAT limitations at the Tier II and Tier III levels are more stringent than the baseline NSPS requirements; EPA's definition of new source thus is intended to allow mills to commit to greater pollutant reductions than EPA could otherwise compel and to do so incrementally while maintaining use of the existing fiber line in the interim. Similarly, the Advanced Technology BAT limitations at the Tier I level promote pollution prevention opportunities not necessarily assured by NSPS, even though the technology bases for NSPS and Tier I are similar. EPA has established different limitations for Tier I than for NSPS because the regulations are intended to achieve different objectives. The new source performance standards for AOX are more stringent because, as a statistical matter, EPA determined that this performance level reflects the best demonstrated performance by mills using the NSPS technology. The Tier I limitations for AOX, in contrast, are intended to reflect a more inclusive performance level that EPA believes existing mills employing extended delignification can achieve, in order to encourage more mills to implement extended delignification technologies. The Tier I limitations also require the recycle of filtrates to the recovery systems and impose limitations on the lignin content of unbleached pulp, which EPA hopes will promote the use of particular pollution prevention technologies and, in turn, encourage mills to look beyond Tier I to the Tier II and Tier III levels. This goal contrasts with the objective of NSPS, which simply is to compel mills to achieve certain discharge levels by any combination of technologies the mill selects, and would be defeated if the definition of new source would have the effect of moving Tier I mills into NSPS. Therefore, EPA has decided that, on balance, imposing NSPS on mills that replace fiber lines for the purpose of participating in the Voluntary Advanced Technology Incentives Program would discourage rather than encourage the long-term goal of achieving even greater environmental performance.

The third criterion appearing in the definition of new source in § 430.01(j)(1)(iii) is identical to the third criterion at § 122.29(b)(1)(iii), and provides that a source is a new source if its processes are substantially independent of an existing source at the same site. In determining whether processes are substantially independent, the permitting or pretreatment authority is directed to consider such factors as the extent to which the new facility is integrated with the existing plant, and the extent to which the new facility is engaged in the same general type of activity as the existing source. For example, if a mill operating in the Bleached Papergrade Kraft and Soda subcategory builds and operates an entirely new fiber line that permanently

supplements the capacity of an existing fiber line (and also, incidentally, increases the total quantity of pollutants discharged by the mill), the new fiber line would be considered a new source subject to NSPS.

EPA believes it is appropriate to subject a new fiber line that is substantially independent of an existing fiber line to new source performance standards because a mill designing that new fiber line has pollution prevention opportunities akin to those available to greenfield mills. For example, a mill would have the opportunity to incorporate pollution prevention principles when designing a new fiber line, including a new flow scheme and water balance. This new fiber line would provide the opportunity to take advantage of pollution prevention savings attributable to reduced chemical needs (and costs), increased energy recovery, the possibility of improving yield, and other operation and maintenance improvements.

EPA notes that a fiber line that is substantially independent of an existing fiber line is a new source even if the new fiber line is enrolled in the Voluntary Advanced Technology Incentives Program. EPA believes that this is appropriate because the supplemental fiber line increases both the mill's production capacity and its discharge of pollution to the environment. However, the fiber line could qualify for incentives if it is enrolled in the Voluntary Advanced Technology Incentives Program for NSPS at the Tier II or Tier III level.

As reflected in the July 1996 Notice, 61 FR at 36848, EPA had considered excluding from the definition of new source those mills that renovated existing fiber lines but remained at existing production levels. In response to comments, EPA has decided not to introduce production levels as a factor in determining new source status. First, taking production levels into account in determining whether an existing source becomes a new source would be a departure from current practice that EPA believes is not justified in this case. EPA believes that the new source status of a subpart B or E mill should be determined by the degree of process and production changes made at a mill's fiber lines—such as the replacement of existing digesters and bleach plants with new equipment—because those changes, not production levels, present the real opportunities for pollution prevention represented by NSPS or PSNS. Moreover, EPA agrees with comments stating that mills subject to subpart B or E frequently undergo changes in various degrees to increase production levels and that many of these changes do not result in or from substantially independent facilities or the total replacement of existing facilities. See DCN 25538 at 70–72. Therefore, the mere fact that a mill increases its production levels does not mean that it concurrently has the opportunity to install the type of advanced pollution prevention technologies represented by NSPS.

(3) Non-Continuous Discharger. EPA is changing the regulatory language defining non-continuous dischargers as it applies to subparts B and E. See 40 CFR 430.01(k)(2). EPA is also republishing, without change, the current definition of non-continuous dischargers because it continues to apply to the other subparts in part 430 and to the determination of technology-based effluent limitations on conventional pollutants for existing dischargers subject to subpart B or E. See 40 CFR 430.01(k)(1).

EPA had proposed a new definition that would have defined as a non-continuous discharger a mill that stored wastewaters for periods of at least 24 hours and that released that wastewater on a batch basis. In the final definition applicable to subparts B and E, EPA is retaining the storage component of the proposed (and existing) regulation but is not specifying a minimum 24-hour storage period because EPA determined that it had no particular significance for these subparts. However, as indicated in the July 1996 Notice, 61 FR at 36842, EPA is adding language defining as a non-continuous discharger a discharger that releases stored wastewater on a variable flow or a pollutant loading rate basis. Finally, in this new definition, EPA is clarifying that it applies to storage or release of wastewaters required by the permitting authority for the purpose of protecting receiving water quality, among other purposes. See 40 CFR 430.01(k)(2). For subparts B and E only, EPA also is eliminating the requirement in the existing regulation, at 40 CFR 430.01(c) (1996 ed.), for the NPDES authority to include maximum day and maximum 30-day average concentration limitations consistent with BPT, BCT, or NSPS limitations as appropriate. See 40 CFR 430.01(k). EPA will defer to the NPDES authority to establish maximum day and maximum 30-day average limitations that are necessary to protect receiving water quality. In later final rulemaking phases (see section II, table II–2), EPA intends to adopt for remaining subcategories the same definition for non-continuous dischargers as is being promulgated today for subparts B and E.

(4) Retention of Previously Promulgated Effluent Limitations Guidelines and Standards. As discussed in more detail in Section VI.B.2, EPA is not revising BPT or BCT effluent limitations for conventional pollutants for subparts B and E. Therefore, EPA is retaining the previously promulgated limitations for these pollutants and subparts. See 40 CFR 430.22, 430.23, 430.52, 430.53.

EPA is also retaining previously promulgated NSPS for subparts B and E because new sources that commenced operation prior to the effective date of today's NSPS remain subject to the earlier standards for ten years beginning on the date construction of the new source was completed. CWA section 306(d); see 40 CFR 430.25(a), 430.55(a).

Finally, as discussed in more detail in Section VI.B.3.f, subparts B and E include previously promulgated end-of-pipe effluent limitations guidelines and standards for pentachlorophenol and trichlorophenol. EPA is also retaining the accompanying provisions authorizing mills that do not use those chemicals as biocides to certify this fact to the permitting or pretreatment authority with the result that they would not be subject to those limitations or standards. *Id.*

In addition to today's new regulations for subparts B and E, EPA is recodifying the previously promulgated BPT, BCT, BAT, NSPS, PSES and PSNS for the other subparts of the pulp, paper, and paperboard category. These limitations regulate the discharges of BOD_5, TSS, zinc, and other analytes. Although EPA is reorganizing the former subcategories in accordance with the new subcategory designations, EPA is not changing these limitations and standards. See Section VI.B.1.

b. Determination of Effluent Limitations for Permits. (1) Definition of Production and Production-Normalizing Parameters. The Agency has based some of the effluent limitations guidelines and standards promulgated today on pollutant concentrations. Others are mass-based, that is, normalized on the basis of an appropriate measure of production. Limitations and standards for AOX, chloroform, BOD_5, and TSS fall into this category.

This appropriate measure of production is known as the ''production-normalizing parameter.'' The current definition of ''production-normalizing parameter'' is annual off-the-machine production (including off-the-machine coating, where applicable) of pulp, paper, and/or paperboard, divided by the number of operating days that year. Most paper and paperboard production is measured at the off-the-

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machine moisture content, while market pulp is measured as air-dry metric tons (10 percent moisture). EPA is not changing this definition of production as it applies to the effluent limitations and standards for any subcategory in Part 430 other than subparts B and E. EPA is also retaining the existing definition of production for the NSPS for conventional pollutants being promulgated today for subpart B and subpart E. See 40 CFR 430.01(n)(1).

However, EPA is codifying a new definition of production for the AOX and chloroform limitations being promulgated today for subparts B and E. See 40 CFR 430.01(n)(2). Under the new specialized definition, the production-normalizing parameter to be used by permit writers in calculating mass-based limitations for chloroform and AOX is air-dried metric tons of brownstock pulp (10 percent moisture) entering the bleach plant at the stage during which chlorine or chlorine-containing compounds are first applied to the pulp. In the case of bleach plants that use totally chlorine-free bleaching, the production-normalizing parameter used to calculate mass-based limitations shall be air-dried metric tons of brownstock pulp (10 percent moisture) entering the first stage of the bleach plant from which wastewater is discharged. *Id*. Production, in turn, is defined as the annual unbleached pulp production that enters the bleach plant (at ten percent moisture) divided by the number of operating days of the bleach plant. *Id*.

The Agency had proposed to change the current definition of production in part 430 by adding the following statement: ''Production in each of the foregoing cases shall be determined for each mill based upon the highest annual production in the past five years divided by the number of operating days that year.'' See 58 FR at 66189. EPA has decided not to revise the definition to include a new time basis because EPA is not revising the current BPT and BCT effluent limitations guidelines at this time for subparts B and E. Codifying a new time basis for determining production of AOX and chloroform would have required permit writers to apply different time bases for determining production for purposes of calculating BAT limitations and limitations for conventional pollutants. In EPA's view, this would have unduly complicated the permitting process. In addition, for NSPS, introducing a time basis would be illogical because new sources do not have five years of data from which to determine the one highest year.

(2) Determination of Permit Limitations for Multiple Subcategory Mills. For facilities with multiple point source categories, subcategories, and segments, the appropriate guidelines for each category, subcategory (or subpart), and segment are used to determine a single permit limit for each pollutant. Chapter 5 of the U.S. EPA NPDES Permit Writers' Manual (EPA–833–B–96–003, December 1996) provides guidance in determining permit limits in situations when the effluent guidelines for one subcategory regulates a different set of pollutants than the effluent guidelines applicable to another subcategory. For mill subject to today's rule, this situation may arise in setting permit limits for AOX when the mill has production in multiple subcategories.

For pollutants regulated today at the bleach plant (i.e., dioxin, furan, chlorinated phenolic pollutants, and chloroform, and, for subpart B PSES/PSNS, AOX), EPA does not believe that multiple guidelines will be relevant. The bleach plant is unlikely to be used for more than one subcategory (or segment in subpart E), and thus, the permit limit will be determined by the limitations and standards for a single subcategory (or segment).

There may be instances where a pollutant is regulated under the limitations and standards promulgated today and the permitting authority also wishes to establish limits for that particular pollutant have yet to be established. For example, the permitting authority might need to use best professional judgment to determine end-of-pipe limits for AOX for a mill with production not only in subpart B or E (for which AOX limitations are being promulgated today) but also in another subpart (for which no AOX limitations have been promulgated) that generates AOX. In these instances, the permitting authority would use best professional judgment to develop pollutant limits for wastestreams and pollutants not covered by today's rulemaking and apply those limits to determine a proper permit limitation for the mill.

Following promulgation of today's rules, EPA will develop and publish additional guidance for the pulp and paper industry for determining permit limitations for facilities with production in multiple categories, subcategories, and segments.

c. Compliance With Effluent Limitations. (1) Compliance Demonstration for In-Plant Limitations. The effluent limitations and standards that the Agency is promulgating today for dioxin, furan, chloroform, the 12 chlorinated phenolic pollutants and AOX will be applied (depending on the subcategory and segment) to the total discharge from each physical bleach line operated at the mill. At most mills, wastewaters from acid and alkaline bleaching stages are discharged to separate sewers. At some mills, however, bleach plant wastewaters are discharged to a combined sewer containing both acid and alkaline wastewaters.

For dioxin, furan, and chlorinated phenolic compounds, compliance with the effluent limitations and standards can be demonstrated by collecting separate samples of the acid and alkaline discharges and preparing a flow-proportioned composite of these samples, resulting in one sample of bleach plant effluent for analysis. However, in determining the limitations, EPA used data from acid and alkaline bleach plant effluents that had been analyzed separately. (EPA also used data from combined sewers.) In a comment on Method 1653 (DCN 20095 A8), the commenter reported problems in achieving the Minimum Level in Method 1653 for samples of composited acid and alkaline filtrates. If necessary to achieve the Minimum Level, EPA recommends that the facility test the effluents separately for reliable determination of the chlorophenolics, TCDD, and TCDF.

For chloroform, however, separate samples and analyses of all bleach plant filtrates discharged separately are required to prevent the loss of chloroform through air stripping as the samples are collected, measured, and composited or through chemical reaction when the acid and alkaline samples are combined. If separate acid and alkaline sewers do not exist, compliance samples must be collected from the point closest to the bleach plant that is or can be made physically accessible.

(2) Compliance with ML Limitations. In today's rulemaking for the Bleached Papergrade Kraft and Soda subcategory, EPA is establishing limitations and standards for 12 chlorinated phenolic pollutants and dioxin, and alternative TCF limitations and standards for AOX, that are expressed as less than the Minimum Level (''<ML''). See 40 CFR 430.24, 430.25, 430.26, 430.27. For various segments of the Papergrade Sulfite subcategory, EPA is establishing limitations and standards for AOX, chlorinated phenolic pollutants, dioxin, and furan that are also expressed as ''<ML.'' See 40 CFR 430.54, 430.55, 430.56, 430.57. Henceforth, this discussion refers to these limitations and standards as ''ML limitations''. The ''ML'' is an abbreviation for the Minimum Level identified today in § 430.01(i) for the analytical methods that EPA used to determine the level of

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pollution reduction achievable for these pollutants through the use of BAT, NSPS, PSES and PSNS technologies for these subparts. (Section VI.B.5.a(4) provides a detailed discussion about ML limitations.) EPA intends for mills subject to ML limitations to have pollutant discharges with concentrations less than the Minimum Levels of the analytical methods specified today in § 430.01(i).

Compliance with the ML limitation for an analyte can only be demonstrated by using the method specified in § 430.01(i) for that analyte, or other methods approved in 40 CFR Part 136 that have Minimum Levels equal to or less than the minimum level specified today in § 430.01(i). Mills are not authorized under this rule to demonstrate compliance with an ML limitation codified today by using an analytical method with a minimum level above the Minimum Level specified in § 430.01(i).

The Minimum Level specified for each method is the lowest level at which calibration is performed. See 40 CFR 430.01(i). Laboratories calibrate their equipment by using standards (i.e., samples at several known concentrations of each analyte). Calibration is necessary because laboratory equipment does not measure concentrations directly. Rather, the equipment generates signals or responses from analytical instruments that must be converted to concentration values. The calibration process establishes a relationship between the signals and the known concentration values of the standards. This relationship is then used to convert signals for samples with unknown concentrations.

In the calibration process, one of the standards will have a concentration value at the Minimum Level for each analyte. Because the minimum levels are the lowest levels for which laboratories calibrate their equipment, measurements below the Minimum Level are to be reported as being ''less than Minimum Level,'' or ''<ML''.

Often, laboratories report values less than minimum levels to be ''not detected'' or ''<ML.'' In some cases, however, the laboratories report these values as if the values were quantified. For example, if the Minimum Level specified in § 430.01(i) is 10 ppq, the laboratory might report a measurement that is 4 ppq. Such reported values might occur in two situations. In the first situation, the laboratory could have used the method specified in § 430.01(i), but referred to the measurement as ''detected'' although it was less than the Minimum Level. The second situation could occur in the future as the analytical methods become more sensitive than the methods specified in § 430.01(i). Using such future methods could conceivably allow laboratories to reliably measure values less than today's minimum levels. Such measurements resulting from either situation would be considered to demonstrate compliance with the ML limitations, because these measurements are less than the method ML specified in § 430.01(i).

When monitoring for compliance with this final rule, a sample-specific Minimum Level greater than the method Minimum Level will not demonstrate compliance with an ML limitation. Such sample-specific Minimum Levels may result from sample volume shortages, breakage or other problems in the laboratory, or from failure to properly remove analytical interferences from the sample. EPA believes that all of these situations can be avoided by careful adherence to sample collection and laboratory analysis procedures. For example, in the Agency's long-term variability study, some of the one-liter jars that were sent to laboratories for analysis were not filled to capacity. In this example, adjustments to the Minimum Levels could have been avoided if a sufficient volume of sample had been collected by filling the one-liter jars to capacity, or by using larger or extra jars. Mill personnel should collect sufficient volume to allow for analysis of the entire sample volume specified in the method and for dilutions, re-analyses, or other problems that may occur. In addition, it is often possible for the laboratory to adjust for extraction of smaller sample volumes by further concentrating the resulting extracts prior to analysis.

Table VI–11 provides some examples demonstrating compliance with the ML limitations. In these examples, the method ML specified in § 430.01 is 10 ppq.

TABLE VI–11.—EXAMPLES DEMONSTRATING COMPLIANCE WITH ML LIMITATIONS

Is concentration reported as ''detected'' or ''non-detected'' in the sample?	Value reported by laboratory (ML in these examples is 10 ppq)	Does the sample demonstrate compliance?	Explanation for compliance determination
Detected	4 ppq	Yes	4 ppq is less than the ML specified in § 430.01.
Detected	10 ppq	No	Compliance is demonstrated only with measurements less than the ML specified in § 430.01.
Detected	11 ppq	No	The measured value is greater than the ML specified in § 430.01.
Non-detected	<5 ppq	Yes	<5 ppq is less than the ML of 10 ppq specified in § 430.01.
Non-detected	<10 ppq	Yes	Compliance is demonstrated for all values less than the ML specified in § 430.01.
Non-detected	<11 ppq	No	The sample-specific ML must be less than the ML of 10 ppq specified in § 430.01.

(3) AOX at Calcium-, Magnesium-, or Sodium-Based Sulfite Mills. The AOX limitation for calcium-, magnesium-, or sodium-based papergrade sulfite mills is expressed as less than the Minimum Level (ML) of the analytical method. As discussed in section VI.B.6, this AOX limitation is based on transfer of data collected at the bleach plant effluent to the end-of-pipe for BAT. EPA received comments asserting that this transfer of data does not account for potential sources of AOX other than the bleach plant. Examples of these potential sources of AOX include the release of AOX from purchased pulp used in papermaking, the use of chlorinated compounds for control of biological growth on paper machines, chlorine use in water treatment, and bleaching colored broke in the stock preparation area. Hypochlorite is also used in deinking processes to strip color from post-consumer waste.

AOX contributions from deinking operations are not covered by this rule and would be addressed in developing appropriate permit limitations as described in VI.B.8.b(2) above. AOX contributions due to chlorine use in treating process water supplies are not taken into account in the development of limitations and standards for the calcium-, magnesium-, or sodium-based

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sulfite pulp segment. In cases where other sources of AOX, such as paper machines, make the end-of-pipe AOX limitations in this rule impractical or infeasible for the purpose of assessing the contribution of AOX from bleach plant sources, the AOX limitation may be imposed on internal waste streams (i.e., bleach plant effluent) before mixing with other waste streams containing AOX. See 40 CFR 122.45(h).

(4) Minimum Monitoring Frequencies. (a) Rationale for Establishing Minimum Monitoring Frequencies. EPA proposed specific minimum monitoring frequencies for pollutants in bleach plant and end-of-pipe effluent discharges. See 58 FR at 66189. Although EPA proposed minimum monitoring requirements for BOD_5 and TSS limitations established as part of NSPS, EPA is not specifying such requirements in the final rule because permit authorities have ample experience regulating these pollutants and can determine the appropriate monitoring frequencies. See Section VI.A.3 for a discussion of BOD_5 monitoring requirements under today's air rule. See also Section VI.B.7 for a discussion of monitoring requirements associated with BMPs.

The final rule specifies minimum monitoring frequencies for AOX, dioxin, furan, chloroform, and chlorinated phenolic pollutants for non-TCF mills because of the nature and composition of the discharges from non-TCF bleached papergrade kraft and soda and papergrade sulfite mills. See 40 CFR 430.02 (a) and (b). Wastewaters from these mills have been found to contain chlorinated organic compounds that are highly toxic and bioaccumulative (e.g., dioxin, furan, and chlorinated phenolic pollutants). Process-related variability in generating these pollutants is clearly reflected in available data. Therefore, given the environmental significance of these pollutants, minimum monitoring is both necessary and appropriate to ensure that data are available to permitting authorities to have an adequate basis to verify compliance with the technology-based effluent limitations and standards. In contrast to discharges of BOD_5 and TSS, receiving water effects from discharges of these chlorinated pollutants are not as easily detected, are not as well understood, and do not manifest themselves in a manner that enables a mill to quickly become aware of and react to releases that may be harmful to the environment.

The monitoring requirements imposed in 40 CFR 430.02 will not take effect until EPA has obtained approval of these information collection requirements from the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501, *et seq.* For monitoring requirements applicable to direct dischargers, EPA will seek to amend the NPDES Discharge Monitoring Report ICR No. 229, OMB approval number 2040–0004, prior to its expiration on May 31, 1998. For indirect dischargers, EPA will seek to add specified monitoring requirements for indirect dischargers to the National Pretreatment Program ICR No. 2, OMB approval number 2040–0009, when it expires on October 31, 1999. EPA will not seek to amend this ICR prior to its expiration date because the monitoring requirements for indirect dischargers do not become effective until April 16, 2001 for existing indirect dischargers, and EPA anticipates no new indirect dischargers commencing discharge prior to the ICR expiration date.

(b) Duration of Minimum Monitoring Frequency. The final rule includes minimum monitoring frequency requirements for demonstrating compliance with limitations and standards for dioxin, furan, chloroform, the 12 chlorinated phenolic pollutants, and AOX for non-TCF mills. See 40 CFR 430.02(a). Permitting and pretreatment authorities retain authority to specify more frequent monitoring on a case-by-case basis and must specify AOX monitoring frequency for TCF mills on a best professional judgment basis. The minimum monitoring frequencies are applicable to mills in Subparts B and E for a duration of five years after inclusion in NPDES permits for direct dischargers. See 40 CFR 430.02(b). For existing indirect dischargers, the minimum monitoring requirements apply until April 17, 2006 which reflects a five-year monitoring period following the termination of the three-year compliance period authorized by CWA Section 307(b)(1). *Id.* For new indirect dischargers, the five year minimum monitoring period commences upon operation. *Id.*

EPA has determined the minimum monitoring frequencies established by this rule are necessary to demonstrate compliance with the effluent limitations guidelines and standards promulgated today, particularly considering the degree of change that is expected to occur to pulping and bleaching processes as this rule is implemented. In establishing the minimum monitoring frequencies for the regulated pollutants, the Agency has struck a balance between the cost of the monitoring regimen and the need to ensure that sufficient data are consistently available to permitting authorities to provide an adequate basis to verify compliance with the effluent limitations and standards and to mills to quickly become aware of and react to releases that may be harmful to the environment.

The Agency has selected a minimum monitoring frequency of once per month for dioxin, furan, and chlorinated phenolic pollutants. See 40 CFR 430.02(a). These pollutants are the most toxic and bioaccumulative among those regulated yet also are the most costly to analyze (total cost of approximately $1,325 per sample; $825 per sample for dioxin, furan, and $500 per sample for all 12 chlorinated phenolic analytes). EPA expects that 12 data points for each pollutant per year, together with daily end-of-pipe AOX data and information on process conditions from detailed mill logs (e.g., unbleached pulp kappa numbers, bleach plant kappa factors, bleached pulp brightness, etc.) that are reviewable upon request, will yield a meaningful basis for establishing compliance with the promulgated limitations through long-term trends and short-term variability in dioxin, furan, and chlorinated phenolic pollutant discharge loading patterns.

The Agency has selected a minimum monitoring frequency of once per week for chloroform. See 40 CFR 430.02(a). This minimum monitoring frequency has been selected because data available indicate there can be considerable temporal variability of this pollutant in bleach plant wastewaters. Therefore, more data are required to adequately assess compliance with the promulgated limitations and standards on both a long-term and short-term basis. While the cost for laboratory analysis of chloroform (approximately $270 per sample) is much lower than for dioxin, furan, and chlorinated phenolic pollutants, chloroform sampling requirements are more extensive and rigorous (e.g., sampling of all bleach plant filtrates using special equipment and containers to prevent volatilization). Weekly data (52 data points) and information on process conditions from detailed mill logs that are reviewable upon request are expected to yield an adequate basis for establishing long-term compliance trends in chloroform discharge loadings and developing process control strategies to ensure the short-term compliance in chloroform discharge loadings.

The Agency has selected a minimum monitoring frequency of once every day for AOX for non-TCF mills. See 40 CFR 430.02(a). This minimum monitoring frequency has been selected because there can be considerable daily variability in chlorinated organic discharge loadings to receiving streams

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reflecting both bleach plant discharge patterns and secondary biological treatment system performance that is readily measured at reasonable cost. At this time, AOX analysis costs $120 per sample. This cost is likely to decrease after this regulation is promulgated with increased capacity at commercial laboratories and analytical laboratories on-site at many mills. While this bulk parameter measures all chlorinated organic constituents in wastewater and not individual pollutants, daily monitoring will provide an essentially continuous data stream on a quick turnaround basis to mill operating personnel and permit compliance authorities to assess and control process technologies and manage the performance of end-of-pipe biological treatment systems.

The minimum monitoring frequencies in this rule as described above will provide sufficient information to evaluate mill compliance with the promulgated limitations over the long term and allow permitting and pretreatment authorities to judge whether a different frequency of monitoring is warranted after the initial compulsory period of minimum monitoring has been completed. These data will prove useful to permitting authorities and also to mill operators in developing a robust mill-specific compliance data base with which to analyze the effects of mill processes on effluent trends. The five-year duration of the minimum monitoring requirements is consistent with permit issuance cycles, will ease administrative burdens on operators and permitting authorities, and will provide data useful for establishing appropriate monitoring requirements during future permit renewals.

Following completion of the compulsory five-year monitoring period set forth by this rule, the permitting or pretreatment authority has discretion to adjust monitoring requirements as deemed appropriate on a case-by-case basis. For those mills consistently demonstrating reductions superior to those required merely to comply with their permit requirements, EPA believes that it may be appropriate to allow less frequent monitoring to reduce the regulatory burden. EPA expects the permitting or pretreatment authority also to consider the mill's compliance and enforcement history in determining monitoring frequencies. This avenue for relief provides incentives for voluntary reductions of pollutant discharges through such means as reuse and recycling. EPA also expects permitting and pretreatment authorities to consider whether poor performance, compliance or enforcement history, or other site-specific factors indicate a need to impose more frequent monitoring than that specified in this rule.

EPA has issued interim guidance for performance-based reductions of NPDES permit monitoring frequencies, which may be useful for permit writers and pretreatment authorities in determining alternative monitoring frequencies at the close of the compulsory five-year period imposed by this rule. (See Interim Guidance for Performance-Based Reductions of NPDES Permit Monitoring Frequencies, April 1996, EPA–833–B–96–001). This document provides guidance to permit writers on implementing EPA's NPDES regulations regarding appropriate monitoring in permits and describes the conditions under which reduced monitoring would be justified. Pretreatment control authorities also may find this guidance useful in setting monitoring frequencies for industrial users of POTWs. The current guidance applicable to all industrial point sources is dated April 19, 1996, and is subject to revision.

(c) Certification for TCF Bleaching. Mills certifying in their permit application process that all bleaching processes are totally chlorine-free are exempted from the minimum monitoring frequencies established in this rule, provided that analytical data routinely submitted as part of the permit application confirm the absence of chlorinated compounds. See 40 CFR 430.02. EPA believes it is appropriate to exclude TCF mills from the minimum monitoring frequencies for chlorinated compounds since any process change that introduces chlorinated compounds to the bleaching process requires notification to the permitting authority and would result in reopening the permit for modification. See, e.g., 40 CFR 122.21(g)(3), 122.21(g)(7), and 122.41(l).

(d) ECF Certification in Lieu of Monitoring. In response to comments, EPA has considered whether certification of ECF bleaching processes can be used in lieu of monitoring. Because of the effect that operation and control of pulping and bleach plant processes have on generation of chlorinated pollutants, EPA has determined that the information available at this time does not demonstrate that ECF certification alone is sufficient to ensure compliance with the regulations promulgated today. Therefore, this rule does not allow certification of ECF bleaching to replace monitoring. (See DCN 14497, Vol. I, and section VI.B.5 of this preamble for a discussion of factors affecting chlorinated pollutant generation.)

Elsewhere in today's **Federal Register**, however, EPA is proposing to allow mills to demonstrate compliance with chloroform limitations by certifying that they use ECF bleaching processes and that these processes are operated in a manner consistent with certain process and related factors. In this notice, EPA also is seeking additional chloroform data, along with corresponding process data, to determine whether an ECF certification process for chloroform should require certification of certain process factors; for example, factors relating to residual lignin content, chemical application rates, and other process variables.

d. Intake Credits, Upsets, and Bypasses. An intake credit is an adjustment made to an effluent limitation to reflect the presence of a pollutant in the discharger's intake water beyond what is removed by an installed technology that would otherwise meet the technology-based effluent limitation or standard. EPA's regulations concerning intake credits are set forth at 40 CFR 122.45 and 40 CFR 403.15.

A ''bypass'' is an intentional diversion of waste streams from any portion of a treatment facility. An ''upset'' is an exceptional incident in which there is unintentional non-compliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. EPA's regulations concerning bypasses and upsets are set forth at 40 CFR 122.41 (m) and (n).

e. Variances and Modifications to Permits. (1) Variances. Dischargers subject to the BAT and PSES limitations promulgated in these final regulations may apply for a Fundamentally Different Factors (FDF) variance under the provisions of section 301(n) of the CWA. The FDF variance considers those facility-specific factors that a permittee believes to be uniquely different from the factors considered by EPA in developing an effluent guideline to determine whether the effluent guidelines limitations should be inapplicable to the permittee's facility. An FDF variance is based only on information submitted to EPA during the rulemaking establishing the effluent limitations, or on information the applicant did not have a reasonable opportunity to submit during the rulemaking process. See CWA section 301(n)(1)(B). If fundamentally different factors are determined to exist, the alternative effluent limitations for the petitioner must be no less stringent than those justified by the fundamental difference. See CWA section 301(n)(1)(C). The alternative effluent

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limitation must not result in non-water quality environmental impacts significantly greater than those accepted by EPA in promulgating the effluent limitations guidelines or pretreatment standards. See CWA section 301(n)(1)(D). FDF variance requests, along with all supporting information and data, must be received by the permitting authority within 180 days after publication of the final effluent limitations guideline or standard. See CWA section 301(n)(a). The specific regulations covering FDF variance requirements and administration are found at 40 CFR 122.21(m)(1), 40 CFR Part 125, Subpart D, and 40 CFR 403.13.

Dischargers may also apply for a variance from the BAT limitations on non-conventional pollutants in these final regulations under CWA section 301(c) (for economic reasons) and 301(g) (for water quality reasons). Regulations for the administration of these variances are specified in 40 CFR 122.21(m)(2).

New sources subject to NSPS or PSNS are not eligible for variances. See *E.I. DuPont* v. *Train,* 430 U.S. 112 (1977).

(2) Permit Modifications. It may be necessary to modify a permit at some point after it has been issued. In a permit modification, only the conditions subject to change are reconsidered. All other permit conditions remain in effect unchanged. A permit modification may be triggered in several ways, such as when the regulatory agency inspects the facility and finds a need for the modification, or when information submitted by the permittee suggests a need for a modification. Any interested person may request that a permit modification be made. There are two classifications of modifications: major and minor. From a procedural standpoint, they differ primarily with respect to the public notice requirements. Major modifications require public notice while minor modifications do not. See 40 CFR 122.63. Virtually all modifications that result in less stringent conditions are treated as a major modification, with provisions for public notice and comment. Conditions that would necessitate a major modification of a permit are described in 40 CFR 122.62. Minor modifications are generally non-substantive changes. The conditions for minor modification are described in 40 CFR 122.63.

VII. Environmental Impacts

This section of the preamble describes the environmental impacts of the air and water regulations being promulgated today, and the environmental impacts of the MACT II regulations being proposed today. These impacts are described in terms of reductions in air pollution emissions expected as a result of the final MACT I and proposed MACT II rules, as well as the reduction in water pollution (effluent) discharges expected as a result of today's effluent limitations guidelines and standards for Subparts B and E. (In this section, all references to MACT I include MACT III unless expressly noted.) The emissions and effluent reductions described in this section generate the quantified and monetized benefits described in Section VIII of this preamble. This section also discusses the non-water quality environmental impacts of the effluent limitations guidelines and standards promulgated today, including air emissions, energy requirements, solid waste generation, water use, and wood consumption. Sections II.B.2 and VII.A describe air and water pollution control technologies for each subcategory regulated today: Kraft, Soda, Sulfite, and Semi-chemical mills that are subject to MACT I and MACT III standards; and bleached papergrade kraft and soda and papergrade sulfite mills that are subject to effluent limitations guidelines and standards. EPA estimates that the application of these technologies by the 155 mills regulated by today's air rules, including 96 of those mills also regulated by today's water rules, will substantially reduce air emissions and water pollution discharges, as described in Section VII.B.

A. Summary of Sources and Level of Control

Table VII–1 shows a summary of sources and technology bases/level of control for the final BAT/PSES effluent limitations guidelines and standards, and the final MACT I standards. The summary of sources and level of control for MACT II are discussed in the preamble for the proposed MACT standards elsewhere in today's **Federal Register**.

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TABLE VII–1.—FINAL CLUSTER RULES—SOURCES AND TECHNOLOGY BASES/LEVEL OF CONTROL

Toxic and nonconventional pollutant effluent control (BAT, PSES, and BMP technology bases) by subcategory					Hazardous air pollutant emission control (MACT I and III levels of control) by subcategory			
Bleached papergrade kraft and soda	Papergrade sulfite			Best Management Practices (BMP), (Subparts B and E)	Kraft	Soda and semi-chemical	Sulfite	Secondary and nonwood fiber, and mechanical wood fiber
	Calcium, magnesium, and sodium sulfite	Ammonium sulfite	Specialty grade					
Selected BAT/PSES				Spent Pulping Liquor Spill Prevention and Control.	Control LVHC System Vents			See Bleach Plant Block Below
ECF: 100% Substitution of Chlorine with Chlorine Dioxide; effective brownstock washing; elimination of hypochlorite; oxygen-and peroxide-enhanced extraction; closed brown-stock screening; and other processes discussed at Section VI.B.5.a(1).	TCF: Oxygen- and peroxide-enhanced extraction; peroxide bleaching; elimination of all chlorine-containing compounds; and improved pulp cleaning.	ECF: 100% Substitution of Chlorine with Chlorine Dioxide; peroxide-enhanced extraction; elimination of hypochlorite; and use of dioxin-and furan-precursor-free defoamers.	ECF: 100% Substitution of Chlorine with Chlorine Dioxide; oxygen- and peroxide-enhanced extraction; elimination of hypochlorite; and use of dioxin and furan precursor-free defoamers.	.....	Control Selected HVLC Vents and Named High HAP Concentrated Condensate Streams.	Control Pulp Washing System Vents at New Sources.	Control Pulp Washing System Vents, and Control Liquor and Acid Tank Vents at New Sources.	
					Bleach Plant: Control Chlorinated HAP from Vents at Stages That Use Chlorinated Bleaching Chemicals, and Control Chloroform Emissions by Complying with BAT codified at 40 CFR 430.24(a) and (e) and 40 CFR 430.54(a) and (c) or by 100% substitution of chlorine with chlorine dioxide and elimination of hypochlorite.			

B. Air Emissions and Water Effluent Reductions

1. Air Emissions Reductions

The reductions described in this section are derived from estimated air emissions reductions at all 155 pulp and paper mills in the CAA kraft, soda, sulfite and semichemical subcategories that are subject to MACT I and MACT II standards. These mills include the 96 mills subject to the effluent limitations guidelines and standards promulgated today. All references in this section to MACT I air emissions refer to the expected effects of implementing both the air and water portion of the final Cluster Rules.

Implementation of the MACT portion of the Cluster Rules is expected to significantly decrease HAP emissions. Table VII–2 presents the environmental impacts of the Final Cluster Rules (BAT, PSES, BMPs, and MACT I) and the Final Cluster Rules in combination with the MACT II proposed standards.

The air emission impacts presented in Table VII–2 are calculated based on mill-specific processes and emission control information, emission factors, and control levels summarized in Table VII–1. A more detailed discussion of the calculation of the environmental impacts for the final MACT standards is presented in Chapter 20 of the Background Information Document described in Section XI of this preamble. A detailed discussion of the environmental impacts of the proposed MACT II is contained in the docket for the proposed MACT II standard. As shown in Table VII–2, these final Cluster Rules not only reduce HAP emissions from all CAA and CWA subcategories regulated, but they also result in decreases of volatile organic compounds and total reduced sulfur using industry data updated to 1996. Emissions of particulate and carbon monoxide are estimated to increase under the final rules, but are expected to decrease when combined with the proposed MACT II standards. Emissions of sulfur dioxides, and, to a lesser degree, nitrogen oxides are estimated to increase. Sulfur dioxide emissions are generated primarily from the combustion of sulfur-containing compounds, such as TRS, in the vent streams at kraft mills. The increases in carbon monoxide, nitrogen oxide, and particulate matter air emissions are primarily from the combustion of air vents in the pulping area and increased energy to produce additional steam for steam strippers and chlorine dioxide for the bleaching system. However, these emission increase estimates are likely overstated because they do not account for the fact that some mills in sensitive areas for sulfur dioxide already have sulfur dioxide controls in place or may choose alternative controls available in the final MACT rule that mitigate these

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increases. The health effects and benefits of these emission reductions and increases are discussed in Section VIII.G.1 of this notice.

TABLE VII–2.—AIR EMISSION IMPACTS OF PULP AND PAPER RULES (ALL CAA SUBCATEGORIES)

Air pollutants	Baseline air emissions (Mg/year)	Air emission reductions (Mg/year)	
		Final cluster rules	Final cluster rules and proposed MACT II
Hazardous Air Pollutants	240,000	139,000	142,000
Volatile Organic Compounds	900,000	409,000	440,000
Total Reduced Sulfur	150,000	79,000	79,000
Particulate	[a]NA	[b](83)	24,000
Carbon Monoxide	NA	(8,700)	49,000
Nitrogen Oxides	NA	(5,200)	(5,700)
Sulfur Dioxides	NA	(94,500)	(94,400)

[a] Industry process data was not collected to calculate emissions for these pollutants increases and decreases for these pollutants reflected in columns to the right are increases or decreases of these pollutants caused by projected installation of MACT control equipment and secondary air emission impacts of BAT, PSES, and BMPs.
[b] Values in ( ) are estimated emission increases over baseline air emissions.

2. Water Pollutant Reductions

Table VII–3 shows the estimated baseline (as of mid-1995) and the reductions from baseline expected from the BMP requirements being promulgated today for the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories. (Hereafter, references to BAT/PSES impacts include impacts associated with today's BMP requirements.) Calculation of these pollutant reductions is discussed in Sections VI.B.5.a(3) and VI.B.6.b(5). For a discussion of the estimated effluent reduction benefits associated with the BAT limitations promulgated for the Voluntary Advanced Technology Incentives Program for the Bleached Papergrade Kraft and Soda subcategory, see Section IX. A.6 and Table IX–1.

TABLE VII–3.—ESTIMATED POLLUTANT REDUCTIONS FROM BASELINE FOR BAT/PSES

Pollutant parameter	Units	Baseline discharge for BPK mills	Estimated reductions: Final BAT/PSES for BPK mills	Baseline discharge for PS mills	Estimated reductions: Final BAT/PSES for PS mills
2,3,7,8-TCDD	g/yr	15	11	0.78	0.65
2,3,7,8-TCDF	g/yr	115	107	6.7	6.4
Chloroform	kkg/yr	48	40	5.4	5.2
Chlorinated Phenolics	kkg/yr	55	45	2.0	1.8
AOX	kkg/yr	36,300	24,200	4,380	4,010

BPK—Bleached Papergrade Kraft and Soda subcategory.
PS—Papergrade Sulfite subcategory.
g—grams.
kkg—metric ton (1,000 kilograms or 1 megagram (Mg)).

The air quality impacts shown in Table VII–2 and the water pollutant effluent reductions shown above are used in the following section to estimate reduced human health and environmental risk attributable to today's rules. These estimates also form the basis for estimating monetized benefits in the following section.

C. Non-Water Quality Environmental Impacts of Effluent Limitations Guidelines and Standards (BAT, PSES, and BMPs)

Sections 304(b)(2)(B) and 306(b)(1)(B) of the Clean Water Act require EPA to consider the non-water quality environmental impacts of effluent limitations guidelines and standards. To address these statutory requirements, EPA analyzed the air emissions, energy requirements, solid waste generation impacts, and other environmental impacts of the compulsory BAT, PSES, and BMPs being promulgated today for the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories. The results of this analysis are presented below. In performing the analysis, EPA assumed that each mill in the regulated subcategory would install the model technologies upon which today's limitations and standards are based.

1. Air Emissions

The air emissions reductions of BAT, PSES, BMPs, and MACT I, in combination, are presented in Section VII.B.1 above. This section presents the estimated air emission impacts of BAT, PSES, and BMPs on the 86 mills with production in the Bleached Papergrade Kraft and Soda subcategory and the 11 mills with production in the Papergrade Sulfite subcategory. (One mill has co-located operations in both subcategories that separately contribute to the number of mills in each subcategory.)

The control technologies that form the basis of effluent guidelines and standards promulgated today involve changes in the processes used to produce bleached pulp. These changes affect the rate at which air pollutants, including HAPs, are emitted from the pulping and bleaching processes that are subsequently controlled by MACT I. As shown in Table VII–4, the process changes at bleached papergrade kraft

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and soda and papergrade sulfite facilities subject to BAT, PSES, and BMPs decrease the emissions of some HAPs but have little impact on others. For example, the elimination of chlorine and hypochlorite from bleaching processes, part of the basis for BAT and PSES, will reduce the emission of chloroform in the Bleached Papergrade Kraft and Soda subcategory by 66 percent [but will have a much smaller impact on the emission of methanol.] The application of the BAT, PSES, and BMPs promulgated today for the Bleached Papergrade Kraft and Soda subcategory will reduce the emission of total HAPs from the sources controlled by MACT I from 149,000 Mg/year to 139,000 Mg/yr (7 percent reduction) without taking into account further reductions achieved by MACT I controls.

TABLE VII–4.—IMPACT OF BAT, PSES, AND BMP: BLEACHED PAPERGRADE KRAFT AND SODA AND PAPERGRADE SULFITE MILLS AIR EMISSIONS FROM SOURCES SUBJECT TO CONTROL BY MACT I

Air pollutants	Bleached papergrade kraft and soda [Mg/year]		Papergrade sulfite (all segments) [Mg/year]	
	Baseline emissions	Emission reductions from BAT/PSES/BMPs	Baseline emissions	Emission reductions from BAT/PSES/BMPs
Total Hazardous Air Pollutants	149,000	10,000	5,190	1,930
Chloroform	9,510	6,060	13	8
Volatile Organic Compounds	569,000	11,000	6,020	2,270
Total Reduced Sulfur	100,000	1,300	0	0

The process changes that form the basis of BAT, PSES, and BMP's increase by approximately 1.5 percent the amount of spent pulping liquor combusted by bleached papergrade kraft mills and papergrade sulfite mills. See the Supplemental Technical Development Document, DCN 14487. HAPs and criteria air pollutants (volatile organic compounds, particulate matter, carbon monoxide, nitrogen oxides, and sulfur dioxides) are generated from combustion of spent pulping liquor by bleached papergrade kraft and sulfite mills. As a result, as shown in Tables VII–5a and VII–5b, the emission of total HAPs from spent pulping liquor combustion sources (i.e., recovery boilers) will increase by 1.1 percent at bleached papergrade kraft and soda facilities and 1.9 percent at papergrade sulfite facilities above the 1995 baseline. However, the net increase in HAP emissions from these combustion sources (235 Mg/yr) represents 1.1 percent of the HAP emissions from all sources subject to control by MACT I, II, and III. Although BAT, PSES, and BMPs result in a small increase in HAP emissions from recovery boilers, the combined effect of the Cluster Rules (including proposed MACT II) is a net decrease of 60 percent in total HAP emissions from all controlled sources. See Table VII–2.

TABLE VII–5A.—IMPACT OF BAT, PSES, AND BMP: BLEACHED PAPERGRADE KRAFT AND SODA AIR EMISSIONS FROM RECOVERY BOILERS AT BLEACHED PAPERGRADE KRAFT AND SODA MILLS SUBJECT TO PROPOSED MACT II [MG/YEAR]

	1995 baseline emission	Emission increases from BAT/PSES/BMPs	MACT II emission reductions	Net change after MACT II[a]
Hazardous Air Pollutants	19,900	220	25	195
Volatile Organic Compounds	19,500	213	0	213
Total Reduced Sulfur	2,650	27	0	27
Particulate Matter	31,400	360	12,900	(12,540)
Carbon Monoxide	124,000	1,440	0	1,440
Nitrogen Oxides	36,100	423	0	423
Sulfur Dioxides	67,800	784	0	784

[a] Parentheses indicate emissions decreases below baseline.

TABLE VII–5B.—IMPACT OF BAT, PSES, AND BMP: AIR EMISSIONS FROM RECOVERY BOILERS AT PAPERGRADE SULFITE MILLS SUBJECT TO PROPOSED MACT II [MG/YEAR]

	1995 baseline emission	Emission increases from BAT/PSES/BMPs	MACT II emission reductions	Net change after MACT II
Hazardous Air Pollutants	2,110	40	N/S	40

N/S—Not Significant.

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Increases in the emission of criteria pollutants are also listed in Table VII–5a. The emission of total criteria air pollutants from spent pulping liquor combustion sources (i.e., recovery boilers) at mills in the Bleached Papergrade Kraft and Soda subcategory will increase by 1.2 percent as a result of BAT, PSES, and BMPs and will be only slightly mitigated by MACT II controls. The increases in nitrogen oxides (423 Mg/yr), sulfur dioxides (784 Mg/yr), and carbon monoxide (1440 Mg/yr) emissions are minor relative to nationwide emissions, which are 19.8 million Mg/yr for nitrogen oxides, 16.6 million Mg/yr for sulfur dioxides, and 83.6 million Mg/yr for carbon monoxide (OAQPS, 1995).

EPA concludes that the technologies that form the basis of BAT, PSES, and BMPs for bleached papergrade kraft and soda and papergrade sulfite mills pose no significant adverse impacts to and indeed have some benefits for air quality. EPA bases this determination on the following:

—Total HAP emissions from the sources subject to control by MACT I and proposed MACT II from kraft and sulfite pulping and bleaching processes decrease as a result of BAT, PSES, and BMPs;

—HAP emissions would increase by less than one percent from bleached kraft combustion sources and increase by less than two percent from papergrade sulfite combustion sources; and

—The increase in criteria air pollutants for the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories is minor relative to current national industrial emissions.

EPA examined the effect of BAT combined with BMPs on the generation of CO_2 by considering the overall mill carbon balance and the energy balance. Anthropogenic generation of water vapor is minuscule relative to atmospheric recycling and is normally ignored in greenhouse gas analysis. Therefore, water vapor is ignored here. EPA concluded that neither option would have an impact on the total emission of greenhouse gasses from mills due to pulping processing. There, EPA concludes that the increased CO_2 emissions attributable to BAT pose no significant adverse non-water quality environmental impact.

2. Energy Impacts

The impacts of BAT, PSES, and BMPs on the energy use of the 86 mills with production in the Bleached Papergrade Kraft and Soda subcategory and the 11 mills with production in the Papergrade Sulfite subcategory are summarized in Table VII–6. The process changes that form the basis of the regulations promulgated today are estimated to result in an increased energy requirement of 3.70 trillion Btu/yr in oil equivalent at the 96 affected pulp and paper mills. This represents a 0.82 percent increase from the current total Bleached Papergrade Kraft and Soda subcategories energy consumption (papergrade sulfite total energy consumption is minor relative to bleached papergrade kraft) of 499.4 trillion Btu/yr in oil equivalent (DCN 14510). The increased energy use is due to the increased off-site chemical manufacturing electrical demand (met by off-site electric generating stations) and on-site electrical demand (also met by off-site electric generating stations, and commonly referred to as ''purchased energy''). These increased demands are partially offset by the decreased steam demand (met by on-site power boilers and recovery furnaces). Oil equivalent is used to express the combined effects of changes in thermal energy and electric power. It is based on the assumption that marginal changes in electric power demand caused by the regulation will be supplied by conventional condensing-type oil-fired power stations. See DCN 14487.

TABLE VII–6.—ENERGY IMPACTS OF BAT, PSES, AND BMP: BLEACHED PAPERGRADE KRAFT AND SODA AND PAPERGRADE SULFITE MILLS

Energy impacts	Units	Bleached papergrade Kraft	Papergrade sulfite (all segments)	Combined total
On-Site Electricity Demand*	Trillion Btu/yr in oil equivalent	(2.37)	(0.0381)	(2.41)
Off-Site Electricity Demand*	Trillion Btu/yr in oil equivalent	10.0	(1.05)	8.95
Steam Demand	Trillion Btu/yr in oil equivalent	(2.88)	(0.010)	(2.89)
Total Energy Demand**	Trillion Btu/yr in oil equivalent	4.78	(1.08)	3.70
Total Energy Equivalent	Number of Households***	46,100	(10,400)	35,700

Parentheses indicate energy savings.
* Assumes an overall electrical generating efficiency of 25 percent. (DCN 14797).
* * Totals do not equal the sum of each line item due to rounding. Refer to Section 11 of the Supplemental Technical Development Document which presents detailed energy estimates.
* * * Assumes 103.6 million Btu/household/yr (Energy Information Administration (DOE) 1993).

The manufacture of sodium chlorate, the raw material used at pulp mills to manufacture chlorine dioxide, requires much more electrical energy than the manufacture of chlorine or other commonly used bleaching chemicals. As a result, off-site electrical demand increases by 8.95 trillion Btu/yr (2.61 million MWhr/yr) because of the effluent limitations guidelines and standards promulgated today. EPA estimates of changes in energy demand as mills install advanced technologies can be found in DCN 14488.

The total increase in energy demand resulting from this rule is equivalent to the energy required for 35,700 households. Compared to the most recent data for total national energy consumption, the rule represents a 0.004 percent increase in energy demand. EPA concludes that the technologies that form the basis of BAT, PSES, and BMPs for bleached papergrade kraft and soda and papergrade sulfite mills do not pose significant adverse impacts in nation-wide energy demand.

3. Incidental BOD_5 Removal and Sludge

The process changes that form the basis for BAT, PSES, and BMP increase by approximately 1.5 percent the amount of spent pulping liquor collected and combusted by bleached papergrade kraft and soda mills. Spent pulping liquor is a significant source of BOD_5 loadings at these mills. The collection and combustion of this spent pulping liquor results in an approximately 20 percent decrease in BOD_5 load into treatment. (EPA expects that papergrade sulfite mills will have similar trends, but lacks data to calculate residuals.)

Sludge is generated as a byproduct of the wastewater treatment systems used at pulp and paper mills. Primary sludge

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(i.e., solids removed during physical wastewater treatment processes such as sedimentation prior to biological treatment) is high in wood fiber and volatile solids. Secondary sludge is the product of biological treatment in which microorganisms consume organic matter (BOD_5) in the wastewater. Secondary sludge is a gelatinous mixture of bacterial and fungal organisms. Because of the reduction in BOD_5 load into treatment, the combined application of BAT limitations, PSES, and BMPs promulgated today will decrease sludge generation by 35,900 kkg/yr (39,600 short tons/yr), which represents a 2 percent reduction from the mid-1995 baseline for subpart B and E mills.

Sludge generated at bleached papergrade kraft and soda and papergrade sulfite mills may contain dioxin and furan if these pollutants contaminate the wastewater treated at these mills. At proposal, the Agency estimated that the mills in these two subcategories generated 177 g/yr TEQ dioxin and furan in their wastewater treatment sludge. Since the proposal, industry has significantly reduced the level of dioxin and furan in its wastewater. The Agency estimates that the dioxin and furan content of the sludge has decreased similarly, to approximately 50 g/yr TEQ. See the Supplemental Technical Development Document, DCN 14487.

The process changes that form the basis of the BAT limitations and PSES promulgated today limit the concentration of dioxin and furan allowed to be discharged to the wastewater treatment system. As a result, the Agency estimates that when fully implemented, the combined application of BAT limitations and PSES will reduce the present sludge loading of dioxin and furan TEQ by 43 g/yr, approximately an 85 percent reduction from current levels. The period of time before individual mills have reached this level will vary somewhat depending on the compliance schedule incorporated in the permit and the type of treatment system in place at each mill. See the Supplemental Technical Development Document, DCN 14487.

EPA concludes that the technologies that form the basis of BAT, PSES, and BMPs for the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories are beneficial from the standpoint of solid waste generation. The technologies both reduce the quantity of solid waste generated and also improve its quality by reducing the pollutant loading in the sludge generated.

4. Other Environmental Impacts

Wood consumption at the bleached papergrade kraft and soda mills will be reduced by up to 0.3 percent by the final BAT limitations and PSES promulgated today. The wood savings results from a reduction in losses of useful fiber associated with the recovery of liquor spills and improvements in brownstock washing and screening of pulp. EPA estimates no change in wood consumption at mills in the Papergrade Sulfite subcategory.

The control technologies that form the basis of the effluent limitations guidelines and standards promulgated today will reduce bleached papergrade kraft and soda mill effluent wastewater flows. The greatest reductions would be realized in mills presently discharging the highest flows. In 1995, the average bleached kraft mill discharged approximately 95 m^3/metric ton effluent (23,000 gallons/metric ton). For a 1,000 metric ton/day mill, the average effluent flow is similar to that from a city of 250,000 people. The effluent limitations guidelines and standards will reduce total effluent flow in two ways: (1) Closure of brownstock screening systems, and (2) BMPs. At a mill with open screening, closure could reduce total effluent flow by 25 percent. BMP implementation could result in further effluent flow decreases of two percent. EPA estimates a small reduction in wastewater effluent flow from mills in the Papergrade Sulfite subcategory.

EPA concludes that the technologies that form the basis of BAT, PSES, and BMPs for the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories are beneficial from the standpoint of wood use and wastewater generation, and will not produce significant adverse non-water quality environmental impacts.

D. Non-Water Quality Environmental Impacts of New Source Performance Standards and Pretreatment Standards for New Source (NSPS and PSNS)

EPA analyzed the projected non-water quality environmental impacts of BAT for the Bleached Papergrade Kraft and Soda subcategory for BAT, PSES, and BMPs based on complete substitution of chlorine dioxide for chlorine and other technology elements. This section presents the non-water quality environmental impacts of a second technology configuration (NSPS and PSNS) which is equivalent to BAT, PSES, and BMPs with the addition of extended delignification (oxygen delignification or extended cooking) on a new 1000 tpd bleached papergrade kraft fiber line.

Table VII–7 presents the non-water quality environmental impacts of the selected technology basis for NSPS and PSNS, compared to conventional pulping and bleaching technology. These estimates are based on the same calculational methodology described under BAT and PSES, applied to a 1000 tpd model mill. Based on these estimates, EPA concludes that the process technologies that form the basis for NSPS and PSNS for the Bleached Papergrade Kraft and Soda subcategory pose no significant adverse non-water quality environmental impacts.

TABLE VII–7.—NON-WATER QUALITY ENVIRONMENTAL IMPACTS OF NSPS/PSNS FOR THE BLEACHED PAPERGRADE KRAFT AND SODA SUBCATEGORY

	1000 tpd fiber line
Wood Consumption	No Difference.
Effluent Flow	Moderate Decrease.[1]
BOD to Treatment	Decrease by 11,300 kg/day.
Sludge Generation	Decrease by 890 kg/day.
Carbon Dioxide	Decrease by 21,700 Mg/year.
Energy Impacts:	
Total Electricity Demand	Decrease by 222,600 million BTU/year in oil equivalent.
Total Steam Demand	Increase by 60,180 million BTU/year in oil equivalent.
Total Energy Demand	Decrease by 162,400 million BTU/year in oil equivalent.
Air Emissions:	
Hazardous Air Pollutants	Increase by 407 Mg/year.
Chloroform	No Difference.
Volatile Organic Compounds	Increase by 707 Mg/year.

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TABLE VII–7.—NON-WATER QUALITY ENVIRONMENTAL IMPACTS OF NSPS/PSNS FOR THE BLEACHED PAPERGRADE KRAFT AND SODA SUBCATEGORY—Continued

	1000 tpd fiber line
Total Reduced Sulfur	Increase by 28 Mg/year.
Particulate Matter	Decrease by 12 kg/year.
Carbon Monoxide	Decrease by 3 Mg/year.
Nitrogen Oxides	Decrease by 28 Mg/year.
Sulfur Dioxides	Decrease by 56 Mg/year.

[1] See Section 11.4.1.3 of the Supplemental Technical Development Document, DCN 14487.

NSPS and PSNS that EPA is promulgating today for the Papergrade Sulfite subcategory are equivalent to BAT and PSES. Therefore, the NSPS and PSNS present no additional non-water quality environmental impacts.

VIII. Analysis of Costs, Economic Impacts, and Benefits

A. Summary of Costs and Economic Impacts

This section presents a summary of EPA's evaluation of the costs, economic impacts, and benefits of the Cluster Rules. A more detailed analysis is contained in the Economic Analysis for the National Emission Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production; Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards: Pulp, Paper, and Paperboard Category—Phase 1 (DCN 14649; hereafter, the Economic Analysis).

Today's action is a significant departure from prior EPA rulemakings in that, for one industry, EPA is considering the ramifications of implementing two major environmental statutes with respect to pollution control, industrial technology and operations, environmental impacts, costs, and economic impacts. As noted in Section II of this preamble, today's rulemaking establishes regulations that implement elements of both the CAA and CWA. The objective of this economic analysis is to provide the most accurate portrayal possible of the aggregate costs that the industry will face by implementing these regulations, as well as the economic, financial, and social impacts that EPA estimates will result from these costs. The economic impacts of the combined, or joint, costs of the final CWA (BAT, NSPS, PSES, PSNS, and BMP) requirements and the final and proposed CAA requirements (MACT I, MACT III, and proposed MACT II) are different than the impacts that would result from the costs of the CWA or CAA requirements considered separately. While EPA presents separately the CWA and CAA compliance costs and the economic impacts of those costs in this section, the Agency believes the most accurate estimation of the economic impacts that the pulp and paper industry will experience is derived by considering total (combined) compliance costs of both the CAA and CWA rules. Under the CWA, EPA considered the economic impacts of each option by subcategory, combining indirect and direct dischargers. EPA combined these groups because there are no differences between direct and indirect dischargers in each subcategory with respect to characteristics of wastewater generated or the model process technologies considered.

The compliance costs described in this section are EPA's best estimates of the actual costs facilities will incur to comply with the promulgated and proposed rules.

The total annualized and operation and maintenance (O&M) costs differ somewhat from the engineering cost estimates shown in Section VI. The annual O&M costs shown in this section include a general and administrative cost of four percent of capital costs, which makes these O&M costs significantly higher than the engineering O&M cost estimates shown in Section VI. The annualized costs shown in Section VIII are both pre-tax and post-tax. Pre-tax costs, because they capture total economic losses to society, are considered the social costs of the rule and are used for examining cost-effectiveness (Sections VIII.D.4 and VIII.F.1) and for comparing the costs and benefits of the rule (Section VIII.H). Post-tax costs, which represent the projected costs to a firm after tax shields for depreciation and other factors are accounted for, are used in the economic achievability determination under the Clean Water Act to evaluate facility closures, firm failures, and related impacts. Post-tax costs are used in Sections VIII.A, VIII.B, VIII.C, VIII.E, VIII.J, and most of Sections VIII.D and VIII.F.

EPA's financial and economic analyses reflect as accurately as possible the information that pulp and paper industry managers will consider in making financial decisions. The economic impacts described in this section (such as facility closures, job losses, and reduced shipments) result from the total costs that a facility will bear (including environmental compliance costs) compared to the facility's expected revenues. EPA also evaluated the aggregate costs for all facilities borne by each company to determine if each company will be in jeopardy of bankruptcy as a result of aggregate compliance costs.

In this section, EPA also describes the qualitative, quantitative, and monetized benefits of environmental improvements expected to result from compliance with these rules, and compares these benefits to the costs of the rules. EPA identified 158 mills at proposal with kraft, soda, sulfite or semi-chemical pulping processes. Of these, EPA now projects that 155 mills will bear costs under the final MACT I and 149 mills will bear costs under the proposed MACT II (six mills do not practice chemical recovery). These numbers could change over time as mills change processes or close operations.

EPA separately evaluated the compliance costs and economic impacts of: (1) MACT I for the 155 mills that pulp wood using kraft, soda, sulfite, or semi-chemical pulping processes; (2) combined final MACT I and proposed MACT II for those mills; and (3) proposed MACT II for combustion sources at the 149 mills. Although all of the regulatory options and alternatives under consideration for MACT II are evaluated in the EA, only the economic impacts related to the proposed regulatory alternative are presented here. EPA estimates that there will be no economic impacts associated with the MACT III regulations, which are promulgated for mills that practice mechanical, secondary fiber, or non-wood pulping or that produce paper or paperboard from purchased pulp, because EPA believes that compliance with MACT III requirements will neither impose costs nor result in additional emissions reductions. For this reason, Section VIII presents no

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further analysis of the MACT III regulations.

EPA separately evaluated the impacts of the BAT, PSES, NSPS, PSNS, and BMP requirements for the 86 mills currently in the Bleached Papergrade Kraft and Soda subcategory and the 11 mills currently in three segments of the Papergrade Sulfite subcategory. (One mill is in both CWA subcategories.) Both direct and indirect discharging mills are subject to BMPs. Hereafter, EPA's reference to BAT/PSES costs includes the costs of complying with the final BMP requirements.

EPA also evaluated the costs and impacts for the combination of MACT I and BAT/PSES for the 96 bleached papergrade kraft and soda and papergrade sulfite mills that are affected by both rules. EPA also provides an estimate of the economic impacts when the proposed MACT II costs are combined with the MACT I and BAT/PSES costs for these 96 mills. Finally, the economic impacts and costs for all 155 kraft, soda, sulfite, and semi-chemical mills affected by air and/or water regulations are reported.

EPA also evaluated the impacts of NSPS or PSNS costs for new sources, both singly and in combination with MACT I and proposed MACT II costs.

EPA evaluated economic achievability based on the relative magnitude of compliance costs (in the form of total annualized costs) and the resulting potential facility closures, potential job losses, firm failures (potential bankruptcies), reduced value of shipments, balance of trade effects, and indirect effects (reduced regional and national output and employment which reflect the fact that impacts on the pulp and paper industry will resonate throughout the economy). Table VIII–1 presents a summary of annualized costs and projected mill closures for the various rules and rule combinations. The level of detail for reporting results in the preamble (and in the EA) is sometimes constrained in order to protect confidential business information. For that reason facility closures and job losses, for example, are not identified for certain combinations of rules. All of the results are contained in the confidential portion of the rulemaking record.

TABLE VIII–1.—SUMMARY: COSTS AND ECONOMIC IMPACTS OF CAA AND CWA RULES

Costs and impacts	Rules					
	MACT I (final) (all mills)	MACT II (proposed) (all mills)	BAT/PSES (final) (BPK&PS) [1]	MACT I and BAT/PSES (final) (BPK&PS)	MACT I, BAT/PSES and MACT II (BPK&PS)	MACT I, BAT/PSES and MACT II (all mills)
Pre-Tax Annualized Costs ($ MM) [2]	125	32	263	351	366	420
Post-Tax Annualized Costs($ MM)	82	23	172	229	240	277
Mill Closures	0	0	1	2	3	3
Firm Failures	0	0	0	0	0	0

[1] BPK: Bleached Papergrade Kraft and Soda subcategory PS: Papergrade Sulfite subcategory.
[2] Pre-Tax costs are not used in determining economic achievability.

MACT Costs: Total annualized MACT I costs for 155 facilities in all subcategories regulated today are $82 million (all annualized costs presented in Section VIII are post-tax costs in 1995 dollars, except where noted). These costs differ from the engineering MACT control cost estimates presented in Section VI, as noted above and in Section VIII.B.1.c. Total annualized proposed MACT II costs for all subcategories that EPA proposes to regulate are $23 million. No mill closures, job losses, or firm failures are projected when either MACT I or proposed MACT II costs are analyzed individually. When the costs for final MACT I and proposed MACT II are combined, the (post-tax) annualized costs are $105 million and result in one estimated mill closure and losses of up to 700 jobs. No firm failures are predicted as a result of the combined costs of MACT I and MACT II.

BAT/PSES Costs: EPA estimated economic impacts for three BAT/PSES options (Option A, Option B, and TCF) for all bleached papergrade kraft and soda mills. Section VI.B.5.a(1) of this preamble contains a description of each option. The naming conventions of Option A, Option B, and TCF, which EPA introduced in that section, are also used here. EPA selected Option A as the technology basis for BAT/PSES for the Bleached Papergrade Kraft and Soda subcategory (see Section VI.B.5.a(5)). For the 11 mills in three segments of the Papergrade Sulfite subcategory, the Agency estimated the economic impacts of one technology for each segment. EPA selected those technologies as the bases for BAT/PSES for this subcategory (see Sections VI.B.6.b and d). EPA presents a summary of the economic impacts of the selected BAT/PSES technology bases immediately below. A summary of the economic impacts for the rejected BAT/PSES options in the Bleached Papergrade Kraft and Soda subcategory is presented in Section VIII.F.

Total annualized costs for the selected BAT/PSES for the 96 mills in the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories are $172 million. One mill closure is predicted for the Bleached Papergrade Kraft and Soda subcategory as a result of compliance costs. Estimates of job losses are not presented in order to protect confidential business information. EPA estimates no closures for the Papergrade Sulfite subcategory as a result of compliance costs. EPA estimates that no firm failures will result from BAT/PSES in these subcategories. Based on current information, EPA projects that there may be some new sources, most likely new fiber lines at existing pulp and paper mills. EPA has identified the per plant NSPS/PSNS costs for the Bleached Papergrade Kraft and Soda and the Papergrade Sulfite subcategories. EPA did not have sufficient information to reliably project the likely number of new sources (see Section VIII.D). EPA also expects that many replacement fiber lines constructed at Subpart B mills will be enrolled in the Voluntary Advanced Technology Incentives Program and will therefore be existing sources rather than new sources. 40 CFR 430.01(j)(2). EPA also conducted a barrier to entry analysis for new sources, discussed below.

Combined Costs: The combined annualized costs for MACT I and BAT/PSES, affecting 96 bleached papergrade kraft and soda and papergrade sulfite mills, are $229 million. As a result of these costs, two mills in the Bleached Papergrade Kraft and Soda subcategory are projected to close with an associated loss of 900 jobs. See Table VIII–3. No

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mills are projected to close in the Papergrade Sulfite subcategory as a result of compliance costs. No firm failures are predicted.

The combined annualized costs for the proposed and final rules (MACT I, BAT/PSES, and proposed MACT II) affecting the 96 bleached papergrade kraft and soda and papergrade sulfite mills are $240 million. With these combined costs, three mills are projected to close. The associated job losses increase with the additional projected closure, but the estimate is not reported here in order to protect confidential business information. No firm failures are expected to result from the combined costs of MACT I, BAT/PSES, and proposed MACT II for these mills.

The annualized costs for the proposed and final rules (MACT I, BAT/PSES, and MACT II) applicable to all 155 kraft, soda, sulfite, and semi-chemical mills are $277 million. With these combined costs for all rules and all 155 mills, the impacts are unchanged; i.e., three mills are projected to close, job losses exceed 900, and no firm failures are expected.

B. Overview of Economic Analysis

1. Revisions in Analysis From Proposal

a. Subcategories. Based on the subcategorization described in Sections II.C.1, VI.A and VI.B.1, EPA estimated impacts for four CAA subcategories—Kraft, Sulfite, Soda, and Semi-Chemical Process—and two CWA subcategories—Papergrade Sulfite and Bleached Papergrade Kraft and Soda. The economic analysis addresses 155 mills in the CAA subcategories and 96 mills in the CWA subcategories. The 96 CWA mills are a subset of the 155 CAA mills.

b. Options. (1) Air Emissions Standards. The selected technology bases for the MACT I & III standards are discussed fully in Section II.B.2 of this preamble. Regulatory options and alternatives for MACT II are discussed in Section IV.F of the preamble to the proposed MACT II standards, which appears elsewhere in today's **Federal Register**, and in the Economic Analysis (DCN 14649). EPA's economic analysis presents results for eight regulatory alternatives. The summary presented here pertains only to the final MACT I standard and proposed MACT II standard.

(2) Effluent Limitations Guidelines and Standards. For the BAT/PSES analyses for the Bleached Papergrade Kraft and Soda subcategory, EPA's economic analysis addresses three technology options. The summary presented in this section of the preamble focuses on Option A, the selected BAT/PSES option, but a brief discussion of the impacts for the rejected options appears below in Section VIII.F. For the Papergrade Sulfite subcategory, EPA's economic analysis (and the summary presented here) analyzes only the technologies selected as the bases for the BAT/PSES for each segment. This is because EPA identified no technically available options for the three papergrade sulfite segments other than those considered and selected.

NSPS/PSNS costs for new sources are presented in Section VIII.D.

c. Methodology. The methodologies used by EPA to evaluate economic impacts at the time of proposal are fully discussed in the Economic Impact and Regulatory Flexibility Analysis of the Proposed Effluent Limitations Guidelines and NESHAP for the Pulp, Paper, and Paperboard Industry (EPA–821–R–93–021, November, 1993). Revisions to these methodologies are discussed below and more fully in Chapters 3 and 4 of the Economic Analysis (DCN 14649).

As discussed or referenced in the July 15, 1996 Notice, EPA revised components of the economic methodology to account for recent changes that have occurred in the pulp and paper industry, including: (1) revision of the discount rate; (2) integration of market (price change) effects into the financial closure model; (3) incorporation of new industry cycle data into the forecasting methodology; (4) adjustment of the starting year for the analysis to 1996; (5) incorporation of updated mill ownership data in the firm failure model; and (6) a revised method for calculating annual costs. See 61 FR at 36843–44. Each of these methodology revisions is briefly discussed below.

At proposal, EPA used a facility-specific cost of capital (an average of nine percent real cost of capital) derived from responses to a 1989 industry survey) that reflected financing costs in 1989. Real (inflation-adjusted) financing costs declined considerably between 1989 and 1995. For the final rule, EPA primarily used an inflation-adjusted seven percent cost of capital or discount rate in the economic analysis because this rate better reflects real industry financing costs from 1995 to 1997, and the Agency does not have accurate information on current facility-specific financing costs. Additionally, the Office of Management and Budget recommends a seven percent discount rate to evaluate the social costs of federal regulations. In Chapter 6 of the Economic Analysis (DCN 14649), EPA presents a sensitivity analysis of results using alternative discount rates.

At proposal, EPA used both a financial model and a comprehensive market model to assess economic effects. Much of the information in the market model was derived from the 1989 survey. A number of substantial changes have occurred in pulp and paper markets since 1989 that the market model does not reflect. EPA decided not to update the market model (which estimated price increases), because an update would have required a new survey of every mill and all product lines, which would have been unnecessarily costly and burdensome to mill operators. EPA was also concerned that the amount of time required for conducting and analyzing a second survey would unnecessarily delay the final rule. This would further extend the industry's inability to plan and make capital investments with certainty regarding regulatory requirements. Instead, EPA modified the financial model to incorporate product supply and demand elasticities, which are estimates of changes in demand or supply in response to price changes. The summary of results presented in this preamble does not reflect the effects of price increases, because such changes did not materially affect EPA decisions. Chapter 6 of the Economic Analysis (DCN 14649) presents all of the results.

The last year of price information available at proposal was 1988. Between 1988 and 1995, the pulp and paper industry completed a full industry revenue cycle, with revenues peaking in 1988, falling through 1992, and reaching historic heights in 1995. For the final rule, this newer information was incorporated into the forecasting methods for the financial closure model, which assumes this seven-year cycle (a six-year cycle was used at proposal) of falling and rising prices will continue into the future. Additionally, the starting year for the analysis was adjusted to 1996 (from 1989, which was used at proposal).

To identify potential firm failures (i.e., bankruptcies) using the Altman's Z financial ratio analysis, EPA obtained updated financial information, including mill ownership data, for publicly held companies. Because updated information for privately held companies was not available from public sources, EPA did not evaluate possible failures among private firms. To include these companies would have required a new industry survey.

A facility-level financial analysis that was conducted at proposal was discontinued because EPA was also unable to update facility-level financial information without a new survey. The facility-level analysis is not a

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component of the Altman's Z analysis, on which EPA has relied to identify firm failures for this final rule. While providing some useful information, the facility financial analysis was not used to identify firm-level bankruptcies at proposal and did not provide the basis at proposal for making determinations of economic achievability.

As noted in Section VIII.A., EPA considers general and administrative as well as variable annual costs in the cost annualization calculation. At proposal, general and administrative costs (GAC) had been calculated as 4 percent of capital costs plus 60 percent of variable annual costs. Subsequent analysis indicated that the engineering estimates for effluent control already included the 60 percent of variable annual costs. To remove this double-counting, GAC is now calculated as four percent of capital costs for effluent control (see DCN 14086). GAC is added after the engineering estimates prior to cost annualization; this explains the differences between engineering and economic estimates of operating and maintenance costs.

All of the previously discussed revisions were made in an effort to conduct an economic analysis of the air and water regulations that is more representative of current economic conditions in the pulp and paper industry and that provides more accurate economic impact results.

C. Costs and Economic Impacts for Air Emissions Standards

Table VIII–2 presents the engineering control cost estimates for MACT I and for the regulatory alternative proposed for MACT II: $755 million in total capital costs and $172 million in annualized costs. A more detailed discussion of the control costs for the final MACT standard, including emission reductions and cost-effectiveness, is provided in Chapter 20 of the Background Information Document. Table VIII–2 also presents the capital costs and pre-tax and post-tax annualized costs used in the economic analysis. EPA has determined that the MACT III standards will impose no costs; therefore, none is presented here or in Table VIII–2.

As noted in Section VIII.A. and Chapter 5 of the Economic Analysis, the engineering control cost estimates of the cost of MACT regulations differ from the costs used in EPA's economic impact analysis of those standards. The economic analysis also differentiates between pre-tax annualized costs and post-tax annualized costs as discussed in Section VIII.A.

TABLE VIII–2.—ESTIMATES OF THE COST OF AIR REGULATIONS

[Millions of dollars]

Regulation	MACT control cost estimates		Economic analysis MACT cost estimates		
	Capital costs	Annualized cost	Capital cost	Annualized costs	
				Pre-tax	Post-tax
MACT I	$496	$130	$501	$125	$82
MACT II	259	42	258	32	23
Total Air	755	172	759	157	105

Based on the economic analysis, EPA predicts no firm failures, mill closures, or associated job losses as a result of the costs of the MACT rules considered individually. When the costs of the MACT rules are combined, EPA projects one mill closure with up to 700 job losses. No firm failures are anticipated for the combined MACT rules.

D. Costs and Economic Impacts for Effluent Limitations Guidelines and Standards

1. BPT and BCT

As explained in Section VI.B.2, EPA is exercising its discretion not to revise BPT limitations for conventional pollutants at this time for Subparts B and E. In addition, candidate BCT technologies do not pass the two-part BCT cost reasonableness test. Therefore, EPA is not revising the current BCT limitations for Subparts B and E mills; as a result, these mills will incur no incremental BPT or BCT costs.

2. Bleached Papergrade Kraft and Soda Subcategory

a. BAT/PSES. For the selected BAT/PSES (Option A), capital costs are $966 million, O&M costs are $151 million, and annualized costs are $162 million. When considering these costs alone, the economic analysis predicts closure of one mill as a result of this rule and no firm failures. Other economic impacts (e.g., job losses) are reported in the CBI portion of the rulemaking record.

b. NSPS and PSNS. EPA considered the cost of NSPS and PSNS technology for new source mills in the Bleached Papergrade Kraft and Soda subcategory. EPA expects few new source mills or fiber lines to be constructed that will be subject to NSPS/PSNS. Even if new source mills or fiber lines are constructed that are subject to NSPS/PSNS, EPA estimates that the selected NSPS/PSNS would not present a barrier to entry. EPA estimated the average incremental capital costs of NSPS/PSNS compliance (compared to Option A technology) to be approximately 0.50 to 2.0 percent of the capital cost of constructing a new source mill or fiber line and concluded that this cost was not sufficient to present a barrier to entry for proposed entrants, particularly considering the lower operating costs of Option B.

3. Papergrade Sulfite Subcategory

a. BAT/PSES. As explained in Section VI.B.6.a, EPA is dividing the Papergrade Sulfite subcategory into three segments. For BAT/PSES for all three segments combined, capital costs are $73.8 million, O&M costs are $7 million, and annualized costs are $9.8 million. No mills are projected to close as a result of these compliance costs, and no firms are projected to fail. There is no expected loss of jobs, shipments, or exports.

b. NSPS/PSNS. EPA considered the costs of NSPS/PSNS for new source mills in the Papergrade Sulfite subcategory. Because NSPS/PSNS equals BAT/PSES, EPA concluded that such costs were not sufficient to present a barrier to entry. First, the cost of the NSPS/PSNS technology is an insignificant fraction of the capital cost of a new source mill or fiber line (less than one percent). Also, the costs of including the selected NSPS/PSNS technology at a new source mill are substantially less on a per ton basis than the costs of retrofitting existing mills. Moreover, the increased chemical recovery and reduced operating costs for the NSPS/PSNS option allow firms to

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recover the capital cost associated with the NSPS/PSNS technology.

4. Cost-Effectiveness

EPA uses a cost-effectiveness ratio of dollars per toxic pound equivalent removed (see Economic Analysis (DCN 14649), Chapter 5) to evaluate the relative efficiency of a technology option in removing toxic pollutants. The results reported below are expressed in 1981 dollars, as prescribed by EPA's cost-effectiveness methodology (DCN 14649). For the Bleached Papergrade Kraft and Soda subcategory, the cost-effectiveness ratio for both BAT and PSES is $14 per toxic pound equivalent removed. The cost-effectiveness ratios for the Papergrade Sulfite subcategory are $13 per toxic pound equivalent removed for BAT and $45 per toxic pound equivalent for PSES. EPA considers the selected technology bases for the BAT/PSES limits for both subcategories to be cost-effective.

E. Costs and Impacts for the Integrated Rules

EPA estimates that 155 kraft, soda, sulfite, and semi-chemical mills will incur costs to comply with the CAA rules; 96 bleached papergrade kraft and soda and papergrade sulfite mills will incur costs to comply with the CWA rule, and the same 96 mills will incur both CAA and CWA rule costs. Table VIII–3 is a summary of the expected costs and impacts for various combinations of CAA and CWA rules. The losses of jobs, shipments, exports, and indirect effects reported in Table VIII–3 are the impacts derived from mill closures. Some results are not disclosed where confidentiality might be compromised.

TABLE VIII–3.—COSTS AND ECONOMIC IMPACTS OF CAA AND CWA RULES

Costs and Impacts	Rules					
	MACT I (final)	MACT II (proposed)	BAT/PSES (BPK&PS)[1]	MACT I & BAT/PSES (96 mills)	MACT I, BAT/PSES & MACT II (BPK&PS) (96 mills)	MACT I, BAT/PSES & MACT II (155 mills)
Capital Costs ($MM)	501	258	1,039	1,394	1,524	1,799
Post-Tax Annualized Costs ($MM)	82	23	172	229	240	277
Mill Closures	0	0	1	2	3	3
Firm Failures	0	0	0	0	0	0
Job Losses (from mill closures)	0	0	400	900	1,700	1,700
Decreased Shipments ($MM)	0	0	150	273	479	479
Decreased Exports ($MM)	0	0	19	19	22	22
Direct and Indirect Effects ($MM)	.....	.....	430	795	1,393	1,393

[1] BPK: Bleached Papergrade Kraft and Soda subcategory.
PS: Papergrade Sulfite subcategory.

While no mills are predicted to close due to MACT I costs alone, and one mill in the Bleached Papergrade Kraft and Soda subcategory is predicted to close due to BAT/PSES costs alone, EPA estimates that two mills in the Bleached Papergrade Kraft and Soda subcategory may close as a result of the combined costs imposed by these rules. The two predicted closures represent approximately 2.3 percent of the 86 bleached papergrade kraft and soda mills and 1.3 percent of all 155 kraft, sulfite, soda, and semi-chemical mills affected by this rulemaking. As a result of these two closures, 900 jobs could be lost. These jobs represent 0.9 percent of the jobs in the Bleached Papergrade Kraft and Soda subcategory. These costs generate a maximum estimated price increase of 1.5 percent for any product (pulp, paper or paperboard). Estimated losses in the value of shipments are approximately $273 million, or 0.8 percent of bleached papergrade kraft and soda shipments, while losses in the value of bleached papergrade kraft and soda exports are approximately $19 million, or 0.5 percent of subcategory exports.

No mills are projected to close in the CWA Papergrade Sulfite subcategory, or the CAA soda, sulfite, or semi-chemical subcategories as a result of either the promulgated CAA or CWA regulations or a combination of both.

EPA examined the indirect effects of the final regulations (MACT I, MACT III and BAT/PSES) on employment and output using a national-level input-output model developed by the U.S. Department of Commerce. The model provides multipliers that enable EPA to estimate national-level impacts based on the loss of employment and output from closing mills. Total projected effects on the U.S. economy of the combined MACT I and BAT/PSES are approximately 5,700 jobs lost and $795 million in lost economic output. While some local communities could experience some economic dislocation as a result of closures, overall national impacts would be insignificant. For comparison, the 1995 U.S. gross domestic product was $7.3 trillion. The loss is approximately one-tenth of 1 percent of the gross domestic product for 1995. EPA also evaluated regional (county-level) economic impacts when determining the economic achievability of the regulation. For the final MACT I and BAT/PSES, in the two counties where mills are projected to close, the unemployment rate would increase by 0.4 percent and 0.7 percent respectively.

In response to public comments, EPA also estimated the economic impacts associated with the combined costs of promulgated and proposed rules. When the MACT I, BAT/PSES, and MACT II costs are considered jointly, EPA projects an additional mill closure with 800 additional jobs lost and further decreases of $206 million in shipments and $3 million in exports. The total projected effects of the combined MACT 1, BAT/PSES, and MACT II costs are approximately 10,000 jobs lost and $1.4 billion in lost economic output.

F. Costs and Impacts of Rejected BAT/PSES Options for the Bleached Papergrade Kraft and Soda Subcategory

1. Summary of Results

Table VIII–4 presents costs and impacts for two options (Option B and TCF) that EPA evaluated, but did not select, as the basis for BAT/PSES for the Bleached Papergrade Kraft and Soda subcategory. EPA's rationale for selecting Option A for BAT/PSES for this subcategory is presented in Section VI.B.5.a(5). Table VIII–4 presents results in three ways: considering CWA costs and impacts alone; considering the costs and impacts of the rejected BAT/PSES options and MACT I; and considering

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the costs and impacts of the rejected BAT/PSES options, MACT I, and MACT II.

TABLE VIII–4.—COSTS AND ECONOMIC IMPACTS OF REJECTED BAT/PSES OPTIONS FOR THE BLEACHED PAPERGRADE KRAFT AND SODA SUBCATEGORY

Costs & Impacts	Rules					
	Option B (BAT/PSES)	TCF (BAT/PSES)	Option B (BAT/PSES)+ MACT I	TCF + (BAT/PSES) MACT I	Option B (BAT/PSES) MACT I & MACT II	TCF, (BAT/PSES) MACT I & MACT II
Capital Costs ($MM)	2,100	3,100	2,600	3,600	2,700	3,700
Post-Tax Annualized Costs ($MM)	216	688	292	764	300	772
Mill Closures	2	7	4	9	ND[1]	9
Firm Failures	([3])	([3])	([3])	([3])	([3])	([3])
Job Losses (from mill closures)	900	7,100	4,800	10,200	ND	10,200
Decreased Shipments ($MM)	273	2,300	1,300	3,200	ND	3,200
Decreased Exports ($MM)	19	308	24	310	ND	310
Direct and Indirect Effects ($MM)	795	NR	3,850	NR	ND	NR

[1] ND: not disclosed to protect confidential business information.
[2] NR: not reported.
[3] 1 or more.

Option B: The BAT/PSES capital costs for Option B for the Bleached Papergrade Kraft and Soda subcategory are estimated at $2.1 billion; O&M costs are $87 million; and annualized costs are $216 million. These costs result in two projected mill closures, with direct impacts of at least 900 jobs lost, $273 million in decreased shipments, $19 million in decreased exports, and one or more potential firm failures. The firm failures may also result in thousands of additional jobs lost (see Section VI.B.5.a(5) and Chapter 6 of the Economic Analysis, DCN 14649). Indirect and direct economic loss (i.e., losses throughout the economy as a result of the closed mills) would be approximately $795 million. The mill closures are projected to increase county unemployment rates for the affected counties by 0.4 percent and 0.7 percent, respectively.

EPA also calculated cost-effectiveness ratios for Option B for this subcategory (for Option A results, see Section VIII.D.4, above). For direct dischargers, the average and incremental (compared to Option A) cost-effectiveness ratios are $15 per toxic pound-equivalent and $36 per toxic pound-equivalent, respectively (1981 dollars). For indirect dischargers, the incremental cost-effectiveness (compared to Option A), is $115 per toxic pound-equivalent.

Option B and MACT I: The combined capital costs for Option B and MACT I for mills in this subcategory are estimated at $2.6 billion; O&M costs are $154 million; and annualized costs are $292 million. MACT I annualized costs are greater under Option B than under Option A due to the additions of MACT controls for oxygen delignification equipment installed to comply with Option B. With the combined costs of Option B and MACT I, the number of projected mill closures increases to four, and the estimated number of firm failures remains unchanged at one or more. The four closures cause losses of approximately 4,800 jobs, $1.3 billion in shipments, and $24 million of exports. Direct and indirect losses would total nearly $4 billion. The mill closures are also projected to increase county unemployment rates; the range of increased unemployment for the affected counties is from less than 0.5 percentage points to nearly 10 percentage points (as a hypothetical example, from a baseline county unemployment rate of 10 percent to 10.5 percent after a closure in County X and from a baseline of 10 percent to 20 percent after a closure in County Y).

Option B, MACT I, and MACT II: The combined capital costs for Option B, MACT I, and proposed MACT II for mills in this subcategory are estimated at $2.7 billion; O&M costs are $153 million; and annualized costs are $300 million. With the combined costs of Option B, MACT I, and MACT II, the number of projected mill closures increases (number not disclosed), and the estimated number of firm failures remains unchanged at one or more. The analysis projects additional losses to jobs, shipments, and exports from the additional mill closures (amounts not disclosed). Direct and indirect losses would also increase, as would the unemployment rates in the counties in which the mill closures are located.

TCF: The capital costs for retrofitting mills in this subcategory for TCF technology are estimated at $3.1 billion for TCF based on peroxide bleaching and $5.6 billion for TCF based on ozone and peroxide bleaching, respectively. EPA evaluated mill closures for the TCF option with the lower capital costs. O&M costs for this option are $783 million, and annualized costs are $688 million. (TCF annualized costs appear lower than annual O&M costs because of tax shields.) EPA estimates that these costs would result in seven mill closures, which are associated with approximately 7,100 job losses. EPA did not conduct a firm failure analysis or calculate combined direct and indirect impacts for this option because the closures and job losses alone are more than sufficient indication that the option is not economically achievable. EPA estimates, however, that a greater number of firms would be placed in financial jeopardy with the costs of this option, compared to Option B, which EPA has already determined is not economically achievable (See Section VI.B.5.a(5)).

TCF and MACT I: The combined capital costs for TCF and MACT I for mills in this subcategory are estimated at $3.6 billion; O&M costs are $851 million, and annualized costs are $764 million. EPA estimates that these costs would result in nine mill closures and an associated loss of 10,200 jobs, $3.2 billion in shipments, and $310 million in exports. EPA conducted no additional economic analysis for this combination of costs.

TCF, MACT I, and MACT II: The combined capital costs for TCF, MACT I, and MACT II for mills in this subcategory are estimated at $3.7 billion; O&M costs are $849 million; and annualized costs are $772 million. With the combined costs of TCF, MACT I, and MACT II, EPA estimates that the number of mill closures, job losses, and

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other impacts remain unchanged. EPA conducted no additional economic analysis for this combination of costs.

2. Implications of Results

The costs of either Option B or TCF are projected to cause one or more firm failures (bankruptcies). This is true even when the BAT/PSES costs are considered without the compliance costs associated with MACT I and/or MACT II. Although EPA cannot determine the actual outcome of the projected failures in terms of lost production, closed facilities, and lost jobs, the level of displacement would almost certainly cause detrimental impacts to the U.S. pulp and paper industry. Section VI.B.5.a(5) discusses EPA's reaction to these projected impacts in terms of regulatory decisions. See also Chapter 6 of the Economic Analysis, DCN 14649. That discussion also includes the Agency's findings that the rejected BAT/PSES options are not economically achievable.

G. Benefits

In addition to costs and impacts, EPA also estimated the environmental and human health benefits of implementing the CAA and CWA requirements. Section VII of this preamble describes the estimated reductions in air emissions and effluent discharges. The incremental environmental improvements noted in Section VII.B. are derived compared to a baseline of current emissions and discharges. Because current emissions and discharges are a function of current technology, this is the same baseline that was used to establish the costs of complying with the rules. To the extent the total benefits of the rule can be measured, costs can be directly compared to benefits.

EPA is confident that its estimation of compliance costs is a full and accurate account of such costs; EPA is less confident that the estimation of benefits is similarly complete. EPA is not currently able to quantitatively evaluate all human and ecosystem benefits associated with air and water quality improvements. EPA is even more limited in its ability to assign monetary values to these benefits and therefore to be able to compare them to costs in a standard cost-benefit framework. A comparison of costs to only the limited monetized subset of benefits severely underestimates the true benefits of environmental quality improvement and compromises the validity of a cost-benefit analysis. The economic benefit values described below and in the Economic Analysis (DCN 14649) should be considered a limited subset of the total benefits of these rules, and should be evaluated along with descriptive assessments of benefits and the acknowledgment that even these may fall short of the real-world benefits that will result from the rule.

1. Air Quality Benefits

Section VII.B.1 of this preamble describes the emissions reductions expected as a result of implementing MACT I and MACT II standards. Implementation of the final MACT I standard is expected to reduce emissions of HAPs, VOCs, and TRS, but increase emissions of PM, SO_2, CO, and NO_X. The proposed alternative for MACT II is expected to reduce emissions for HAPs, VOCs, PM, TRS, CO, and SO_2, while it is expected to create a slight increase in NOx emissions. The technology bases for BAT/PSES have secondary impacts on the level of air emissions. The combined effect of MACT I and MACT II for all subcategories regulated under the CAA is to decrease emissions for all of the above mentioned pollutants except NO_X and SO_2. See Table VIII–5 below. EPA performed an evaluation of the benefits associated with the air regulations based on the emission reductions estimated in Section VII.B.1. The net change in air benefits expected to result from the changes in emissions will be a change in adverse health effects associated with inhalation of the above pollutants as well as changes in welfare effects such as improved visibility and crop yields, and reduced materials soiling and corrosion. Chapter 4 of the EA presents a detailed description of the methodology used to monetize the benefits.

a. Qualitative Description of Pollutant Effects. The air rules are designed to reduce the emission of HAPs as defined in Section 112 of the CAA. Several of these HAPs are classified as probable or possible human carcinogens. Reducing the emissions of these pollutants is expected to reduce the cancer risk of the exposed population. Other HAPs are not classified as carcinogens; however, they have been shown to cause other adverse health effects such as damage to the eye, central nervous system, liver, kidney, and respiratory system when the concentration of these emissions is above the health reference benchmark for human exposure.

Total reduced sulfur (TRS) emissions cause the malodorous smell often associated with areas near pulp and paper mills. The MACT standards will reduce these effects significantly. Odorant stimulants of the nasal receptors that are associated with TRS emissions have been associated with marked respiratory and cardiovascular responses, however, the association is not direct because the perception of the odor does not necessarily cause toxic effects. The threshold for odor detections may occur before the onset of toxic effects. However, the absence of odor does not guarantee safety since some components of TRS emissions can cause fatigue of the olfactory senses, so individuals may not perceive an odor on some occasions when toxic effects can occur. There are numerous anecdotal reports of adverse reactions related to odors associated with TRS, including headaches, shortness of breath, nasal irritation, and, in some cases, nausea and sinus congestion.

VOC and NO_X emissions interact in the presence of sunlight to create ground-level ozone. Recent scientific evidence shows an association between elevated ozone concentrations and increases in hospital admissions for a variety of respiratory illnesses and indicates that ground-level ozone not only affects people with impaired respiratory systems (such as asthmatics), but healthy adults and children as well. Adverse welfare effects of ozone exposure include damage to crops, tree seedlings, ornamentals (shrubs, grass, etc.), and forested ecosystems. The reactions between VOCs and NO_X to form ozone depend on the balance in concentrations of each pollutant found in the ambient air. For example, when the concentration of NO_X is high relative to the concentration of VOCs, VOC reductions are effective in limiting ozone formation, while NO_X reductions in that situation are ineffective. The integrated rule is expected to increase NO_X emissions, but decrease VOC emissions. The increase in NO_X is not expected to cause significant adverse health or environmental impacts because the magnitude of this increase is much less than the magnitude of the VOC emission reduction. The VOC reductions are expected to contribute to the decrease in ozone concentrations.

The adverse human health effects associated with PM include: premature mortality; aggravation of respiratory and cardiovascular disease (as indicated by increased hospital admissions and emergency room visits, school absences, work loss days, and restricted activity days); changes in lung function and increased respiratory symptoms; alterations in lung tissue and structure; and altered respiratory tract defense mechanisms. Populations at greater risk from exposure are: individuals with respiratory disease and cardiovascular disease, individuals with infectious disease, elderly individuals, asthmatic individuals, and children. Reduced

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welfare is associated with elevated concentrations of fine particles which reduce visibility, damage materials, and cause soiling. The integrated rule will decrease the adverse effects of PM.

CO is a colorless, odorless gas that is toxic to mammals. When inhaled, it combines with hemoglobin, which reduces the oxygen-carrying capacity of blood and results in less oxygen being transported to vital organs of the body. This can have detrimental effects on the cardiovascular, central nervous, and pulmonary systems. The reduction of CO emissions will diminish these potential effects.

SO_2 oxidizes in water to form both sulfurous and sulfuric acids. When SO_2 dissolves in the water of the respiratory tract of humans, the resulting acidity is irritating to the pulmonary tissues, causing nasal irritation and breathing difficulties (especially to individuals with respiratory diseases such as asthma). When SO_2 dissolves in the atmosphere in rain, fog, or snow, the acidity of the deposition can corrode various materials and cause damage to both aquatic and terrestrial ecosystems. SO_2 can also transform into $PM_{2.5}$, the effects of which are discussed above.

b. Monetized Air Quality Benefits. Table VIII–5 below presents both the health and welfare benefits described in this section as well as the emission reductions identified in Section VII.B.1 that are not monetized but are considered in the evaluation of benefits.

The benefit transfer method is utilized to value a subset of the pollutants discussed above (VOC, SO_2, and PM). This method relies on previous benefit studies that have been conducted for the same pollutants that are impacted by the pulp and paper rulemaking. These studies provide useful data that can be transferred across contexts in order to approximate the benefits of the pulp and paper emission reductions.

TABLE VIII–5.—EMISSIONS REDUCTIONS AND ANNUAL AIR QUALITY BENEFITS

Pollutant	Standard					
	MACT I		MACT II		Combined	
	Decrease (Mg)	Value ($MM)	Decrease (Mg)	Value ($MM)	Decrease (Mg)	Value ($MM)
HAPs	139,000	NE	2,600	NE	142,000	NE
TRS	79,000	NE	—	NE	79,000	NE
NO_X	(5,200)	NE	(500)	NE	(5,700)	NE
VOC	409,000	24–1,055	32,600	2–84	441,000	26–1,139
PM	(83)	(1)	24,000	300	24,000	299
CO	(8,700)	NE	58,000	NE	49,000	NE
SO_2	(94,500)	(1,064)–0	30	0.1–0.3	(94,400)	(1,064)–0.3
Total	.....	(1,040)–1,054	.....	302–384	.....	(739)–1,438

NE = not estimated.
Numbers in parentheses ( ) indicate emissions increases or negative benefits values.
Numbers in table rounded.

For VOCs, benefits are valued using estimates of a range of the average benefit per Megagram (Mg) derived from a recent benefit analysis conducted by EPA in the process of revising the ozone national ambient air quality standard (NAAQS) (see docket no. A–95–58: Regulatory Impact Analysis for the Particulate Matter and Ozone NAAQS and proposed Regional Haze Rule; July 1997). EPA values a range of VOC benefits reflecting (1) an assumption that the transfer of benefits must correlate with the areas that violate the ozone standard, and (2) an assumption that recognizes that reductions outside areas of violation of the ozone standard can have a positive benefit. Therefore, the range of values reflects the application of a range of values for the average benefit per Mg as they are applied to (1) the subset of VOC emission reductions in areas of violation, and (2) to all VOC emission reductions expected to be achieved by the integrated rule. The true value is likely to fall within this range. Using the range of values of the average benefit per Mg for ozone, monetized annual VOC benefits of MACT I emission reductions range from $24 million to $1,055 million. The lower-end of this range reflects an assumption of zero mortality effects associated with ozone exposure and assumes morbidity benefits occur only in areas predicted to violate the ozone standard, while the upper-end includes mortality estimates as are calculated for the upper-end of the range of ozone benefits is included in the NAAQS RIA and assumes morbidity benefits occur in all areas. For the proposed MACT II alternative, total annual VOC benefits range in value from approximately $2 million to $84 million. Therefore, total monetized VOC benefits of the integrated rule are approximately $26 million to $1,139 million.

For PM, a benefit transfer estimate is obtained from a benefit analysis of PM_{10} that was prepared to support the evaluation of the revised PM NAAQS (see Appendix C of the Regulatory Impact Analysis for the Particulate Matter and Ozone NAAQS and proposed Regional Haze Rule; July 1997). The average benefit per Mg derived from this study is applied to all changes in emissions of PM that result from the integrated rule. Using this value, the *loss* in total monetized annual PM benefits associated with MACT I is approximately $1 million. The proposed MACT II alternative achieves a *positive* benefit approximately equal to $300 million. Thus the combined value of PM benefits for the final and proposed pulp and paper air standards is $299 million.

For SO_2, the EPA transfers a benefit estimate from a national SO_2 strategy analysis conducted for the evaluation of the revised PM NAAQS (see docket no. A–95–54: Regulatory Impact Analysis for the Particulate Matter and Ozone NAAQS and proposed Regional Haze Rule; July 1997). This analysis shows that benefit values are higher in the eastern regions of the country when compared to the western regions. Therefore, EPA derives a range of benefit per Mg values for each segment of the country. In addition, EPA takes into consideration the uncertainty inherent in the estimate of MACT I SO_2 emission increases that may result from the rulemaking. Therefore for MACT I, EPA values all SO_2 emission increases to obtain a lower bound estimate of (negative) benefits and assumes zero emission increases due to the likely effects of mitigating behavior to obtain an upper bound estimate of zero

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disbenefits. For MACT II, all emission reductions are valued. Using the range of values for the average benefit per Mg for SO_2 and the assumptions for the changes in emissions, monetized annual SO_2 disbenefits of MACT I range from $1,064 million down to $0. For the proposed MACT II alternative, total annual SO_2 benefits are from approximately $0.1 to $0.3 million. Therefore, total monetized SO_2 benefits (disbenefits) of the integrated rule are approximately ($1,064) million to $0.3 million.

Summing the monetized benefits and disbenefits for VOC, PM, and SO_2 emission changes provides a range of total annual benefits (disbenefits) for MACT I of approximately ($1,040) million to $1,054 million. Aggregate annual benefits attributed to MACT II range in value from $302 million to $384 million. Combining the benefits of the final and proposed air standards yields a range of total annual benefits from approximately ($739) million to $1,438 million.

These benefits are incomplete due to EPA's inability to quantify many benefit and disbenefit categories including individual health and welfare endpoints as well as the benefits and disbenefits of controlling entire pollutant categories. Pollutant categories that are not monetized are HAPs, TRS, CO, and NO_X.

c. Uncertainties Associated With Air Quality Benefits. Benefit per Mg estimates used to monetize PM and VOC emission reductions are uncertain because average benefit per Mg values do not take into account location-specific information such as the population exposed. The location-specific information is expected to have a significant effect on the estimated benefits associated with these emission reductions. Also, lack of information for several benefit categories precludes a complete quantification of all benefit categories (or disbenefits for pollutant increases).

2. Water Quality Benefits

This section describes environmental and human health benefits expected as a result of implementing new BAT/PSES limits at 92 of the 96 mills in the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories. (EPA estimated benefits for 92 mills because it did not have effluent discharge information from 3 mills and did not have receiving stream flow data for 1 mill). Because EPA was not able to project the number of new sources, EPA attributes no benefits to the final NSPS or PSNS regulations. Discharge of toxic, nonconventional, and conventional pollutants into freshwater, estuarine, and marine ecosystems may alter aquatic habitats, affect aquatic life, and adversely impact human health. See Section VII.B.2. Chlorinated organic compounds from chlorine bleaching, particularly 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and 2,3,7,8-tetrachlorodibenzofuran (TCDF) are human carcinogens and human systemic toxicants and are toxic to aquatic life. These pollutants are persistent, resistant to biodegradation, and bioaccumulative in aquatic organisms. As of December 1995, states have issued 19 dioxin/furan-related fish consumption advisories near 18 papergrade sulfite and bleached papergrade kraft and soda mills (EPA, *National Listing of Fish Consumption Advisories,* June 1996).

EPA's analysis of these environmental and human health risk concerns and the water-related benefits resulting from the final effluent limitations guidelines and standards for these two subcategories is contained in the ''Water Quality Assessment of Final Effluent Limitations Guidelines for the Papergrade Sulfite and Bleached Papergrade Kraft and Soda Subcategories of the Pulp, Paper, and Paperboard Industry'' (WQA) (DCN 14650).

a. Qualitative Description of Water-Related Benefits. The final BAT limitations and PSES promulgated today for Subparts B and E will benefit aquatic life by reducing the pulp and paper industry's discharge of toxic and nonconventional pollutants, including a 91 percent reduction in TCDD and TCDF, a 69 percent reduction in AOX, an 83 percent reduction in chloroform, and an 82 percent reduction in chlorinated phenolic pollutants compared to mid-1995 discharge levels. Toxic and nonconventional pollutants will be reduced to levels below those considered to impact biota in many receiving waters. Pollution reduction numbers are provided in Section VII.B.2. Such impacts include acute and chronic toxicity, sublethal effects on metabolic and reproductive functions, and loss of prey organisms. Chemical contamination of aquatic biota may also directly and indirectly impact local pescivorous wildlife and birds.

b. Quantitative Estimates of Water-Related Benefits. EPA has quantified human health and aquatic life benefits using a site-specific analysis for baseline conditions and for the conditions that would result from pollutant removals under the rule. The final BAT limitations and PSES for Subparts B and E would result in a significant reduction of dioxins and furans in fish tissues. As a result, the largest quantifiable and monetizable water benefit is a reduction in number of potential excess cancer cases from the consumption of contaminated fish by recreational and subsistence anglers. The next largest category of monetized benefits includes recreational fishing benefits derived from lifting of all 19 existing dioxin/furan-related fish consumption advisories in waters downstream from mills in the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories. Removing fish consumption advisories would be expected to increase the number of recreational anglers at sites where advisories are lifted and to increase fishing enjoyment by existing anglers. Three of the 19 receiving streams with dioxin/furan-related fish consumption advisories also have advisories in place for other contaminants (from other sources) that will not be affected by this rule. No monetized benefits are expected to accrue for these streams at this time. Quantified, non-monetized benefits include reduction in exceedances of aquatic life and health-based ambient water quality concentrations.

(1) Fish Consumption Cancer Risks and Non-cancer Hazards. Upper-bound individual cancer risk, aggregate risk, and non-cancer hazards from consuming contaminated fish are estimated for recreational, subsistence, and Native American subsistence anglers. At proposal, concentrations of carcinogenic and systemic toxicants in fish were estimated using two site-specific models—a simple dilution model and EPA's draft Dioxin Reassessment Evaluation model (DRE)(DCN 14650). For the final rule, EPA used only the DRE model to estimate TCDD and TCDF levels in fish below 92 mills discharging into 73 receiving streams, as well as individual cancer risks and non-cancer hazards. Of these mills, two in the Bleached Papergrade Kraft and Soda subcategory discharge through the same pipe and therefore were treated as a single discharger. As a result, a total of 91 discharges from 92 mills were evaluated for the water quality assessment. EPA continues to use the simple dilution model to evaluate other chlorinated organics (i.e., three carcinogens and four systemic toxicants). EPA believes the DRE approach provides more reliable estimates of dioxin and furan fate and transport in the environment for use in human health assessments. The reasons for relying exclusively on the DRE for assessing impacts due to dioxin and furan are explained in greater detail in

Chapters 4 and 8 of the Economic Analysis (DCN 14649).

EPA is also updating fish consumption rates used to estimate cancer and non-cancer hazards. At proposal, EPA used 25 g/day for recreational anglers, and 145 g/day for subsistence anglers. The revised estimates are 21 g/day for recreational anglers and 48 g/day for subsistence anglers, based on data provided by the nationally based ''Continuing Survey of Food Intake by Individuals'' (CSFII), conducted by the U.S. Department of Agriculture. EPA is also using an updated fish consumption rate for Native American subsistence populations of 70 g/day, based on two studies (CRIFTC, 1994; Wolfe and Walker, 1989, in rulemaking record). This consumption rate represents an average fish consumption rate for Native Americans. (See Environmental Justice Analysis in Chapter 8 of the Economic Analysis, DCN 14649).

Projected individual cancer risks differ among the evaluated mills and among recreational, subsistence, and Native American subsistence fishermen due to the differences in consumption rates. TCDD and TCDF contribute most of the estimated cancer risks. The final BAT/PSES for the papergrade sulfite and Bleached Papergrade Kraft and Soda subcategories are projected to reduce average baseline individual cancer risks up to about one order of magnitude for each affected group—recreational, subsistence, and Native American subsistence populations. At both baseline and post-compliance, Native American subsistence populations are at about one order of magnitude higher risk than recreational anglers and less than one order of magnitude higher risk than subsistence fishermen in this assessment because of their comparatively higher fish consumption rates.

At proposal, EPA estimated exposed recreational and subsistence fishermen based on a comparison of creel survey results to licensed anglers in counties adjoining pulp mill streams. Based on these surveys, EPA estimated that 29 percent of county fishermen would use affected stream reaches and therefore could be exposed to contaminated fish. Since proposal, EPA has considered additional recreational angler survey information and has determined that a range of 10 percent to 33 percent of adjacent county-licensed anglers provides effective upper and lower bounds to the fishing effort expected on most affected stream segments. EPA's benefit estimation methodology is described in Chapter 4 of the Economic Analysis (DCN 14649).

EPA estimated the reduced annual cancer cases for combined recreational and subsistence angler populations as a result of the final BAT/PSES for the Papergrade Sulfite and Bleached Papergrade Kraft and Soda subcategories. The projected number of increased cancer cases for this population under baseline conditions due to pulp and paper discharges is 0.83 to 2.76 annual cancer cases. EPA estimates this number would decline to 0.1 to 0.35 excess cancer cases per year after implementation of the final BAT/PSES, thus eliminating approximately 0.73 to 2.41 annual cancer cases.

For Native American subsistence fishermen, EPA evaluated an upper bound total risk at baseline and post-compliance with the selected BAT/PSES. EPA assumed that the total population of the tribes with treaty-ceded fishing rights near pulp and paper mills consumed an average of 70 g/person/day of TCDD/TCDF contaminated fish. The projected number of increased cancer cases for this population under baseline conditions due to pulp and paper discharges is 0.14 annual cancer cases. EPA estimates this number would decline to 0.008 excess cancer cases per year after implementation of the final BAT/PSES.

With respect to non-cancer benefits, EPA examined the current discharge of four pollutants that have reference doses (RfDs) contained in EPA's Integrated Risk Information System (IRIS). The four pollutants are chloroform, pentachlorophenol, 2,3,4,6-tetrachlorophenol, and 2,4,5-trichlorophenol. The RfD represents an estimate, with uncertainty spanning perhaps an order of magnitude, of daily exposure—expressed in milligrams per kilogram of body weight per day (mg/kg/day)—that is likely to be without an appreciable risk of deleterious effects to a given population during a lifetime. (EPA notes that this analysis considers only the contribution of Subpart B and E pulp and paper current discharge effluent to the RfD; the contribution from other sources (background level of exposure) is not evaluated.)

For the four pollutants with RfDs in IRIS, EPA used the simple dilution model to determine fish tissue concentrations. EPA then estimated whether human consumption of fish by recreational, subsistence, and Native American subsistence populations exposed to the pollutants below pulp and paper mills would exceed a chemical-specific noncancer hazard quotient of 1.0. Hazard quotients are based on the relationship between fish tissue concentrations, fish consumption, and RfDs. If a hazard quotient exceeds 1.0, adverse effects might occur. None of the four pollutants with RfDs in IRIS is estimated to exceed a non-cancer hazard quotient of 1.0 under baseline or BAT/PSES conditions for recreational, subsistence, or Native American subsistence anglers.

EPA did not use the reference dose (RfD) approach to evaluate potential noncancer effects associated with dioxin/furan. The use of an RfD for dioxin/furan presents special problems. If EPA were to establish an RfD for dioxin/furan using the standard conventions of uncertainty, the RfD value would likely be one to two orders of magnitude below average background population exposure. As stated above, the RfD is a level that is likely to be without an appreciable risk; it is not an ''action level'' or exposure level where non-cancer effects are predicted. Where the RfD is below background levels, and where effects are not readily apparent at background levels, it is not appropriate to use the RfD for quantifying benefits.

As an alternative to using the RfD, EPA evaluated potential noncancer effects of dioxin/furan by comparing the modeled incremental exposure of dioxin/furan from fish consumption (based on results from the DRE model) to estimated ambient background levels (i.e., 120 picograms of toxic equivalents/day (pgTEQ/day)). EPA estimates that adverse impacts associated with dioxin/furan exposures may occur at or within one order of magnitude of average background exposures. As exposures increase within and above this range, the probability and severity of human noncancer effects most likely increases. EPA's analysis shows that the estimated dioxin/furan exposure from pulp and paper effluent at baseline exceeded estimated ambient background exposure by an order of magnitude for two mills, with the size of the exposed population ranging from 4,910 to 16,205 recreational and subsistence anglers. The selected BAT/PSES are projected to reduce the incremental exposure from fish consumption to a level that was not significantly different from estimated ambient background exposure. The size of the recreational and subsistence angler population exposed to dioxin/furan doses exceeding one order of magnitude greater than the background level would be zero under the selected BAT/PSES.

For Native American subsistence populations with treaty-ceded fishing rights, the maximum dioxin/furan exposure under baseline conditions is projected to be 803 pgTEQ/day. Under the selected BAT/PSES, the maximum exposure is reduced to 39 pgTEQ/day,

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which is less than estimated background levels for the United States.

(2) Impact of BAT/PSES Controls on Dioxin/Furan-Related Fish Consumption Advisories. EPA estimates that all 19 dioxin/furan-related fish consumption advisories in place downstream of papergrade sulfite and bleached papergrade kraft and soda mills as of December 1995 would be lifted some time after the rule is implemented. Recent evidence indicates that dioxin/furan fish tissue concentrations decline within several years of removing dioxin/furan discharges, which is more rapidly than previously thought (see Chapter 9 of the Economic Analysis, DCN 14649). EPA accounts for potential latent dioxin/furan contributions from sediment to fish tissue by assuming a three-year lag before cancers from fish tissue consumption are reduced or dioxin/furan-related fish tissue advisories are lifted.

(3) Exceedances of Human Health-Based Ambient Water Quality Concentrations (AWQCs). EPA also has compared the modeled in-stream pollutant concentrations to human health water quality criteria or other toxic effect values, which are referred to as health-based AWQCs. Exceedances of health-based AWQCs indicate existing human health-based water quality problems.

EPA has analyzed the health-based AWQCs for the ingestion of organisms and the ingestion of water and organisms based on the simple dilution model. EPA estimates that no mills exceed the health-based AWQCs for ingestion of organisms only under baseline conditions or under the final rule. With respect to the ingestion of water and organisms, at baseline, three mills exceed AWQCs for two pollutants, chloroform and pentachlorophenol (a total of four exceedances). Under the rule, only one mill exceeds AWQCs (for pentachlorophenol).

EPA did not estimate exceedances of AWQCs for dioxin and furan because the simple dilution model is not well-suited for use in estimating human health effects associated with water column concentrations of hydrophobic chemicals like dioxin and furan. EPA did not use the DRE model for this analysis for dioxin/furan because results of the DRE model would not be comparable with AWQCs.

(4) Aquatic Life Benefits. EPA used the simple dilution approach to estimate exceedances of aquatic life AWQCs. This is a conservative approach that assumes all pollutants (including dioxin and furan) discharged to receiving streams are available to the biota. Although hydrophobic chemicals such as dioxins and furans will be associated primarily with suspended particulates and sediments, some concentrations will also be found in the water column near the discharge point. This is particularly true if discharges are assumed to be continuous because even though the pollutants might eventually become associated with suspended solids and sediment, they would also be present in the water column in the vicinity of the discharge on an ongoing basis prior to partitioning. Therefore, although it is conservative, EPA believes that the simple dilution approach provides a reasonable estimate of impacts to aquatic life.

EPA compared modeled in-stream concentrations of toxic discharges to EPA's aquatic life AWQCs. EPA's modeling results show that receiving water concentrations for up to four pollutants (of 15 pollutants with chronic aquatic life AWQCs) at 19 mills exceed aquatic life criteria at baseline discharge levels (up to 25 total exceedances). The final BAT/PSES for the papergrade sulfite and Bleached Papergrade Kraft and Soda subcategories are projected to reduce these exceedances to one pollutant (TCDD) at six mills (six total exceedances). On average, the selected BAT/PSES will reduce color of effluent by approximately 2.5 percent compared to current discharges. This color reduction may have some aquatic life or recreational benefits depending on the natural color of the receiving water, but they are not quantifiable or monetizable at this time.

c. Monetization of Water Quality Benefits. Monetized benefits of the final BAT/PSES for mills in the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories are presented in Table VIII–6. EPA has monetized the human health benefits resulting from elimination of 0.73 to 2.41 cancer cases per year for the nation as a whole (see Section VIII.F.2.b.(1)). The projected benefits range from $2 million to $22 million.

EPA estimates the value to anglers of contaminant-free fisheries as a result of lifting 16 of the 19 dioxin/furan-related fish consumption advisories to be $2 million to $19 million. (Because these values are based on a benefits transfer from a study of contamination of the Great Lakes trout and salmon fishery, which may differ greatly from some of the areas affected by this rule, these values provide only a general sense of the magnitude of the benefits of the rule.) Because non-dioxin/furan fish consumption advisories (PCBs and mercury) will remain in place on three streams, EPA did not monetize the benefits of removing the dioxin/furan fish consumption advisories on these streams. EPA also estimates that recreational fishing would increase on the 16 streams by 115,000 angling days to 379,000 angling days post-compliance. However, the monetary value of this increase is not estimated because of the difficulty of determining the extent to which this increased participation reflects a net increase in fishing activity or merely a shift from other locations (see the Economic Analysis, DCN 14649, Chapter 4).

Because of dioxin/furan removals due to compliance with BAT limitations and PSES, sludge from pulp and paper mills may be disposed of through land application, instead of more costly landfilling or incineration. (Pursuant to a January 1994 Memorandum of Agreement between EPA and the American Forest and Paper Association (AF&PA), a maximum dioxin/furan concentration of 50 ppt is allowed for land application of sludge or a sludge-derived product. See DCN 14399). Mill sludge disposal costs could be expected to decline by $8 million to $16 million. EPA estimated these values based on the reduced tonnage of expected dioxin/furan-contaminated sludge, which in turn was based on the proportional reduction of dioxin/furan in effluent (see the Economic Analysis, DCN 14649, Chapter 8).

Total monetized water-related benefits for all the above categories range from $12 million to $57 million.

As noted previously, the above estimates do not include the benefits that have been identified but not monetized, such as health effects for Native American subsistence fishermen, reduction in AWQC exceedances, reduction of projected non-cancer effects and improvements in fish and wildlife habitat.

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TABLE VIII–6.—MONETIZED WATER QUALITY BENEFITS OF FINAL BAT/PSES FOR BLEACHED PAPERGRADE KRAFT AND SODA AND PAPERGRADE SULFITE MILLS

Benefit category	Final BAT/PSES (millions 1995$)
Water-related Benefits	
Human health (recreational fish consumption)	$2–$22
Recreational angling	
''Contaminant-free'' fishery	$2–$19
Increased participation	+
Reduced Sludge Disposal Costs	$8–$16
Total Water-related Benefits	$12–$57

+ Positive benefits expected but not estimated.

H. Comparison of Costs and Benefits

This section provides the individual and combined costs, economic impacts, and benefits of the proposed and final CAA and CWA pulp and paper regulations described in earlier sections. See Table VIII–7. The costs and benefits of the CAA (MACT) rules apply to all 155 kraft, soda, sulfite and semi-chemical mills subject to final or proposed MACT requirements, while the costs and benefits for the final CWA (BAT/PSES) regulations apply to the 96 mills in the Papergrade Sulfite and Bleached Papergrade Kraft and Soda subcategories.

Using the pre-tax annualized cost estimates reported in Section VIII.C, net monetized air-related benefits are estimated to range between net costs of $1,165 million to net benefits of $929 million per year for the final MACT I rule considered in combination with the pre-tax annualized cost estimates for the final BAT/PSES. Pre-tax annualized cost estimates are used as a proxy for the social costs of the rules. Net benefits of the proposed regulatory alternative for MACT II are $270 million to $352 million. Thus, the range of net benefits (disbenefits) of the final and proposed air quality standards is ($896) million to $1,281 million.

EPA did not estimate annual net benefits for the final BAT/PSES for the Papergrade Sulfite and Bleached Papergrade Kraft and Soda subcategories because so many categories of benefits are unmonetized that the comparison would be misleading.

TABLE VIII–7.—SUMMARY OF COSTS, ECONOMIC IMPACTS AND BENEFITS

	MACT I	MACT II	Combined air rules	Final BAT/PSES	MACT I and final BAT/PSES (96 mills)	MACT I, MACT II, and final BAT/PSES (96 mills)	MACT I, MACT II, and final BAT/PSES (155 mills)
Capital Costs	$501	$258	$759	$1,039	$1,394	$1,524	$1,799
Pre-Tax Annualized Costs*	$125	$32	$157	$263	$351	$366	$420
Monetized Annual Benefits	($1,040)–$1,054	$302–$384	($739)–$1,438	$12–$57	($1,028)–$1,111	NE	($727)–$1,495
Net Annual Benefits (Benefits-Costs)	($1,165)–$929	$270–$352	($896)–$1,281	NE	NE	NE	NE
Projected Mill Closures	0	0	1	1	2	3	3
Potential Job Losses (due to mill closures)	0	0	ND	ND	900	ND	ND
Projected Firm Failures	0	0	0	0	0	0	0

* Pre-tax costs are greater than the post-tax annualized costs shown in Tables VIII–1 and VIII–3.
Net costs (where costs exceed benefits) are shown in parentheses.
NE = not estimated.
ND = not disclosed to protect confidentiality.
Figures in table reflect rounding.

I. Costs and Benefits of Rejected Options for the Bleached Papergrade Kraft and Soda Subcategory—Option B and TCF

1. Air Benefits

As noted in Section VIII.F.1, the oxygen delignification technology used as a component of Option B and TCF increases emissions of certain pollutants and, hence compliance costs to meet MACT I standards; the implementation of additional MACT controls, however, also increases MACT-related removals. As a result, both MACT I costs and benefits increase where oxygen delignification is utilized. (As noted above, only VOC, PM, and SO_2 benefits are monetized here.) However, because the MACT I technologies control all of the increased emissions associated with oxygen delignification, there is no increased net benefit of the CWA and CAA technologies to ambient air quality. Rather, the net monetized benefits of MACT I in combination with Option B or TCF are equivalent to the monetized benefits of MACT I in combination with the final BAT/PSES. Thus, MACT I benefits associated with reducing VOCs under either Option B or TCF range from $29 million to $1,050 million. MACT II VOC reduction benefits range from $2 million to $84 million. Therefore, total monetized VOC benefits of the air quality standards under either Option B or TCF are $31 million to $1,134 million. PM related disbenefits for MACT I are $1 million, while MACT II PM benefits are $300 million for a total PM benefit of approximately $299 million, for either Option B or TCF. SO_2 related disbenefits for MACT I are from $1,043 million down to $0, while MACT II SO_2 benefits are from $0.1 to $0.3 million.

Total monetized benefits (disbenefits) for MACT I are ($1,015) million to $1,049 million under BAT/PSES Option

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B or TCF (see the Economic Analysis, DCN 14649, Chapter 8). Aggregate annual benefits attributed to MACT II range in value from $302 million to $384 million. Combining the benefits of the final and proposed air quality standards yields a range of total annual air quality benefits (damages) from ($713) million to $1,433 million.

2. Water Benefits

The water quality benefits described in this section include benefits for rejected BAT/PSES options for the Bleached Papergrade Kraft and Soda subcategory in combination with benefits for the selected BAT/PSES for the Papergrade Sulfite subcategory. (Benefits for the two CWA subcategories were also combined in Section VIII.G.2 for the selected BAT/PSES.) EPA estimated the human health benefits that could be expected if either of the rejected BAT/PSES options for the Bleached Papergrade Kraft and Soda subcategory—Option B or TCF—were implemented. For combined recreational and (non-Native American) subsistence angler populations using the same fish consumption rates EPA used for the selected BAT/PSES, Option B is projected to eliminate approximately 0.75 to 2.50 annual cancer cases from the baseline of 0.83 to 2.76 annual cancer cases projected to result from the mills' discharges at [mid-1995] levels, leaving a residual of 0.08 to 0.26 excess cancer cases per year. Here, as in Section VIII.G.2.b(1), excess cancer cases refers to cancer cases attributable solely to pulp and paper dioxin/furan discharges. This represents a reduction of 90 percent from baseline. The monetized value of this reduction is $2 to $23 million. TCF is projected to result in a reduction from the mid-1995 discharge baseline of 0.83 to 2.76 cases to 0.0 cases, which increases the benefits from TCF by $0.1 million to $2.7 million, compared to Option B. Because chlorine or chlorinated compounds are not used for bleaching, no dioxin formation was attributed to the mills under this option. Although some background dioxin cancer risk would remain that is attributable to sources other than current pulp and paper discharges, no residual cancer risk would remain from bleached papergrade kraft and soda mills.

For Native American subsistence fishermen, EPA evaluated cancer risks at baseline and under Option B. To estimate the maximum potential risk, EPA assumed that the entire population of the tribes with treaty-ceded fishing rights near pulp and paper mills would consume an average of 70g/person/day of TCDD/TCDF contaminated fish. With this level of consumption, the projected increased number of cancer cases for this population at baseline would be 0.14 cancer cases/year. EPA estimates that this number would decline to 0.007 cancer cases/year if BAT/PSES based on Option B were promulgated and to 0.0 cases/year if BAT/PSES based on TCF were promulgated.

Both Option B and TCF would result in the removal of 19 dioxin/furan-related fish consumption advisories on streams downstream from bleached papergrade kraft and soda mills. EPA estimates that non-dioxin advisories will remain on three of those streams. Therefore, here as in Section VIII.G.2.c, EPA did not monetize the benefits of removing the dioxin/furan fish consumption advisories on these streams. EPA estimates the value to anglers of the 16 ''contaminant-free'' fisheries as a result of removing these advisories to be $2 million to $19 million. EPA also estimates that recreational fishing would increase on these 16 streams by an estimated 115,000 angling days to 379,000 angling days post-compliance. However, the monetary value of this increase is not estimated because of the difficulty of determining the extent to which this increased participation reflects a net increase in fishing activity or merely a shift from other locations. These results are the same as those presented for the selected BAT/PSES. Because of dioxin removals, sludge disposal costs for both Option B and TCF could be expected to decline by $8 million to $16 million (see the Economic Analysis, DCN 14649, Chapter 8).

With respect to non-cancer human health benefits, none of the four pollutants with RfDs is estimated to exceed a non-cancer hazard quotient of 1.0 under baseline or under conditions associated with rejected Option B for recreational, subsistence, or Native American subsistence anglers. The same is true for the selected BAT/PSES. Similarly, Option B would reduce projected health-based AWQC exceedances to one facility for one pollutant (pentachlorophenol). Under TCF, EPA estimates that there would be no exceedances of health-based AWQCs. For dioxin, EPA estimates that Option B would reduce incremental exposure from fish consumption to a level that is not significantly different from ambient background exposure. Under TCF, chlorine and chlorinated compounds are not used for bleaching, and therefore no dioxin was attributed to mills under this option.

With respect to aquatic life benefits, EPA's modeling results show that, for the four pollutants exceeding chronic aquatic life criteria at 19 mills (up to 25 total exceedances), rejected Option B would reduce these exceedences to one pollutant (TCDD) at three mills (three total exceedences). TCF would reduce these exceedances to zero.

In addition to the benefits of reducing dioxin in fish, EPA investigated other potential benefits associated with Option B and TCF, including color, COD, AOX, and chronic sub-lethal toxicity.

Increased color in a receiving water can decrease light penetration there, thus resulting in shifts of phytoplankton community structure to undesirable species, reduced primary productivity (which can alter the trophic structure of fish communities), and elevated receiving stream temperatures. However, the actual impact on the receiving water of reducing color in mill effluent is highly site-specific and depends in particular on the natural color of the receiving water and other factors. Therefore, the monetized benefits will also be site-specific, to the extent that they can be determined at all. EPA is not promulgating national technology-based limitations or standards for color, but rather has determined that the potential aesthetic or aquatic impacts are best addressed on a site-specific basis by the permitting or pretreatment authority where necessary. See Section VI.B.3.e. Indeed, EPA notes that about eight mills currently have limitations for color in their NPDES permits, and an additional two mills have current color monitoring requirements where stream water quality requires such measures.

Lowering COD can protect the receiving water against oxygen depletion and is likely to reduce non-chlorinated organic compounds that cause chronic sub-lethal effects on aquatic life. Evidence indicates that this toxicity is associated at least in part with families of non-chlorinated organic materials. Several studies indicate that, as wastewater COD is reduced, indices of these chronic toxicity effects also are reduced. EPA is deferring regulation of COD to the individual permitting process for the time being, although EPA intends to promulgate effluent limitations guidelines and standards for COD for Subpart B mills in the future. See Section VI.B.3.d.

Although a statistically significant relationship between AOX and adverse environmental effects has not been established, EPA believes that reduction of AOX (a valid measure of the total chlorinated organic matter) will result in water quality benefits. See Section VI.B.3.c. However, these cannot be quantified at this time.

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Compared to current discharges, the incremental benefits associated with OD (Option B) include: reduction of color (by 40 percent); COD (by 40 percent); AOX (by 84 percent); and chronic sub-lethal aquatic toxicity. TCF would also reduce color discharges (by 40 percent), COD (by 40 percent), AOX (by 96 percent) and chronic sub-lethal aquatic toxicity. The water quality benefits of the rejected options are shown in Table VIII–8.

TABLE VIII–8.—MONETIZED WATER QUALITY BENEFITS OF REJECTED BAT/PSES OPTIONS FOR BLEACHED PAPERGRADE KRAFT AND SODA & PAPERGRADE SULFITE MILLS

Benefit category	Option B (millions 1995$)	TCF (millions 1995$)
Water-related Benefits		
Human health (Recreational fish consumption)	$2–$23	$2–$25
Recreational angling		
"Contaminant-free" fishery	$2–$19	$2–$19
Increased participation	+	+
Reduced Sludge Disposal Costs	$8–$16	$8–$16
Total Monetized Water-related Benefits	$12–$58	$12–$60

+ Positive benefits expected but not estimated.

Combined annual air and water benefits related to Option B for all 155 mills regulated by today's rule, including final MACT I, proposed MACT II and BAT/PSES based on Option B, would total ($701) million to $1,491 million. Combined annual air and water benefits related to TCF, including final MACT I, proposed MACT II and BAT/PSES based on TCF would total ($701) million to $1,493 million.

J. Benefit-Cost Comparison Using Case Studies

Many benefits are highly site-specific. At proposal, EPA estimated the costs and benefits of the pulp and paper rule at three sites using a case study approach. EPA has expanded the case study analysis to incorporate additional sites. The case studies focus on water quality benefits, resulting from installation of BAT/PSES technologies, with air quality benefits modeled for case study mills as they are at the national level (see Section VIII.G.1, above). The three case studies at proposal were (1) the Penobscot River in Maine, (2) the Wisconsin River in central Wisconsin, and (3) the lower Columbia River in Washington and Oregon. In addition, a qualitative retrospective case study was conducted of the Leaf River in Mississippi. These case studies were selected to provide geographic representation of the impacts of the proposed rule, taking data availability into consideration.

For the final rule, the three quantitative case studies were updated to reflect EPA's revised analysis of costs, loadings, and human health risks to sport anglers. In consideration of environmental justice, EPA also evaluated health risks to Native American anglers in the Penobscot and Columbia River case study areas.

The four new case studies of monetized benefits analyze: (4) the Lower Tombigbee and Mobile River watersheds in Alabama, (5) the Pigeon River in North Carolina, (6) the Samoa Peninsula in California, and (7) the upper Columbia River in Washington State and British Columbia, Canada. These new case studies provide EPA with the first real empirical evidence of already-realized benefits that can be expected from adoption of the final BAT/PSES limits. Although a portion of the water-related benefits estimates in these newer case studies are based on actual outcomes from installing pollution control equipment (i.e., a retrospective analysis), estimates of the benefits of MACT standards in these case studies are prospective, based on expected future benefits.

The case studies compare costs and benefits at specific bleached papergrade kraft and soda mills in these seven areas across the country, some of which have not installed technologies comparable to the bases for BAT/PSES and some of which have installed such technologies, thereby allowing the retrospective assessment of BAT/PSES costs and benefits. Where mills have installed BAT-like technologies, capital investments may include: 70 percent to 100 percent substitution; oxygen delignification plus 100 percent substitution; and/or totally chlorine-free technologies.

EPA evaluated control cost estimates and air benefits for emission controls necessary to meet the MACT I and II standards on a prospective basis, assuming the level of controls currently existing at mills in the case study areas as a baseline.

As with the national-level analysis, significant water-related benefits are derived from removal of dioxin/furan from fish, and air-related benefits from improved agriculture and health from reduced ozone emissions. However, the case studies also address a wider range of water-related benefits, including some site-specific recreational benefits such as surfing, boating, white water rafting, non-consumptive uses and non-use benefits that result from improved color in the receiving water, improved odor and removal of health advisories. The case studies provide a more complete picture of the range of water-related benefits that may be expected from the rule, although a number of identifiable benefits, including improvements in ecological conditions and reductions of non-cancer health effects remain unquantified and unmonetized.

Benefits and costs for the case studies are summarized and compared in Table VIII–9. The monetized benefits range from two percent to 387 percent of BAT/PSES compliance costs. The case study results indicate that monetized benefits may be of the same order of magnitude as costs at individual sites.

From a water quality perspective, the case studies provide a cross-section of mills and receiving waters nationwide, including fast- and slow-moving streams, lakes and ocean waters.

Using receiving water and population characteristics, EPA attributed benefits from the case study sites to all bleached papergrade kraft and soda and papergrade sulfite mills. As a sensitivity analysis, EPA used the water quality benefits from the case studies to estimate the national level water quality benefits of the integrated final and proposed rule for the Bleached Papergrade Kraft and Soda and Papergrade Sulfite subcategories. Based on the case studies, monetized benefits from the water rules (Option A) would be expected to range from $91 million to $451 million per year, or from 35

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percent to 170 percent of water-related costs.

The case studies were not selected to be, and are not necessarily, representative of national benefits with respect to air quality.

TABLE VIII–9.—COMPARISON OF POTENTIAL ANNUAL BENEFITS TO POTENTIAL ANNUALIZED COSTS FOR SEVEN CASE STUDY SITES

[Millions of 1995 dollars]

Site	Water-related benefits	Air-related benefits [b]		Total monetized benefits	Total compliance costs [a]
		MACT I	MACT II		
ORIGINAL CASE STUDIES					
Penobscot River	$0.7–$2.3	($9.5)–7.7	$0.1	($8.7)–10.1	([c])
Wisconsin River	$0.1–$1.5	($16.9)–15.6	$2.1	($14.7)–19.2	$9.3
Lower Columbia River	$1.5–$8.6	($26.9)–56.2	$0.7	($24.7)–65.5	$16.6
NEWER CASE STUDIES					
Lower Tombigbee and Mobile Rivers	$1.1–$12.0	($136.8)–113.2	$81.7	($54.0)–$206.9	$32.5
Pigeon River	$2.7–$8.7	($5.8)–$5.7	$2.1	($1.0)–$16.5	[c] $7.1
Samoa Peninsula	$0.1–$1.4	($5.0)–10.1	$0.0	($4.9)–$11.5	[d] $5.0
Upper Columbia River/Lake Roosevelt	$1.5–$11.6	NA	NA	$1.5–$11.6	$3.0

[a] The total compliance costs shown in this Table (for BAT/PSES, MACT I and proposed MACT II Option #1) differ from compliance costs used to determine economic achievability. The cost estimates for the case studies were based on custom analysis of technology in-place corresponding to the case study timeframes. In contrast, estimates used to determine economic achievability used a standard mid-1995 baseline for technology in-place

[b] Based on implementation of technologies consistent with Option A.

[c] Confidentiality agreements preclude disclosure of total costs for this site.

[d] This mill has indicated EPA's cost estimate is too high because EPA did not fully account for technology in-place.

NA = Not applicable.

IX. Incentives for Further Environmental Improvements

A. The Voluntary Advanced Technology Incentives Program

1. Introduction

EPA is promulgating BAT limitations today that will achieve significant pollutant reductions using technologies within the economic capability of the subcategory as a whole. At the same time, EPA wants to encourage the widespread use and perfection of technologies such as extended delignification and to promote the development of even more advanced technologies, such as those aimed at reducing bleach plant flow. EPA also wants to encourage the widespread use and perfection of TCF processes. These technologies and processes have the ability to surpass the environmental protection that would be provided by compliance with the baseline BAT. Indeed, EPA's vision of long-term environmental goals for the pulp and paper industry includes continuing research and progress toward such environmental improvement. The Agency believes that individual mills can be encouraged to make substantial environmental progress beyond the base level compelled by law. This industry's participation in the 33/50 program, its progress toward reducing toxic discharges in advance of the proposed BAT revisions, its joint initiative with the U.S. Department of Energy to reduce future energy demands, and its development and implementation of the Sustainable Forestry Initiative, among other voluntary environmental undertakings, indicate that an incentives program may be widely accepted and utilized by individual mills.

For this reason, EPA is establishing a Voluntary Advanced Technology Incentives Program to encourage mills in the Bleached Papergrade Kraft and Soda subcategory to move beyond today's baseline BAT technologies toward the ''mill of the future,'' which EPA believes will have a minimum impact on the environment. EPA also intends the program to serve as a pilot program for determining the effectiveness of regulatory incentives as a means of stimulating development of environmentally beneficial technologies. As a result of the Voluntary Advanced Technology Incentives Program, EPA hopes to achieve within sixteen years greater pollutant reductions than it could achieve solely by establishing a technological floor. Indeed, the development of increasingly more advanced bleach plant process technologies is a critical step toward the Clean Water Act's ultimate goal of eliminating the discharge of pollutants into the Nation's waters. See CWA Section 101(a)(1).

The BAT program under the Clean Water Act is widely and justifiably applauded as a critical tool in forcing the development and installation of environmentally beneficial technologies. The statute demands progress toward the goal of eliminating the discharge of all pollutants, CWA Section 301(b)(2)(A), but emphasizes that that progress must be ''reasonable.'' *Id.* This Voluntary Advanced Technology Incentives Program marries the twin objectives embodied in Section 301(b)(2)(A): compelling the industry to go as far as it reasonably can go, through the achievement of limits that are technically and economically achievable, while holding out through the Voluntary Advanced Technology Incentives Program an array of alternative effluent limits that EPA believes will lead to zero discharge. The baseline BAT limitations discharge EPA's statutory mandate: to promulgate limitations based on the best available technology economically achievable. The Voluntary Advanced Technology Incentives Program, in turn, promotes EPA's statutory goal: to establish limitations that act as a beacon to show what is possible.

EPA is codifying three tiers of Voluntary Advanced Technology BAT effluent limitations and two tiers of Voluntary Advanced Technology NSPS, which together form the backbone of the Voluntary Advanced Technology Incentives Program for mills in the Bleached Papergrade Kraft and Soda subcategory. The three BAT tiers are

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labeled Tier I, Tier II and Tier III; the two NSPS tiers are labeled Tier II and Tier III. Tier III is the most stringent of the tiers. Each BAT tier is made up of an array of increasingly more stringent enforceable effluent limitations, culminating in the ultimate performance requirements for that particular tier. The NSPS tiers consist entirely of the ultimate performance requirements for each tier. In addition to the Voluntary Advanced Technology effluent limitations and NSPS codified today, EPA has also assembled a number of incentives relating to permitting and enforcement matters and public recognition. EPA hopes these incentives will encourage many mills to develop and install advanced and even innovative technologies that will lead the industry as a whole toward the elimination of pollutant discharges.

EPA believes it is appropriate as a matter of policy to offer mills incentives to reach beyond the baseline BAT and NSPS process technologies. Capital costs associated with the Tier I technology are substantially greater than the capital costs of Option A, which is the technology basis for the baseline BAT limits. Although over ten years a mill employing Tier I technologies will likely save money in operating costs, the capital outlay involved may discourage mills from doing more than the regulatory minimum. For Tiers II and III, the costs and risks are even more acute, when one considers the cost of research, development, and full scale commercial trials of technologies in the early stages of development and implementation, as well as the associated uncertainties concerning possible product impacts. EPA is interested in encouraging research, development and installation of emerging technologies in order to motivate the development of these technologies for broader commercial applications. As these technologies become proven and their efficiencies publicized, EPA hopes that they will become—in effect if not as a matter of law—the industry floor. Thus, EPA believes it is in the public interest to encourage mills today to develop environmentally beneficial technology and to reward mills that are innovative and forward-looking in their use of new and more environmentally effective technology despite its greater cost.

EPA received suggestions for an incentives program from a number of stakeholders. From these and other stakeholder suggestions, EPA has developed a program, presented below, that is intended to provide incentives for further long term environmental improvements. EPA is incorporating several types of incentives in this program. In addition, because mill-specific factors, including product specifications and existing equipment, will affect the technical approach taken and the environmental goal attainable by an individual mill, EPA is establishing several tiers of Advanced Technology performance objectives, each with limitations and standards specific to the model technology EPA is positing. In order to promote ambitious use of Advanced Technologies, EPA is offering greater incentives for greater reductions in pollutant discharge.

EPA recognizes that some mills in the Bleached Papergrade Kraft and Soda subcategory have already installed or have committed to install Advanced Technologies that are achieving or have the potential to achieve effluent limitations equivalent to the ultimate performance requirements of one or more of the Voluntary Advanced Technology Incentive Tiers. If these mills accept enforceable NPDES permit limitations at one of the Tier levels, they will qualify for the incentives program at that level. In some instances, therefore, the incentives will actually serve as rewards for effluent reductions already achieved.

2. Mechanics of the Incentives Program

The Voluntary Advanced Technology Incentives Program for the Bleached Papergrade Kraft and Soda subcategory will supplement the otherwise compulsory baseline BAT and NSPS program. EPA emphasizes that the Voluntary Advanced Technology Incentives Program is entirely voluntary; no mill in Subpart B is required to participate. Rather, mills subject to the baseline BAT limits and NSPS contained in Subpart B may enroll in the incentives program and thus subject themselves to more stringent technology-based limitations corresponding to the Incentives Tier they select. For example, a mill that determines that it can achieve Tier II limits may designate itself as a BAT Tier II mill. A mill with more than one fiber line subject to Subpart B may choose to enroll all or some of its fiber lines in the Voluntary Advanced Technology Incentives Program. A mill wishing to experiment with advanced or even innovative bleaching technologies also may choose different Tiers for different fiber lines. After the mill enrolls in the Voluntary Advanced Technology Incentives Program, the permit writer must place the corresponding BAT limitations in the mill's permit. Achievement of the Advanced Technology BAT limitations thereafter would be compulsory for that mill. A mill that chooses not to participate in the program will receive the baseline BAT limitations or NSPS; similarly, a mill that chooses to enroll some but not all of its Subpart B fiber lines in the Voluntary Advanced Technology Incentives Program will receive baseline BAT limitations or NSPS for its non-participating fiber lines.

EPA expects that an interested mill would formally enroll in the Voluntary Advanced Technology Incentives Program prior to issuance of its next NPDES discharge permit. Enrollment can be made by indicating the mill's intent on its permit application or through separate correspondence to the permitting authority as long as the signatory requirements of 40 CFR 122.22 are met. However, as discussed in more detail in Section IX.A.7 below, EPA assumes that most mills, for practical purposes, will decide whether to participate in the Voluntary Advanced Technology Incentives Program in the next year in order to assure that they will have the maximum amount of time to achieve the various Tier limitations and to receive the additional compliance time for MACT, established under these rules for mills enrolled in the Voluntary Advanced Technology Incentives Program. Any mill can voluntarily enter at any tier appropriate to its individual circumstances. Further, mills that enter either at Tier I or Tier II may decide, after making such a commitment in permits but before termination of the appropriate compliance period (i.e., not later than six years after publication of these rules—Tier I, or not later than 11 years after publication of these rules—Tier II), to commit to the requirements of a more stringent tier (i.e., Tier II or Tier III). Such mills will be subject to the deadlines specified in the regulation for the newly chosen tier.

Existing dischargers volunteering to participate in the incentives program would receive BAT limitations that become progressively more stringent over time. Although applied in stages, the limitations represent a continuum of progress that a participating mill commits, and is required, to achieve. At the first stage in the continuum are limitations for the enrolled fiber line that reflect either a mill's existing effluent quality or its current technology-based permit limits for the BAT parameters, whichever are more stringent. See 40 CFR 430.24(b)(1). For the bleach plant parameters, such as dioxin, existing effluent quality would be determined at the bleach plant, while existing effluent quality for AOX would be determined at the end of the pipe based on loadings attributable to that

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fiber line. *Id*. The next stage in the continuum consists of enforceable interim milestones. Under one set of milestones, existing dischargers enrolled in Tiers II or III are required to meet interim BAT limitations equivalent to the baseline BAT limitations by April 15, 2004. 40 CFR 430.24(b)(3). (By that date, dischargers enrolled are required to meet the baseline BAT limitations for all pollutants, except for Tier I; the AOX limitation for mills enrolled in Tier I is the ultimate performance requirement for Tier I. *Id*.) Under the second set of milestones, existing dischargers enrolled in any tier are required to meet enforceable requirements determined by the permitting authority based on best professional judgment; these milestones would be expressed as narrative or numeric conditions in the mill's NPDES permit. 40 CFR 430.24(b)(2). EPA intends the milestones to reflect each step in a mill's progress toward achievement of the Tier's ultimate performance requirements. Elsewhere in today's **Federal Register**, EPA is proposing to require each participating mill to submit to its permitting authority a plan detailing the steps it plans to take (with corresponding dates) in order to meet its applicable BAT Tier limitations. Under the proposed regulation, permit writers would be authorized to use the information in the milestone plan as a basis for setting milestone limitations. The final stage in the BAT continuum represents the ultimate Advanced Technology performance levels for the Tier selected. 40 CFR 430.24(b)(4)(i). As noted above, the Voluntary Advanced Technology Incentives Program is also available for new sources that elect to exceed baseline NSPS requirements. See 40 CFR 430.25(c). For new sources (as defined at 430.01(j)), the incentives program begins at Tier II. The ultimate Tier II and Tier III performance requirements constitute NSPS for such mills, with the addition of standards for conventional pollutants at the baseline NSPS level. See 40 CFR 430.25(c)(1) and (2). The NSPS Tier II and Tier III performance requirements are the same as the ultimate BAT Tier II and Tier III performance requirements for BAT. As required by CWA Section 306, new sources must comply with the applicable NSPS upon commencing operation; therefore, the incremental approach of achieving progressively more stringent performance levels discussed above for existing sources would not apply to new sources enrolled in the incentives program.

In addition to Voluntary Advanced Technology BAT limitations and NSPS, the NPDES permit of a mill enrolled in the Voluntary Advanced Technology Incentives Program will need to contain all other permit limitations and conditions otherwise applicable to the mill, including any conventional pollutant limitations and standards, any water quality-based effluent limitations required under CWA Section 301(b)(1)(C), and best management practices provisions, including those promulgated today. Schedules for complying with those requirements, if any, are determined by the applicable law; nothing in this incentives program alters in any way those compliance deadlines.

Because mills enrolling in the Voluntary Advanced Technology Incentives Program are subject to more stringent BAT limitations and NSPS than EPA could otherwise compel through national effluent limitations guidelines, EPA has assembled a package of rewards and incentives for participating mills. The public recognition incentive is available as soon as a mill accepts Voluntary Advanced Technology BAT limitations in its NPDES permit. The reduced monitoring incentive applicable to dioxin, furan, chloroform and the 12 chlorinated phenolic pollutants is available as soon as participating mills achieve those limitations. See 40 CFR 430.02(c). The reduced monitoring incentive applicable to AOX is available only after the ultimate Advanced Technology performance level for that pollutant is achieved. See 40 CFR 430.02(d) and (e). The remaining incentives, including greater permit certainty, reduced inspections, and reduced penalties, are available only after the mill achieves all of the ultimate Advanced Technology performance levels.

EPA has decided not to make the Voluntary Advanced Technology Incentives Program available to indirect discharges at this time because it would be much more difficult to administer than the baseline PSES program and therefore would impose substantial burden on local governments. Further, EPA does not believe that commitments by indirect dischargers to reduce AOX or flow levels warrants any delay in compliance with limitations on dioxin and furan due to POTW pass-through and biosolids contamination concerns. Similarly, EPA has not identified feasible technologies beyond BAT that can significantly reduce pollutant discharges from mills in the Papergrade Sulfite subcategory at this time, and so is not able to develop an incentives program for this subcategory. Moreover, stakeholders have offered no specific suggestions or supporting information and data upon which EPA reasonably could develop a program for the Papergrade Sulfite subcategory. However, EPA will consider developing incentive programs for other subcategories as BAT limitations are promulgated for those subcategories.

3. The Technology Bases for the Voluntary Advanced Technology BAT Limitations and NSPS

In order to determine the appropriate Voluntary Advanced Technology BAT limitations and NSPS, EPA first selected a model technology for each Tier. For Tier I, which applies only to BAT, EPA determined that the most appropriate technology was extended delignification with complete substitution of chlorine dioxide for elemental chlorine, closing up wastewater discharges from the fiber line prior to bleaching, and efficient biological wastewater treatment. EPA selected this technology basis because it is available today (see discussion of BAT Option B and NSPS technology in Section VI.B.5.(a) and (b)), because it is economically achievable for mills voluntarily choosing to implement it (see Section IX.A.6), and because it represents an important step in the direction of a minimum impact mill.

The model technology for Tier II Voluntary Advanced Technology BAT limitations and NSPS consists of extended delignification with complete substitution of chlorine dioxide for elemental chlorine, supplemented with increased use of water conservation practices, water reuse practices, bleach plant filtrate recycling practices, and efficient biological wastewater treatment. EPA anticipates that Tier II mills will maximize the capability of extended delignification technology, thereby reducing the amount of chlorine dioxide used in bleaching. The model Tier II mill also will have highly effective pulping liquor spill prevention and control and will have evaporators that minimize the amount of black liquor carryover, to allow for extensive condensate reuse. EPA expects that Tier II mills also will employ a closed fiber line prior to bleaching improved water reuse within the bleach plant, and will recycle a portion of bleach plant filtrate back through the fiber line to the recovery cycle. The Tier II Advanced Technology BAT limitations and NSPS represent the performance demonstrated by mills that minimize effluent flow and reduce the formation of chlorinated organic compounds using these technologies and practices. Three mills in the United States are approaching the reduced wastewater flow levels equivalent to Tier II, which leads EPA

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to conclude that flow reduction technologies are emerging. Although the flow volume projected or reported by these mills excludes pulping area or evaporator condensates, which EPA includes within its Tier II flow limitation, EPA expects that over the next ten or eleven years condensate reuse strategies and discharge flow reduction technologies will mature to allow mills to achieve the pulping area condensate, evaporator condensate and bleach plant wastewater flow level being codified today as part of Tier II. For further discussion of EPA's rationale for selecting this technology as the basis for Voluntary Advanced Technology BAT limitations and NSPS at the Tier II level, see Section IX.A.6.

The model technology for the Tier III Voluntary Advanced Technology BAT limitations and NSPS represents what EPA believes can be achieved in 15 or 16 years by mills on the cutting edge of minimum effluent technology. In EPA's view, such mills will fully reuse pulping area and evaporator system condensates, have a closed fiber line prior to bleaching, and recycle the majority of bleach plant filtrates back to the recovery cycle. EPA expects that these mills will also operate efficient biological treatment systems. To achieve this degree of mill closure, in addition to the level of technology described under Tier II, EPA expects the model Tier III mill will have ''kidney'' technology to remove metals from bleach filtrate and chloride from the mill liquor cycle, and may perform extensive steam stripping or other treatment of condensates to allow for full reuse. Mills that choose to use ozone delignification may avoid the need for a chloride removal system. EPA also expects that the Tier III mills will have advanced process control systems and negligible losses of black liquor through leaks and spills. Finally, the model Tier III mill will likely have extended liquid storage capacity as part of its water recycle and liquor management systems to help maintain the good hydraulic balance required for low discharge flow operation. While no U.S. mill today is achieving these limitations, EPA believes that the continuing progress being made by mills toward closed-loop processing will lead to greater innovation regarding technologies and practices necessary to achieve the Tier III limitations. For further discussion of EPA's rationale for selecting this technology as the basis for Voluntary Advanced Technology BAT limitations and NSPS at the Tier III level, see Section IX.A.6. For a more detailed discussion of the technology bases for the Voluntary Advanced Technology BAT Limitations and NSPS, see Voluntary Advanced Technology Incentives Program Technical Support Document (DCN 14488).

4. Pollutants Regulated by Voluntary Advanced Technology BAT and NSPS Limitations

Except for TCF-based processes, each Advanced Technology tier consists of limitations for dioxin, furan, chloroform, and 12 chlorinated phenolic pollutants monitored at the bleach plant. EPA is not codifying limits for these pollutants for TCF processes. As discussed in more detail below, each Tier also includes AOX limitations monitored at the end of the pipe and, depending on the Tier, limitations on lignin content or wastewater flow. In addition, each BAT Tier includes limitations on pentachlorophenol and trichlorophenol (when used as biocides), see 40 CFR 430.24(d), and each NSPS Tier includes limitations on BOD_5, TSS and pH, as well as biocides. See 40 CFR 430.25(c) and (d).

EPA has chosen to use AOX as a performance standard for each of the three Voluntary Advanced Technology BAT tiers because AOX is a measure of progress in reducing the total chlorinated organic matter in wastewaters resulting from the bleaching of pulps. In addition, the use of AOX rather than other measures of organic matter (e.g., BOD_5) will further encourage a pollution prevention approach instead of end-of-pipe treatment technologies. The final rule establishes minimum monitoring frequencies for AOX for each of the Tiers, except for TCF fiber lines. See 40 CFR 430.02(d) and (e). For TCF fiber lines, permit writers should determine the appropriate monitoring frequency to assure continued compliance with the AOX limitation.

In addition to the AOX criterion, EPA is establishing BAT limitations requirements for Tier I that include kappa numbers measured prior to bleaching and a narrative limitation calling for recycling of all filtrates generated prior to the point at which that kappa number is measured. See 40 CFR 430.24(b)(4)(i). The kappa number is a measure of lignin content in unbleached pulp, and is routinely determined by mills. EPA is not establishing minimum monitoring requirements for kappa numbers in this regulation. Permit writers maintain the authority to establish monitoring frequencies on a best professional judgment basis.

By meeting the kappa number limitations, Tier I mills will achieve substantial reductions in precursors for chlorinated organic pollutants found in lignin beyond reductions achieved by mills with conventional pulping processes. See DCN 14488. Some industry commenters suggested that EPA simply specify qualifying Advanced Technologies and require participating mills to employ one or more of those technologies in order to receive incentives. EPA rejected this approach because it would inhibit development of equivalent technologies that EPA cannot foresee today and is inconsistent with the traditional performance-based structure of technology-based effluent limitations under the Clean Water Act. Nevertheless, EPA agrees with these commenters that Tier I mills will in all likelihood employ extended delignification technologies or other technologies that similarly reduce the kappa number prior to bleaching; EPA, therefore, is requiring Tier I mills to achieve specified kappa numbers that reflect the performance capabilities of well-operated, extended delignification systems. In addition, EPA's Tier I limits reflect EPA's expectation that Tier I mills will be bleaching pulps with less lignin and, hence, will realize significant reductions in the amount of unrecoverable bleaching chemicals required to achieve their target brightness. By using less bleaching chemical, Tier I mills will further reduce the formation and discharge of chlorinated organic pollutants generated by bleaching pulps with chlorine-containing compounds, including chlorine dioxide. By recycling the pulping area filtrates, Tier I mills also will be implementing an important building block for long-term flow reduction goals, and eliminating an important source of weak black liquor discharge that would otherwise go to the mill's wastewater treatment plant. See DCN 14488.

By defining Tier I with parameter values (AOX, kappa numbers) and recycle requirements as presented above, EPA intends to provide maximum encouragement to as many mills as possible to achieve the performance of at least the initial threshold of the Advanced Technology program. Adopting threshold performance criteria that are too stringent could discourage mills from making additional capital investments beyond those necessary to achieve the baseline BAT. This could undermine one goal of the incentives program, which is to achieve the greatest environmental results possible consistent with mills' capital

investment cycles. Conversely, setting threshold criteria at levels that could be met by some mills that comply only with the baseline BAT limitations and that do not employ Advanced Technologies could serve as a disincentive to invest in Advanced Technologies that achieve dramatic reductions in pollutant loadings and flow. The kappa numbers defined above for Tier I, while at the upper end of the range of values achieved by extended delignification technologies, nonetheless appear to separate mills that employ them from mills that would use conventional pulping technologies to achieve the BAT limitations. See DCN 14488.

EPA is setting the Voluntary Advanced Technology BAT limitations and NSPS for Tier II and Tier III based on a different philosophy than for Tier I. EPA believes that Tiers II and III should reflect a movement toward the long-term goal of minimizing impacts of mills in all environmental media through partially or fully closed loop processes. For Tier II, EPA is setting an AOX limit based on a long-term average (0.10 kg/kkg) that is currently being achieved by some of the best mills in the industry. See DCN 14488. See 40 CFR 430.24(b)(4)(i) and 430.25(c)(2). For Tier III, EPA is setting an AOX limit based on a long-term average (0.05 kg/kkg) that is being achieved by only a very few mills, including one ECF mill. SeDCN 14488. Id. This ECF mill achieved the AOX limit only with hardwood furnish; moreover, it did so without the level of flow reduction anticipated for Tier III. See DCN 14488. It is the Agency's judgment, based on trends in ECF technology development to date, that with recycle of pulping and evaporator condensates and bleach plant filtrates necessary to achieve a wastewater flow of 5 m^3/kkg, and removal of chlorides from the liquor cycle, commensurate reductions in the mass of chlorinated organic pollutants contained in wastewaters discharged also are likely to occur. For this reason, it is EPA's judgment that the Tier III AOX limit will be achievable by advanced ECF mills for both hardwood and softwood furnishes as well as advanced TCF mills.

The Tier II and Tier III BAT limitations and NSPS also include restrictions on wastewater flow and a requirement that all pulping-area filtrates be recycled to chemical recovery prior to bleaching. See 40 CFR 430.24(b)(4)(i) and 430.25(c)(2). As discussed above for Tier I, the filtrates recycle requirement is an important step toward long-term flow reduction. Flow reduction and progress toward closed loop mill operations, in turn, are very important long-term environmental goals because pollutant releases to all environmental media would be minimized.

While mills currently measure end-of-pipe flow at the point of permitted discharges, Tier II and Tier III mills will be required to establish and maintain flow measurement equipment to verify compliance with the annual average reduced flow limits for those tiers for bleach plant and pulping area and evaporator condensates. EPA is not establishing minimum monitoring frequencies for flow in this regulation. Permit writers maintain the authority to establish monitoring frequencies on a best professional judgment basis. See 40 CFR 430.02.

Review of currently available data and literature indicates that the numerical values for flow set forth to define Tiers II (10 m^3/kkg) and III (5 m^3/kkg) are appropriately stringent reduced flow targets by comparison to current wastewater flow for mills with extended delignification technologies. See DCN 14488. EPA believes it is appropriate to include condensates as part of the specified wastewater flow volume because technologies are available today that allow for their recycle and reuse; use of these technologies therefore ensures that the cumulative volume of wastewater flow is reduced to the greatest extent possible. See DCN 14488. One technology in particular is the ''clean condensate alternative,'' which is a viable MACT compliance alternative. See 40 CFR 63.447. This alternative facilitates the segregation, treatment, and reuse of condensates and thus will assist mills in achieving the wastewater flow objectives. Inclusion of pulping and evaporator condensates in these reduced flow targets therefore is consistent with the ''clean condensate'' MACT compliance alternative and will promote flow reduction through recycle and reuse of the greatest possible volume of process wastewater.

EPA has the legal authority to establish Advanced Technology effluent limitations for non-chemical parameters, such as lignin content measurements and flow, and to do so where appropriate in narrative form. For Tier I, these limitations take the form of kappa numbers to measure lignin content in unbleached pulp and a narrative requirement to recycle pulping area filtrates; for Tiers II and III, they take the form of numerical limitations on process wastewater flows, as well as the narrative requirement to recycle pulping area filtrates. EPA has the authority to establish limits for lignin content in unbleached pulp, for recycle of filtrates, and for reduced process wastewater flows because each of these parameters functions as a restriction on the quantities, rates or concentrations of chlorinated organic pollutants and other pollutants in a mill's wastestream. See CWA Section 502(11). Restrictions on lignin content of unbleached pulp, measured as a kappa number, can be used to reduce the presence of precursors for chlorinated organic pollutants in a mill's wastewater. In addition, lignin itself is a material that includes polynuclear aromatic hydrocarbons; a number of polynuclear aromatic hydrocarbons are included in EPA's list of priority pollutants. See Appendix A to Part 403 (reprinted after 40 CFR 423.17). Recycling pulping area filtrates to the chemical recovery cycle prevents the discharge of weak black liquor, which includes inorganic pulping chemicals and dissolved wood substances. The dissolved wood substances include polynuclear aromatic materials, degraded carbohydrates, low-molecular weight organic acids, and wood extractives (resins and fatty acids). The toxicity of the materials contained in black liquor is well documented; see the BMP Technical Support Document (DCN 14489). Limits for process wastewater flow, in this case pertaining to total pulping area and evaporator condensate and bleach plant wastewater, move mills toward closed loop operations. Reductions in flow will have the effect of dramatically reducing mass loadings—and discharges—of non-chlorinated organics such as lignin and a variety of chlorinated organics in addition to dioxin, furan and the chlorinated phenolic pollutants specifically regulated today. Because those pollutants are far too numerous to measure individually (and some have not been specifically isolated and identified), EPA determined that it was impracticable to set mass-based limits for all of those pollutants. See DCN 14488. EPA judged that establishing flow levels for Tiers II and III would be the best way to control the discharge of these pollutants.

For the foregoing reasons, all of these Advanced Technology performance objectives qualify as effluent limitations under CWA section 502(11). As noted above, the filtrates recycle limitation is a narrative limitation. Nothing in the definition of effluent limitation in CWA section 502(11) or elsewhere in the CWA compels that restrictions on the discharge of pollutants be expressed in numeric form. *See NRDC* v. *Costle*, 568 F.2d 1369, 1380 (D.C. Cir. 1977). In this instance, EPA determined that the

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restriction on filtrates (and hence the prevention of discharge of toxic materials) could not be expressed as a numeric limitation and therefore expressed that restriction in narrative form instead.

For further discussion of the effluent reductions and environmental benefits associated with the Advanced Technology BAT limitations and standards promulgated for these parameters, see DCN 14488.

5. Voluntary Advanced Technology BAT Limitations and NSPS

The Voluntary Advanced Technology BAT limitations consist of three separate components, which together comprise BAT for the particular Tier. See 40 CFR 430.24(b). The first and third components consist of numeric effluent limitations for the pollutants regulated by the Voluntary Advanced Technology Incentives Program. The second component consists of enforceable interim milestones. Under one set of milestones, existing dischargers enrolled in Tiers II or III are required to meet interim BAT limitations equivalent to the baseline BAT limitations by April 15, 2004. Under the second set of milestones, existing dischargers enrolled in any tier are required to meet enforceable requirements that are developed on a best professional judgment basis by the permitting authority; these milestones are expressed in either narrative or numeric form. Taken together, these three components constitute reasonable further progress toward the national goal of eliminating the discharge of all pollutants and for this reason represent BAT.

The Voluntary Advanced Technology NSPS consist of only one stage—the ultimate performance objectives for the Tier in question, with the addition of conventional limitations at the baseline NSPS level. See 40 CFR 430.25(c). This is because new sources, unlike existing sources subject to BAT, must design and construct their facilities to achieve NSPS upon commencing operation; sequencing limitations to achieve continuing progress would be inconsistent with this statutory mandate.

a. ''Stage 1'' BAT Limitations. In the regulation, EPA has codified the first set of numeric BAT effluent limitations as ''stage 1'' limitations to be applied in the absence of more stringent WQBELs. See 40 CFR 430.24(b)(1). Although expressed in this regulation in narrative form, EPA intends that the permitting authority will express that limitation in numeric form for each participating mill on a case-by-case basis. The ''stage 1'' limitations thus will be numeric values on dioxin, furan, chloroform, AOX, and 12 chlorinated phenolic pollutants that, for each pollutant, are equivalent to the more stringent of either the technology-based limit on that pollutant in the mill's last permit or the mill's current effluent quality with respect to that pollutant. *Id.* Existing effluent quality for AOX would be determined at the end of the pipe based on loadings attributable to that fiber line; for all other pollutants covered by the Advanced Technology BAT limitations, such as dioxin, existing effluent quality would be determined at the point where the wastewater containing those pollutants leaves the bleach plant. *Id.* These ''stage 1'' BAT limits represent the first step in the Advanced Technology BAT continuum and are enforceable against the participating mill as soon as they are placed in the mill's NPDES permit.

The purpose of the ''stage 1'' BAT limits is to ensure that, at a minimum, existing effluent quality is maintained while the mill moves toward achieving the ultimate Voluntary Advanced Technology BAT performance requirements for the Tier selected by the mill. As Advanced Technology permits are reissued for Tier II or Tier III mills, in particular, new ''stage 1'' limitations must be established to reflect the improving effluent quality of that mill. *Id.* Allowing a mill to degrade its effluent quality during development and installation of Advanced Technologies would be inconsistent with the statute's direction that BAT limitations achieve reasonable further progress toward the Clean Water Act's national goals. EPA's ''stage 1'' limitations, thus, are intended to capture continuously improving effluent quality.

EPA had considered, but rejected, attempting to codify the ''stage 1'' limits in numeric form. First, EPA has no way on this record to quantify and hence codify the existing effluent quality of each mill that is potentially eligible to participate in this program. Nor would such an attempt be wise, because EPA expects that mills considering participating in the Voluntary Advanced Technology Incentives Program will continue to improve their effluent quality up to and beyond the promulgation date of this regulation and, most likely, up to and beyond the dates that their existing effluent quality is translated into enforceable permit limits. Therefore, even if EPA could codify such ''stage 1'' limitations today, doing so would likely establish a less stringent technological floor than the permitting authority would be able to establish each time an Advanced Technology permit is issued prior to achievement of the ultimate Advanced Technology performance requirements.

Because the ''stage 1'' limitations reflect a level of technology that the mill is already employing or that was previously determined to be BAT for that mill, EPA has determined that the technology bases for the ''stage 1'' limits are both technically available and economically achievable. EPA has also determined that they would not impose any adverse non-water quality environmental impacts. EPA has determined that these ''stage 1'' limitations are the ''best'' available technology economically achievable for mills participating in the Voluntary Advanced Technology Incentives Program because they allow those mills to focus their resources on the research, development, testing, and installation of the technologies ultimately needed to achieve the Advanced Technology performance levels. Thus, ''stage 1'' limitations reflect ''reasonable further progress toward the national goal of eliminating the discharge of all pollutants,'' as called for by CWA section 301(b)(2)(A). EPA also considered all of the other statutory factors specified in CWA section 304(b)(2)(B) and concluded that nothing in EPA's analysis of those factors justifies selecting a different set of ''stage 1'' BAT limitations. For these reasons, EPA determined that the ''stage 1'' BAT limitations promulgated today represent the appropriate first rung of the Advanced Technology BAT ladder that participating mills will have committed to ascend.

EPA did not set ''stage 1'' limits at the baseline BAT level because baseline BAT limits are not a logical first step to meeting the ultimate Advanced Technology BAT limitations for the reasons set forth below. See DCN 14488. First, as a technical matter, mills subject to such interim limits most likely would need to install more chlorine dioxide generator capacity than they ultimately would use to achieve the Advanced Technology performance requirements. (EPA believes most Advanced Technology mills ultimately will employ complete substitution of chlorine dioxide for elemental chlorine, preceded by extended delignification processes—a sequence that calls for approximately 30 to 75 percent less chlorine dioxide than a mill would use to achieve the baseline BAT requirements depending on the degree of extended delignification used.) Second, as an economic matter, interim limitations driving a mill to over-design its chlorine dioxide generator would cause the mill to divert capital away

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from the processes needed to achieve the ultimate Voluntary Advanced Technology BAT limitations. That diversion of resources undercuts one of EPA's principal assumptions regarding the economic achievability of the ultimate Voluntary Advanced Technology BAT limitations: that mills would be able to focus their capital and other resources entirely on those superior performance levels. Thus, EPA was concerned that by compelling achievement of baseline BAT limitations as ''stage 1'' limitations, EPA would unnecessarily inflate the overall cost of achieving the ultimate Advanced Technology limitations. This would likely cause some mills to conclude that they cannot sustain the overall costs of achieving the Voluntary Advanced Technology BAT limitations in an economically achievable manner. Other mills, in turn, might decide to absorb the additional costs by diverting resources from other environmentally beneficial projects that they might have voluntarily undertaken. The Clean Water Act authorizes EPA to consider non-water quality environmental impacts and other factors EPA deems appropriate in setting BAT limitations. See CWA Section 304(b)(2)(B). For these reasons, EPA believes that compelling achievement of the baseline BAT limits in the first instance would have had the contradictory and unintended effect of discouraging participation in the program, with the result that fewer mills ultimately would be motivated to achieve superior environmental performance. Finally, as discussed in more detail below, EPA is requiring mills at the Tier II and Tier III levels to achieve interim limitations equivalent to baseline BAT by April 15, 2004. See 40 CFR 430.24(b)(3).

b. Interim Milestones. As the second component of the Voluntary Advanced Technology BAT for the three Incentives Tiers, EPA is requiring the establishment of enforceable interim milestones. See 40 CFR 430.24(b) (2) and (3). EPA believes that interim milestones would incrementally benefit the environment during the period prior to achievement of the ultimate Advanced Technology performance levels and will ensure that participating mills make reasonable progress toward achieving the superior performance represented by the various Advanced Technology BAT Tiers.

EPA is promulgating two sets of enforceable interim milestones. The first set requires mills enrolled at the Tier II or the Tier III level to achieve limitations equivalent to baseline BAT limitations by April 15, 2004. 40 CFR 430.24(b)(3). (Mills enrolled at the Tier I level are required to achieve those limitations as well as the ultimate Advanced Technology limitations by that date. 40 CFR 430.24(b) (3) and (4).) EPA believes that this is a reasonable requirement not only because it ensures significant environmental progress consistent with CWA section 301(b)(2), but it also reflects the technology performance Tier II and Tier III mills are likely to be achieving by that date. Mills enrolled in Tier II and Tier III are expected to substantially modify pulping and bleaching processes (e.g., install extended delignification, ECF, or TCF bleaching) to comply with the Advanced Technology limitations. EPA expects that all Tier II or Tier III mills will install extended delignification and complete substitution (ECF) or TCF bleaching processes well in advance of achieving their wastewater flow objectives in order to allow sufficient time to design, install, test and adjust their other flow-related processes. In EPA's judgment, process changes sufficient to achieve baseline BAT limitations will occur by April 15, 2004. Once these processes are installed, the mill will be achieving or exceeding the baseline BAT limitations being required by that date. See DCN 14488.

EPA notes that mills required to achieve water quality-based or other effluent limitations equivalent to one or more of the Voluntary Advanced Technology BAT limitations are still eligible to enroll in the Voluntary Advanced Technology Incentives Program and to receive incentives for achieving the remaining Voluntary Advanced Technology limitations. However, the time for complying with water quality-based or other equivalent effluent limitations would be determined by applicable law, not by this Voluntary Advanced Technology Incentives Program. Therefore, for example, if a mill's NPDES permit compels immediate compliance with a dioxin limitation equivalent to the Voluntary Advanced (BAT) Technology limitation on dioxin because of water quality concerns or other requirements of state or federal law, this six-year milestone would not be available for that dioxin limitation. See CWA section 301(b)(1)(C).

The second set of enforceable interim milestones promulgated today applies to all mills enrolled in the Advanced Technology Incentives Program. Although today's rule leaves the type and frequency of these milestones to the permit writer's best professional judgment, see 40 CFR 430.24(b)(2), milestones should include intermediate pollutant load and wastewater flow reductions (for Tier II and Tier III mills) in addition to research schedules, construction schedules, mill trial schedules, or other milestones appropriate to the advanced technology and the participating mill. Interim milestones should be tailored to circumstances and process technologies at individual mills.

In order to facilitate the development of appropriate interim milestones on a case-by-case basis, EPA proposes elsewhere in today's **Federal Register** to require all mills enrolling in the incentives program to submit plans detailing the strategy the mill will follow to develop and implement the technology required to achieve the chosen incentive tier, as well as the interim numeric limitations for Tiers II and III. The plan should describe each envisioned new technology component or process modification the mill will need to achieve the Voluntary Advanced Technology BAT limits. A master schedule should be included in the plan showing the sequence of implementing the new technologies and process modifications and identifying critical path relationships within the sequence. For each individual technology or process modification, a schedule should be provided that lists the anticipated date that associated construction, installation, or process changes will be initiated, the anticipated date that those steps will be completed, and the anticipated date that the full Advanced Technology process or individual component will be fully operational. For those technologies or process modifications that are not commercially available or demonstrated on a full scale basis at the time the plan is developed, the plan should include a schedule for research (if necessary), process development, and mill trials. The schedule for research, process development, and mill trials should show major milestone dates and the anticipated date the technology or process change will be available for mill implementation. The plan also would need to include contingency plans in the event that any of the technologies or processes specified in the Milestones Plan need to be adjusted or alternative approaches developed to ensure that the ultimate tier limits are achieved by the dates in the master schedule. EPA expects the permitting authority to use the information contained in those plans, as well as its own best professional judgment, to establish enforceable interim milestones applying all statutory factors. EPA also expects permit writers to include reopener clauses in the permits to adjust these milestones including dates to reflect the

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results of research (if necessary), process development, and mill trials.

Section 402(a) of the Clean Water Act authorizes permit writers to establish permit conditions and limitations on the basis of best professional judgment as necessary to achieve the objectives of the Act. Although EPA is promulgating BAT limitations under CWA sections 301 and 304, EPA is not—nor could it today—codify the particular process development, construction, and testing milestones that will lead each participating mill to achieve the ultimate Voluntary Advanced Technology performance requirements. Identifying those milestones is best left to the judgment of the permit writer, who will have access to far more mill-specific information than EPA has today.

c. ''Stage 2'' limitations. The third component of the Voluntary Advanced Technology BAT limitations consists of the ''stage 2'' limitations. See 40 CFR 430.24(b)(4)(i). These are the only standards applicable to Voluntary Advanced Technology NSPS and must be achieved upon commencing operation. See 40 CFR 430.25(c). Also included in the Voluntary Advanced Technology NSPS are standards for dioxin, furan, chloroform, 12 chlorinated phenolic compounds, BOD_5, TSS, and pH at the baseline NSPS level. See 40 CFR 430.25(c)(1). In addition, standards for pentachlorophenol and trichlorophenol, when used as biocides, are part of the Voluntary Advanced Technology NSPS. See 40 CFR 430.25(d).

These limitations and standards represent the ultimate performance requirements for each Tier. The ''stage 2'' limitations are as follows:

(1) Tier I Voluntary Advanced Technology BAT Limitations (''stage 2''). For Tier I, the ultimate performance requirement for AOX is a long-term average (LTA) of 0.26 kg/kkg, measured at the end of the pipe. 40 CFR 430.24(b)(4)(i). Under this Tier, Advanced Technology fiber lines at participating mills must also achieve reduced lignin content in unbleached pulps as measured by a kappa number of 20 for softwoods and 13 for hardwoods and reported as an annual average. *Id.* Finally, Tier I Advanced Technology fiber lines must recycle to recovery systems all filtrates up to the point at which the unbleached pulp kappa numbers are measured (e.g., brownstock into bleaching). Tier I also includes limitations for dioxin, furan, chloroform and 12 chlorinated phenolic pollutants, see 40 CFR 430.24(b)(3). Limitations on these parameters are established at the baseline BAT levels because application of Advanced Technologies does not appear on this record to justify more stringent limitations.

(2) Tier II Voluntary Advanced Technology BAT Limitations (''stage 2'') and NSPS. For Tier II, the ultimate performance requirement for AOX is an LTA of less than 0.10 kg/kkg, measured at the end of the pipe. 40 CFR 430.24(b)(4)(i) and 430.25(c)(2). In addition, Tier II Advanced Technology fiber lines must recycle to chemical recovery systems all pulping-area filtrates prior to bleaching. *Id.* Finally, Tier II Advanced Technology fiber lines must also achieve total pulping area condensate, evaporator condensate, and bleach plant wastewater flow of 10 m^3/kkg or less reported as an annual average. *Id.* Tier II mills must also meet (or, in the case of existing dischargers, must continue to meet) limitations for dioxin, furan, chloroform, and the 12 chlorinated phenolic pollutants. See 40 CFR 430.24(b)(3) and 430.25(c)(1). Application of the Tier II Technologies does not appear to justify more stringent limitations for these parameters.

(3) Tier III Voluntary Advanced Technology BAT Limitations (''stage 2'') and NSPS. For Tier III, the ultimate performance requirement for AOX is an LTA of less than 0.05 kg/kkg, measured at the end of the pipe. See 40 CFR 430.24(b)(4)(i) and 430.25(c)(2). In addition, Tier III Advanced Technology fiber lines must recycle to chemical recovery systems all pulping-area filtrates prior to bleaching. *Id.* Finally, Tier III Advanced Technology fiber lines must also achieve total pulping area condensate, evaporator condensate, and bleach plant wastewater flow of 5 m^3/kkg or less reported as an annual average. *Id.* Tier III mills must also meet (or, in the case of existing dischargers, must continue to meet) limitations for dioxin, furan, chloroform, and the 12 chlorinated phenolic pollutants. See 40 CFR 430.24(b)(3) and 430.25(c)(1). Application of the Tier III Technologies does not appear to justify more stringent limitations for these parameters.

d. Voluntary Advanced Technology BAT Limitations and NSPS for Mills Employing TCF Processes. In order to encourage mills to employ Advanced Technologies founded on TCF processes, EPA is opening today's incentives program to fiber lines that employ or commit to employ such processes. Existing dischargers that choose to employ TCF processes are subject to the ''stage 1'' limitations, interim milestones (including the baseline BAT limitations), and the ''stage 2'' limitations applicable to the selected tier. 40 CFR 430.24(b) and 430.25(c). These limitations are discussed above. However, recently gathered data from TCF mills indicate that all TCF mills will be able to achieve the AOX performance requirements at any Tier level because end-of-pipe AOX levels are being reported at below minimum level. See DCN 14488. Consequently, the AOX limitations for TCF fiber lines are expressed as ''<ML.'' See 40 CFR 430.24(b) (3) and (4) and 430.25(c)(2). In addition, unlike mills using ECF processes to achieve Tier II and III BAT limits, TCF fiber lines would not receive limitations for the presence of TCDD, TCDF, chloroform, or the 12 chlorinated phenolics if they certify as part of their permit application (with appropriate corroborating data) that the bleaching process at those fiber lines does not involve the use of chlorine-based compounds. See 40 CFR 122.21(g)(3), (13) and 40 CFR 122.22(d). Similarly, a mill making the TCF certification is not subject to the minimum monitoring frequencies otherwise applicable to AOX. See 40 CFR 430.02. (For fiber lines that converted from ECF to TCF processes, mills should submit up to six months of AOX data—at the discretion of the permit writer—in order to allow the permit writer to determine an appropriate monitoring frequency on a best professional judgment basis.) EPA has determined that limitations on dioxin, furan, chloroform and the 12 chlorinated phenolic pollutants, and minimum monitoring requirements for AOX are unnecessary for TCF processes because a mill that does not use or generate compounds containing chlorine will not generate chlorine-related pollutants as a result of its bleaching processes. EPA hopes that such substantially reduced requirements for TCF mills will encourage more mills to employ TCF bleaching processes.

6. Selection of Voluntary Advanced Technologies as Bases for BAT Limitations and NSPS

Achievement of these BAT limitations, in particular the ''stage 2'' limitations for Tiers II and III, would represent substantial progress toward the national goal of eliminating the discharge of all pollutants. The ''stage 2'' limitations include limitations on AOX that are significantly more stringent than the baseline BAT limitations for AOX, as well as Tier-specific restrictions on the lignin content of unbleached pulps, the discharge of pulping area filtrates, and the quantity of total pulping area condensate, evaporator condensate and bleach plant wastewater flow. The latter restrictions, which are unique to the

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Voluntary Advanced Technology Incentives Program, call for environmental performance far in excess of the performance compelled by the baseline BAT.

EPA chose the parameters and limitations unique to the Voluntary Advanced Technology Incentives Program because they reflect the levels of performance EPA believes can be achieved over time by mills willing and able to invest the resources to develop and apply the corresponding Advanced Technology processes and practices. The Tier I technology is available today and does not impose significant non-water quality environmental impacts; it was not selected as the baseline BAT technology because it is not economically achievable for the subcategory as a whole or any segment as is discernible from the record available today. See Section VI.B.5.a(5). However, for mills willing and able to employ that technology, EPA believes that limitations based on extended delignification, complete substitution, and other processes would be economically achievable by the year 2003. EPA believes that the technology bases for Tier II, in turn, could be technically and economically achievable for mills willing to participate by the year 2008, and would not impose significant non-water quality environmental impacts. EPA bases its view on the experience of at least three U.S. mills that are moving in the direction of reduced bleach plant flow. See DCN 14488. None of these mills, however, is presently achieving the ''stage 2'' flow limits for Tier II because those limits include pulping area and evaporator condensate as well as bleach plant wastewater flow. Finally, with respect to Tier III, EPA notes that one mill in Finland today is achieving flow levels close to 5 m^3/kkg or less, although this mill's flow rates also exclude condensates. This mill is able to achieve its current level of performance without imposing significant non-water quality environmental impacts. In addition, mills choosing Tier III will have up to 16 years and considerable flexibility to develop and implement appropriate flow control strategies. (For a discussion of the timeframes associated with achieving the Voluntary Advanced Technology BAT Limitations, see Section IX.A.7.) While EPA recognizes that achievement of the ''stage 2'' limits for Tier III may call for considerable creativity and innovation by industry participants, EPA believes that such spurs to innovation are consistent with the Clean Water Act's ultimate goal of eliminating the discharge of pollutants. Finally, EPA emphasizes that participation in the Advanced Technology Incentives Program is purely voluntary. No mill in the Bleached Papergrade Kraft and Soda subcategory is required to commit to achieve the Voluntary Advanced Technology BAT limitations at any level.

The voluntary nature of the Advanced Technology Incentives Program also supports EPA's finding that the ''stage 2'' BAT limitations for the various Incentives Tiers will be economically achievable by the dates specified in the rule for the mills choosing to achieve them. See 40 CFR 430.24(b)(4)(ii). The ''stage 2'' limitations apply only to mills that designate themselves as Tier I, Tier II or Tier III Advanced Technology performers and that voluntarily accept the corresponding ''stage 2'' limits in their NPDES permits. In other words, the ''stage 2'' limitations are BAT for an Advanced Technology mill only because that mill announces, by choosing to participate in the Program and by its choice of Tier, that by the date specified in the rule for the applicable ''stage 2'' limits a technology will be both available and economically achievable for the purpose of achieving those limitations. Based on the experiences of mills that have voluntarily pursued performance levels comparable to the ''stage 2'' limitations of Tiers I and II, EPA believes that a mill choosing to pursue those objectives can do so within its economic capability. Therefore, EPA believes it is reasonable to presume that a mill would not subject itself to enforceable technology-based limits if achievement of those limits would exceed the mill's economic capability. Because the economic achievability of the ''stage 2'' limitations ultimately is evaluated according to the mill's own choices, EPA concludes that the ''stage 2'' limitations are economically achievable. In addition, while implementation of these Advanced Technologies today is beyond the economic capabilities of many mills because of the significant capital investments that can be incurred at the outset, EPA believes that a mill able to plan for these investments over time could reduce those investment costs to some extent, if only by minimizing the amount of capital the mill would need to borrow. Moreover, with additional time mills will inevitably find ways to implement these technologies that reduce costs. More importantly, it could make these environmental improvements in sequence with other business decisions related to capital investment, thus reducing the overall cost of installing the Advanced Technologies. Although on this record EPA cannot state with confidence what the cost of implementing these Advanced Technologies would be if spread over time (and hence cannot make an economic achievability finding for the subcategory as a whole or any discernible segment relating to those Advanced Technologies), EPA nevertheless believes that each mill is capable of making that judgment and assuming the corresponding economic risks. This Voluntary Advanced Technology Incentives Program thus establishes a structure by which mills willing to predict their economic fortunes over the next several years and to commit to enforceable permit limits based on that prediction can do so.

EPA has considerable discretion under CWA section 304(b)(2) to determine whether and when a particular technology or process is BAT. EPA also has broad authority to interpret CWA section 301. In *E.I. du Pont de Nemours & Co.* v. *Train*, 430 U.S. 112 (1977), the Supreme Court accorded great deference to EPA in promulgating effluent limitations guidelines as regulations under section 301, noting that ''[CWA Section] 101(d) requires us to resolve any ambiguity on this score in favor of the Administrator.'' *Id.* at 128. The Supreme Court also found that section 501(a) supports EPA's broad use of its regulatory authority to implement section 301. *Id.* at 132. EPA believes that its decision to promulgate Voluntary Advanced Technology BAT limitations is authorized by sections 301 and 304. Section 301(b)(2) in particular directs EPA to promulgate BAT limitations that, within the constraints of economic achievability, ''will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants.'' Section 301(b)(2)(A). In addition, both case law and the legislative history interpreting the BAT program make it clear that the statute is to be used to force technology, within the constraints imposed by sections 301(b)(2) and 304(b)(2). Promulgation of regulations to promote the use of Advanced Technologies and, hence, progress toward the elimination of pollutant discharges thus is within the scope of the Administrator's 501(a) authorities. *See Cleveland Electric Illuminating Co.* v. *EPA*, 603 F.2d 1, 6 (6th Cir. 1979) (''The ultimate justification for every regulation and guideline pertaining to discharges is its effectiveness in promoting the achievement of the goals of Congress in enacting the 1972 Amendments.'')

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As part of its BAT analysis, EPA performed a case-study analysis to determine the potential effluent reduction benefits derived from the incentives program. Effluent reductions were calculated for a hypothetical case-study mill complying with Voluntary Advanced Technology BAT limitations at each incentive Tier. This case study is discussed in more detail at DCN 14488. The 1000 metric ton-per-day case-study mill operates a softwood and a hardwood bleach line of equal size, and uses a conventional three-stage bleach sequence with chlorine on each line. Table IX–1 presents effluent load reductions from that case-study mill, calculated for the baseline BAT (BAT Option A) as well as each incentive Tier.

TABLE IX–1.—EFFLUENT LOAD REDUCTIONS FOR CASE STUDY MILL

Pollutant	Units	Baseline BAT Technology	Tier I	Tier II	Tier III
AOX	kkg/yr	670	770	830	840
BOD5	kkg/yr	290	440	720	870
COD	kkg/yr	6,000	11,000	13,000	18,000
Color	kkg/yr	2,000	15,000	30,000	34,000
Chloroform	kg/yr	290	290	290	290
TCDD&TCDF	g/yr	4.9	4.9	5.0	5.0
12 Chlorinated Phenolics	kkg/yr	1,000	1,100	1,200	1,200

Note that for all levels, TCDD, TCDF, chloroform and the 12 chlorinated phenolics will not be detected in the final effluent. The differences between the levels are the result of technologies employed to reduce discharge flow rates under the incentive Tiers.

In selecting the technology basis for each of the Incentives Tiers, EPA also evaluated the associated non-water quality environmental impacts, changes in energy requirements, the age of facilities and equipment involved, the process used, and the engineering aspects of various types of control techniques and process changes. See DCN 14488. Nothing in EPA's analysis of these factors justified selecting different BAT technologies than those identified in section IX.a.3. EPA found that the technologies that form the basis of the Incentives Tiers provide a significant degree of water conservation, particularly at Voluntary Advanced Technology Tiers II and III. EPA also expects lower secondary sludge generation rates at Incentives Tier mills with activated sludge treatment because of reduction in BOD_5 loads associated with the Advanced Technologies. The technology basis of each of the Incentives Tiers will lead to overall decreases in energy consumption, primarily because of replacement of chlorine dioxide with oxygen-based delignification and bleaching chemicals. EPA expects a slight increase in air emissions (<2 percent) due to increased recovery of black liquor that will occur under the Incentives Tiers. However, these are offset by reductions in air pollution that derive from the reductions in overall energy consumption.

EPA considered the potential for cross-media transfer of pollutants through implementation of the Advanced Technologies that form the basis of the Incentives Tiers. EPA found no basis to conclude that cross-media transfer of pollutants would occur. See DCN 14488 and DCN 14492. However, much of the Tier II and Tier III technology bases focus on closing mill process cycles, which has not yet been fully demonstrated. As these technologies are fully developed and implemented, sufficient engineering analyses and testing should be performed to assess whether unacceptable cross media transfer of pollutants are occurring, and whether modifications need to be made to avoid any unacceptable transfers identified.

For NSPS, EPA has determined that Tier II and Tier III technologies constitute the best demonstrated control technologies for mills enrolling in those tiers. Although EPA cannot say today that either of these technology sequences is the best demonstrated control technology for new sources in the Bleached Papergrade Kraft and Soda subcategory as a whole, EPA does believe that new sources emerging within the next 16 years may characterize them as such based on their own sense of their economic and technical capabilities. Therefore, as with existing sources, EPA is promulgating this additional array of NSPS in order to provide such mills the opportunity to pursue voluntarily pollution prevention technologies—and to accept correspondingly more stringent effluent limitations—if business circumstances warrant. EPA notes that a mill subjecting itself to the Advanced Technology NSPS will be shielded from more stringent technology-based effluent limitations for ten years beginning on the date that construction is completed. See CWA section 306(d). Because these standards are entirely voluntary, their promulgation today presents no barrier to entry. In addition, EPA has determined that achievement of these standards will not result in any significant non-water quality environmental impacts or significant additional energy requirements. See DCN 14488. Nothing in EPA's analysis of the other statutory factors applicable to NSPS justified selecting different NSPS technologies.

EPA also believes it is appropriate to promulgate limitations for all three Tiers at the same time it promulgates the baseline BAT limitations. (The same rationale applies for today's Voluntary Advanced Technology NSPS.) By promulgating all three Voluntary Advanced Technology BAT Tiers today, rather than in five-year increments, EPA hopes to encourage as many mills as possible to develop and install Advanced Technologies. On this record, EPA has determined that its customary practice of promulgating a single BAT for similarly situated mills—represented here by the baseline BAT limitations—would have the unintended effect of impeding some mills' progress toward even greater environmental objectives than EPA can compel at this time. Thus, if EPA were to promulgate only baseline BAT limitations today and not establish a parallel track for mills converting to Advanced Technologies, EPA is concerned that mills might abandon their voluntary long-term strategies of superior environmental performance in favor of compulsory short-term compliance strategies focused on the baseline BAT. Instead, by promulgating Voluntary Advanced Technology BAT limitations at the same time as baseline BAT limitations, EPA allows interested mills to consider all technology options at the outset before they make their investment decisions and to design and install precisely the technologies and

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