

Economic Impact of Pending Air Regulations on the U.S. Pulp and Paper Industry - Updated

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Introduction

This report is an updated version of a report of similar name released in August 2010. It describes the potential impact of a series of rules issued by the Environmental Protection Agency (EPA) in March 2011 establishing Maximum Achievable Control Technology for industrial boilers, commonly referred to as the Boiler and Incinerator MACT rules¹. Several other unrelated air regulations also are pending. They include but are not limited to the Cluster MACT reopening, Pulp and Paper Residual Risk, and several National Ambient Air Quality Standard (NAAQS) revisions that directly or indirectly drive more stringent standards.

This update uses the same assumptions as the original report with the following exceptions:

- Pulp and paper mill assets and costs-of-production were taken from FisherSolve™'s Q1_2011 release;
- Capital and operating costs of compliance to regulations were updated by the consulting firm URS based on the latest available information.

The American Forest & Paper Association (AF&PA) engaged URS to update estimates of the likely costs of complying with these pending regulation changes and Fisher International Inc. to assess the impact of these compliance costs on the economic viability of U.S. pulp and paper mills.

The URS findings are presented in detail in a report entitled, "Cumulative Cost Burden Analysis of Air Regulations Potentially Impacting the Forest Products Industry," dated August 2011. A regulation-specific summary of the URS cost estimates appears in Appendix A of this report and indicates which rules were included in this assessment and which were not.

In summary, this update shows potentially severe impacts on the pulp and paper industry from EPA regulations affecting industry boilers (e.g. Boiler MACT and CISWI) and other upcoming Clean Air rules for which the costs could be estimated, as follows:

- The Boiler MACT rules, after accounting for the impact on jobs of proposed general pulp and paper manufacturing Clean Air regulations, put at serious risk an incremental :
 - o 20,541 jobs in pulp and paper mills alone
 - o 87,299 jobs considering both job losses in pulp and paper mills and jobs lost along their supply chain and in the surrounding community.²

¹ On March 21, EPA published the Boiler MACT rule and three related rules -- the Commercial and Industrial Solid Waste Incinerator (CISWI) rule (setting emissions limits for non-hazardous solid waste incinerators); the definition of Non-Hazardous Secondary Materials (a Resource Conservation Recovery Act rule determining which materials are wastes and thus covered under the CISWI rule when burned); and Boiler GACT (Generally Achievable Control Technology for boilers at smaller sites). These four rules often are collectively referred to as the "Boiler MACT rules."

² Note that these estimates do not include job losses in the wood products manufacturing sector of the forest products industry from an estimated \$2 billion in new MACT costs.

- The Boiler MACT rules and other upcoming Clean Air regulations put at serious risk a *total* of:
 - o 38,060 jobs in pulp and paper manufacturing alone
 - o 161,755 jobs considering both the losses in pulp and paper mills and the jobs lost along the supply chain and in the surrounding community.³

Methodology

Fisher International was asked to quantify the likely impact of new air pollution control regulations on employment in U.S. pulp and paper mills by estimating how many mills would be in jeopardy of closing if they had to comply with the relevant new air regulations. To make the estimate, we used two major resources: FisherSolve™, a proprietary industry database describing the assets and costs-of-production of each mill, and descriptions provided by URS of how different types of mills would need to respond to each potential new regulation and the costs of that compliance.

We projected the costs of compliance for each mill and calculated them as a percentage of costs of production. When compliance would increase a mill's cost-of-production by more than a sustainable amount, we listed that mill and its associated employment as being "at-risk." Note that the costs projected in this report for each mill's compliance do not include the costs associated with a number of regulations for which URS was unable to quantify a mill-specific compliance impact.⁴ Moreover, there is another set of regulations that trigger a cost to a mill only when the mill makes a physical change in the future, such as rebuilding a boiler. As we do not know which mills may make changes in the future, these impacts also are not included in this analysis. For this reason, the analysis may understate the impact of regulations on mill costs and jobs.

We assumed that the "sustainable amount" of incremental cost a given mill can absorb is equal to the amount of cash that the average mill produces for its owner after variable costs and capital expenditures. In other words, when a mill gets to a cash break-even level, it becomes a serious risk for closure. It would be fair to argue that this is a conservative assumption because many owners would prefer to shutter a mill well before it reached a cash cost breakeven level to redeploy management time and maintenance capital to other, more profitable facilities. The average sustainable amount of cost increase for the industry based on this analysis is 12.5% of cost of production. (See below for a more detailed explanation of how this figure was derived.)

³ Note these estimates do not include job losses in the wood products manufacturing sector of the forest products industry.

⁴ Roughly \$2 billion in new capital costs for pulp and paper mills meeting various National Ambient Air Quality Standards (NAAQS), changes to the New Source Review (NSR) requirements, New Source Performance Standards (NSPS), and the Clean Air Interstate Rule (CAIR) were not factored into the mill closure/job loss calculations because they could not be allocated to specific mills.

For most regulations, compliance requires both capital and operating costs. We translated capital costs into operating costs by using an interest rate of 11%, representing the industry’s weighted average cost of capital (WACC), and a term of five years. We based the WACC on a survey of investment bankers and industry analysts. The five-year term was arrived at by noting that:

- the industry’s capital structure is approximately 50% debt and 50% equity,
- the average industry term of debt is about ten years, and
- funding with equity is equivalent to a term of “zero” years (because shares are diluted immediately when a company raises cash by selling equity).

Therefore, the average payback term we used to calculate the cost of funding compliance is five years ((10 years + 0 years) divided by 2 = 5 years).

The table below summarizes how we arrived at the financial “at-risk” rate of spending on compliance that would put a mill in jeopardy of closing. Ideally, we would have compared the cost impact of compliance to mill margins. However, since we did not have data on each mill’s profit margin, we assumed an industry average margin, added an industry average factor for cash spent on capital and applied them to cost-of- production data that we do have. This allowed us to create an industry average “at-risk” rate that we could compare to the costs of compliance.⁵

We estimated the industry average “at-risk” rate using data drawn from the financial statements of a group of public U.S. pulp and paper companies. We found the industry’s average gross margin over a 10-year period, which is revenue less the cost of goods sold (mainly materials and labor) as a percentage of revenue. We then deducted average capital expenditures per dollar of sales and an average cost-of-sales (such as broker commissions and early payment discounts).

Item	Percent
10-year average industry gross margin	19.7%
Less 10-year average capital expenditures per \$ of sales	7.6%
Less factor for cost of sales	<u>2.0%</u>
Equals at-risk rate as percent of <u>sales</u>	10.1%
At-risk rate as percent of <u>cost-of-production</u>	12.5%

⁵ While the methodology is the same, this description is different from the one supplied in the original report in an attempt to clarify the methodology used.

These calculations resulted in an average “at-risk” rate (the maximum amount of cash cost increase the typical mill could absorb) of 10.1% of sales. Given the industry’s average margins, this is equivalent to 12.5% of cash cost-of-production. Hence, if air regulation-related incremental operating costs and annualized costs associated with capital expenditures to comply with the regulations amount to more than 12.5% of a mill’s cash costs, the mill is classified as at risk of closing.

The increase in costs of compliance with new air regulations will affect mills in different ways. In some cases, mills will suffer increases in costs greater than their domestic competitors, thus losing competitiveness in their home markets and becoming risks for closure. In other cases, even if all mills in a product category experience similar cost increases, many U.S. mills become “at-risk” for closure because international competitors gain a cost advantage and prevent prices from rising.

As of this date, there still is some uncertainty around how certain rules will be written. Therefore, this report contains the results of two scenarios, each representing one possible outcome. The results for Scenario 1 are presented in this report. The results for Scenario 2 are summarized at the end. The two scenarios are:

- Scenario 1 – many types of biomass that is burned are treated as solid waste, and therefore, are subject to the Solid Waste Incinerator rules instead of the Industrial Boiler MACT rule.
- Scenario 2 - many types of biomass that is burned are treated as fuel, and therefore, are subject to the Industrial Boiler MACT rule and not the Solid Waste Incinerator rule.

Scenario 1 Results

Analysis of mill-specific increases in annualized air regulation compliance costs suggest that the Boiler MACT regulations, if they are incremental to the pending manufacturing-related air regulations, could result in the closure of 36 mills employing 20,541 people or 18% of the primary pulp and paper sector’s workforce. (The primary pulp and paper sector encompasses only pulp and paper mill jobs; the risk to logging jobs and converting operations are not included in these figures.)

The calculations suggest that 79 pulp and paper mills would be at significant risk of closing if the larger suite of new air regulations for which we have data were implemented. These mills employ 38,060 people, or 33% of the primary pulp and paper sector’s workforce. The following table shows potential mill shutdowns and job losses:

Mills at Significant Risk of Closure					
Incremental from Adding Boiler MACT		P&P Mfg Regs Only		Total of Boiler MACT and P&P Mfg Regulations	
Jobs At Risk	# of Mills	Jobs At Risk	# of Mills	Jobs At Risk	# of Mills
20,541	36	17,519	43	38,060	79
		Base		113,858	349
		Percent change		33%	23%

Ripple Effect

Pulp and paper mill jobs support jobs in other industries that supply the pulp and paper industry in local communities and throughout the United States. A scholarly paper prepared by the Economic Policy Institute -- "Updated Employment Multipliers for the US Economy, 2003" -- was provided to Fisher by AF&PA. Table 9 of the paper indicates that for every 100 jobs in the paper industry, there are an additional 325 jobs sustained in other industries due to the purchase of supplies and the re-spending of worker incomes. Hence, the pulp and paper industry's multiplier is 4.25.

Applying the 4.25 multiplier in the previous table suggests that 87,299 jobs can be lost by imposing Boiler MACT regulations on top of the proposed new pulp and paper manufacturing-related air regulations (20,541 X 4.25 = 87,299). A total of 161,755 jobs – inside and outside the pulp and paper industry -- could be lost as a result of the entire suite of proposed air regulations (38,060 X 4.25 = 161,755).

Mill & Community Jobs at Risk at 4.25 Multiplier			
	Incremental from Adding Boiler	P&P Mfg Only	Total of Boiler MACT and P&P Mfg Regulations
Scenario	87,299	74,456	161,755

Fisher International also calculated pulp and paper jobs losses associated with the proposed regulations by region. Regional figures do not include the multiplier effects.

Job losses for Regions (No Multiplier)			
	Incremental At Risk Jobs from Adding Boiler Regulations	At Risk Jobs for P&P Mfg. Regulations Only	At Risk Jobs for Boiler and P&P Mfg Regulations
US - Northeast	2,177	2,877	5,054
US - Midwest	5,505	3,878	9,383
US - Southeast	11,924	7,529	19,453
US - West	935	3,235	4,170
Total US	20,541	17,519	38,060

Scenario 2 Results

Under Scenario 2, many types of biomass that are burned are treated as fuel, and therefore, most plants are subject to the Industrial Boiler MACT rule and not the Solid Waste Incinerator rule.

The calculations for this scenario suggest that the Boiler MACT regulations, if they are incremental to the pending manufacturing-related air regulations, could result in the closure of 35 mills employing 19,921 people, or 17.5% of the primary pulp and paper sector's workforce. If jobs in supplier industries and local communities are factored in, the number of jobs in jeopardy rises to 84,664. The impact of the pending manufacturing-related air regulations on employment and mill closings is the same as under Scenario 1.

Comparison of Findings: This Report vs. August 2010 Report

In August 2010, Fisher prepared a study on EPA's proposed Boiler MACT regulations and other pending air regulations. The August 2010 study found that 43,666 pulp and paper mill jobs would be placed at risk due to a broad suite of pending air regulations.

Of the 43,666 at-risk paper industry jobs identified in the 2010 study, 26,778 were associated with the "other" pending air regulations and 16,888 with Boiler MACT-related compliance spending that is incremental to spending on the other air rules.

This new study examining the final Boiler MACT rules found that 38,060 paper industry jobs would be placed at risk due to the entire suite of air regulations. Among those

38,060 jobs, 20,541 job losses could result from the final Boiler MACT/CISWI-related costs that are incremental to spending needed to comply with the other air regulations, and 17,519 jobs are placed at risk by the costs of non-Boiler MACT air regulations.

The decline in the number of jobs placed in jeopardy by non-Boiler MACT air regulations between the original and updated study reflects several factors:

- Between the first and second studies, the number of mills operating in the U.S. declined by 7, and the employee base declined by 5,302 jobs. Of the 5,302 fewer jobs, 2,600 were lost due to mill closures after the completion of the first report, and the remainder reflected headcount reductions at mills that remained operational.
- Average cost-of-production increased between the two study periods. Because we measured compliance costs as a percentage of cash costs, higher cash costs appeared to raise the threshold for compliance costs that would put mills at risk. In actuality, higher costs might put more U.S. mills at risk rather than fewer because foreign mills gain a cost advantage vis-a-vis U.S.mills.

The increase in the number of jobs put at risk by Boiler MACT rules reflects the underlying fact that the regulations as a whole still threaten a significant number of mills and jobs:

- While fewer mills were placed in jeopardy of closing by the “other” air rules, the *total* number of jobs at risk declined by a smaller number. The Boiler MACT/Incinerator MACT rules, therefore, account for a larger incremental impact.
- In the 2010 study, capital spending was estimated by URS at \$5 billion for the proposed Boiler MACT/CISWI rules and \$13.7 billion for the larger suite of pending air rules, including the Boiler MACT/CISWI rules. However, not all of the costs could be allocated to specific mills, so capital spending-related compliance costs used by Fisher came to \$4.6 billion for Boiler MACT and \$10.3 billion for the entire suite of air regulations.
- Capital spending for the 2011 study was estimated by URS at \$4 billion for the final Boiler MACT/CISWI and \$12.6 billion for all of the pending air rules, including Boiler MACT/CISWI. However, not all of the costs could be allocated to specific mills, so capital spending-related compliance costs used by Fisher came to about \$3.8 billion for Boiler MACT/CISWI and \$10.1 billion for the entire suite of air regulations.
- The Boiler Rules changed between proposal and promulgation. In particular, more fuels were classified as solid wastes and therefore, many plants are subject to the CISWI rule instead of the Boiler MACT rule. In addition, costs were added for NOx emissions reduction requirements to mills in close proximity to projected non-attainment areas.

In sum, this study, like the preceding study, shows that the EPA's Boiler MACT rules would have a major impact on the economic viability of many pulp and paper mills and place at risk tens of thousands of pulp and paper mill jobs as well as jobs in surrounding communities and supplier industries.

Appendix A

URS Estimates of Pulp and Paper Mills Costs of Complying With Proposed Air Regulations:

How Costs Were Determined:

URS Corporation (URS) worked with the American Forest and Paper Association (AF&PA) and its members to develop a rough order of magnitude estimate of the costs of complying with various air regulations that could impact the forest products industry. The cost estimates were compiled in a Microsoft Excel workbook; were based on published information or similar project costs; have been reviewed by member company representatives; and have been made available to the US EPA and others for review. The Boiler MACT and CISWI estimated costs are in large part based on information in EPA's March 2011 survey and emissions databases.

Capital and operating costs estimates are not intended to represent a worst case analysis. Rather, they represent median costs for the various scenarios based on published reports, industry information on specific project costs, EPA reports or control device fact sheets, or actual Best Achievable Control Technology (BACT) or Best Achievable Retrofit Technology (BART) analyses submitted to permitting agencies. A primary resource was the document entitled, "Evaluation of Air Pollution Control Costs for the Pulp and Paper Industry," prepared by National Economic Research Associates (NERA) in May 2003. All costs were discussed with a core team of AF&PA members and reviewed by URS engineers familiar with boiler and other pulp and paper mill operations and controls prior to finalizing the study.

Boiler MACT Costs:

The Boiler MACT will require emissions controls for particulate matter, hydrogen chloride, mercury, carbon monoxide, and dioxin/furan. The control technologies that EPA has identified as necessary to comply with the Boiler MACT are a fabric filter for control of particulate matter, carbon injection for control of mercury and dioxin/furan, a scrubber for control of hydrogen chloride, and combustion improvements or an oxidation catalyst for control of carbon monoxide. In some cases, the emission limits will be very difficult to achieve over all operating conditions, but the cost analysis assumes that for each boiler, facilities can apply emissions controls to achieve the Boiler MACT limits with a comfortable margin of compliance. In some cases, existing equipment configurations may prove impossible to upgrade, and boilers and process heaters may need to be replaced, which is a cost that is not reflected in the analysis. Note also that many facilities may choose fuel switching as a compliance option; however, as the cost of fuel switching is highly dependent on site specific factors (e.g., whether the boiler can burn the alternate fuel, what upgrades must be made to the fuel supply system) and the price of fuel will change over time due to factors like supply and demand, URS did not attempt to quantify costs for fuel switching.

The EPA collected information during Phase 1 of the Boiler MACT information collection request (ICR) on thousands of boilers and process heaters at hundreds of facilities. A detailed spreadsheet was developed to estimate costs for Boiler MACT for individual boilers and process heaters, based on EPA's major source boiler inventory database table and the emissions data included in EPA's boiler MACT database. URS extracted information from EPA's major source boiler inventory database including boiler ID, size, fuel category, emissions, and current air pollution control equipment. Based on the information in EPA's database and the baseline emission factors developed by EPA by boiler type and control device, URS determined whether each unit would require additional air pollution controls to meet the Boiler MACT limits. Note that we did not perform any quality assurance on the information in EPA's database, but where we had knowledge that a boiler had been mis-categorized (e.g., a biomass boiler was listed as a liquid boiler) we did make those changes in our spreadsheet.

A spreadsheet was developed that represents only the units to be regulated by the rule (excludes natural gas boilers, process heaters, boilers and process heaters less than 10 MMBtu/hr heat input, and limited use units). Based on the information in the EPA emissions database, we estimated costs of controls that would likely be necessary to comply with the Boiler MACT for coal, biomass, liquid, and Gas 2 boilers 10 MMBtu/hr and greater (note that for the final rule, EPA moved all gas-fired boilers to the Gas 1 subcategory unless they were burning any amount of coke oven gas or blast furnace gas). As some forest products boilers at major sources did not receive an ICR from EPA in 2008, we added information for those boilers to the detailed spreadsheet based on information from AF&PA/National Council for Air and Steam Improvement (NCASI). There are likely other units that are not included in the study, as other trade groups have submitted comments indicating that EPA has likely underestimated the universe of affected units (e.g., American Chemistry Council (ACC) and American Petroleum Institute (API)/ National Petrochemical and Refiners Association (NPRA)).

Information from various sources was used to determine a base capital cost for a 250 MMBtu/hr boiler for each PM, CO, and HCl control technology option and then scaled using an 0.6 power function based on the size of each boiler in the inventory. For example, the capital cost of a wet scrubber on a 100 MMBtu/hr boiler is calculated as the base cost times $(100/250)^{0.6}$. A fixed cost of \$1 million was assumed for installation of a carbon adsorption system for Hg and/or dioxin control, as these systems do not vary much in cost by boiler size. Base cost assumptions are presented below.

Base Control Size, MMBtu	250
Fabric Filter	\$7,000,000
Scrubber	\$8,000,000
Scrubber/FF/ESP upgrade	\$4,000,000
Carbon Injection for Hg/dioxin	\$1,000,000
Combustion Improvements or Catalyst for CO	\$3,000,000

Controls were evaluated separately, first for particulate matter, then for hydrogen chloride, then for mercury and dioxin/furan, and last for carbon monoxide. To estimate Boiler MACT controls and costs for each unit, if there was no emissions information available for a particular boiler, we use the baseline emission factors developed by EPA for their analysis. In their boiler inventory table, EPA put the boiler pollution controls into categories. The categories are explained in greater detail in EPA's baseline emission factor memo, but basically are as follows: for PM control code, 1=FF, 2=EFB/ESP, 3=venturi scrubber, 4=wet scrubber, 5=multiclone, 6=none/mist eliminator/unknown. If a unit did not already have a FF or ESP and there was information that indicated the unit cannot meet the limit, we assumed a new FF. If the unit already had a FF or ESP and there was information that indicated the unit cannot meet the limit we assumed an upgrade to the existing control equipment. For HCl control code, 1=wet scrubber or spray dryer, 2=dry scrubber, 3=sorbent injection, 4=venturi scrubber, 5=none/dry PM only. To estimate control costs for HCl, if there was information that indicated the unit cannot meet the limit, we assumed either a scrubber upgrade or new scrubber depending on whether the unit currently had a scrubber. For Hg control code, 1=carbon injection, 2=FF plus sorbent injection or spray dryer, 3=FF only, 4=wet scrubber, 5=venturi scrubber, 6=none/multiclone/EFB/mist eliminator. For Hg and dioxin, if there was information that indicated the unit cannot meet the limit, we added carbon injection. For CO, if there was information that indicated the unit cannot meet the limit, then we assumed that capital would be necessary to either perform combustion/fuel feed improvements or other boiler improvement projects to reduce CO or install a CO catalyst.

Although EPA's estimates indicate that the total capital cost of the final rule will be \$5 billion, URS has estimated that the total capital cost of the rule will be over \$14 billion for all industry (\$2.85 to 3.2 billion for pulp and paper mills, depending on whether more materials are waste or fuel). It is evident major capital investments in add-on control technology will be required for continued operation of solid and liquid fueled boilers and process heaters.

URS capital cost estimates differ from EPA's cost estimates as follows:

- EPA has used the outdated Control Cost Manual and URS based cost estimates on more recent information, including actual vendor cost estimates, actual project costs, BACT and BART analyses, industry control cost studies, etc.
- URS used a CO catalyst cost 4 times higher than EPA's. The URS cost is based on a recent quote from BASF and EPA's is based on the 1998 Control Cost Manual section on catalytic oxidizers for VOC control.
- EPA has estimated that a tune-up or burner replacement will be adequate for many units to achieve the CO limits. URS does not agree with this assumption because some of the CO limits are fairly low and must be met over all operating conditions except startup and shutdown, so we have estimated higher costs to implement combustion controls, burner replacements, fuel feed system improvements, or CO catalyst.

- URS CO control capital costs are higher than EPA's, mostly because EPA assumed that tune-ups and replacement burners will be adequate for the vast majority of boilers to comply, and URS does not agree with that assumption.
- EPA has estimated that activated carbon injection will be required on only 120 existing units because installation of a fabric filter is expected to achieve the mercury emission limits, except in cases where a unit already has a fabric filter and does not meet the limits. URS does not agree that fabric filters will be sufficient to reduce mercury emissions to the ultra-low levels in this rule. There is a flaw in the logic that fabric filters are expected to achieve mercury emission limits when there are many boilers in the database that are equipped with fabric filters and have measured mercury emissions higher than the applicable limit. EPA's estimated industry-wide capital cost for activated carbon injection presented in the ERG cost and emissions impacts memo is extremely low, at only \$6.2 million (only \$52,000 per unit average). This cost better represents 12 units than 120 affected units.
- EPA has estimated costs to install packed bed scrubbers for HCl control. Industrial boilers do not use packed bed scrubbers for acid gas control, as the limitations of these devices make them impractical for use on applications with high flow rates, high PM loading, and high inlet pollutant concentration. EPA's own fact sheet on these devices, located at <http://www.epa.gov/ttn/catc/dir1/fpack.pdf>, lists these limitations of these devices and indicates that they are only used in applications up to 75,000 scfm, which limits their use to small units only (EPA responded to this comment by applying multiple packed bed scrubbers to units with higher flow rates). Facilities will instead install wet scrubbers, dry scrubbers, or semi-dry scrubbers to control acid gas emissions from industrial boilers. EPA has estimated HCl control costs for equipment that industry is not likely to install.
- EPA has assumed that facilities will not incur costs to comply with the dioxin/furan standards because they will test for dioxin/furan and be below detection levels. This logic does not make sense, especially when there are boilers in the EPA emissions database with dioxin/furan emissions that are non- detect but actually measured emissions higher than the applicable limit and there are boilers where EPA's baseline emission factor for dioxin/furan is above the applicable limit. We have estimated carbon injection as the control measure for dioxin/furan emissions, assuming that it will be effective at these low levels.

The following capital costs for control additions/upgrades were estimated by URS for pulp and paper coal, biomass, and liquid units having numerical emission limits under Boiler MACT (assuming many materials burned are solid waste and not fuel).

This is Scenario I:

PM Upgrade Cost	HCl Upgrade Cost	Hg/Dioxin Upgrade Cost	CO Upgrade Cost	Total Capital Cost
\$1.1 Billion	\$918 Million	\$232 Million	\$578 Million	\$2.85 Billion

The following capital costs for control additions/upgrades were estimated by URS for pulp and paper coal, biomass, and liquid units having numerical emission limits under Boiler MACT (assuming many materials burned are fuels and not solid waste).

This is Scenario II:

PM Upgrade Cost	HCl Upgrade Cost	Hg/Dioxin Upgrade Cost	CO Upgrade Cost	Total Capital Cost
\$1.3 Billion	\$1 Billion	\$270 Million	\$660 Million	\$3.2 Billion

These estimated costs differ from the costs of the proposed rule as follows:

- The final emission limits and the combination of biomass and coal boilers into a solid fuel subcategory for the fuel-based HAP (PM, HCl, and Hg) resulted in a reduction in control cost for many units.
- For the proposed rule, since many of the limits were so low as to be unachievable, we estimated that controls would be required on boilers where no emissions information was available. For the final rule costs, if no boiler-specific emissions information was available we used EPA's baseline emission factors by boiler type and control type to determine if controls would be required.
- Costs for compliance with the CO limits were adjusted based on information received from companies that had done preliminary engineering and cost estimates. We used a base cost of \$3 million and scaled using the 0.6 factor by boiler size for the final rule, versus a fixed cost of \$2 million for the proposed rule.

- Costs for mercury and dioxin are captured in the same column because it is assumed that carbon injection will be needed to meet both, based on the use of carbon injection to meet dioxin standards for higher emitting source categories such as municipal waste incinerators. However, the costs to achieve the dioxin limits for industrial boilers are uncertain and are likely underestimated because most of the dioxin limits are 100-1000 times lower than any previous MACT and it is unclear what emission reduction strategies could be implemented to meet the standards. The dioxin limits are essentially unachievable for most boilers.

CISWI Rule:

Costs for the CISWI Rule were developed in a similar manner as costs for the Boiler MACT rule. EPA's CISWI ICR database was used to determine which units would be subject to the CISWI rule and what controls would be needed. Units were also identified that were in EPA's Boiler MACT database, but burn NHSM such as wastewater treatment residuals, recycling process residuals, TDF, resinated wood, creosote treated wood/rail ties. Costs were assigned for PM/metals, NOx, acid gas, and mercury/dioxin controls. The estimated capital cost of controls for boilers at large pulp and paper mills, assuming the current NHSM rule, which classifies many existing biomass fuels as solid wastes, is approximately \$950 million. Smaller mills that would otherwise be regulated under the Boiler GACT rule but are burning secondary materials could also face costs under CISWI, but those costs were not modeled in this study. If changes are affected to the NHSM rule that allow more materials to be classified as fuels, the cost for CISWI controls for large pulp and paper mill boilers could be reduced to \$470 million.

Scenario	Solid Waste Determination	Capital Cost for Boilers at Large Pulp and Paper Mills
One	Many materials wastes	\$950 M
Two	Few materials wastes	\$470 M

Other Pending Air Regulations Where Costs Could Be Assigned to Mills⁶

- Cluster MACT I/III Re-do and Residual Risk
 - \$780 million – >95% of costs due to MACT organic HAP (Methanol) controls on paper machines; \$360 million in O&M is especially high due to energy intensive nature of controls which also produce over 2 million metric tons of CO₂

⁶ Fisher was unable to allocate about \$2 billion of these costs to specific mills, so the total capital cost used was \$6.3 billion.

- New Cluster MACT could set limits on additional pieces of equipment (like paper machines) for organic HAPs; EPA has discretion not to undertake de novo review of MACTs
- Residual risk review likely to show few risks remain
- EPA scheduled to complete in June 2012 with controls by mid-2015
- Cluster MACT II Re-do and Residual Risk
 - \$3.3 billion: >95% of cost due to MACT; \$300 million in O&M plus 1.5 million metric tons of new CO2 emissions
 - New MACT II could lead to addition of mercury, and HCl controls and more stringent PM controls on recovery furnaces, lime kilns, and smelt tanks. Again, EPA has discretion whether to revisit MACTs;
 - Residual risks from these sources also small
 - EPA is likely to complete in 2013 with controls by 2016
- Hydrogen Sulfide HAP Listing
 - \$2.7 billion in capital, plus \$180 million in operating costs
 - Assumes H2S listed as HAP and MACT establishes limits for pulping operations and wastewater treatment ponds
 - EPA has discretion to deny petition or conclude not an issue for pulp mills based on careful risk assessment
 - Possible final rule in 2015 (maybe sooner), with 2018 implementation
- NOx Controls due to Tighter NAAQS
 - Assumed NOx controls (either low-NOx burners, SNCR, or SCR) needed on boilers at facilities in or near projected non-attainment areas.
 - \$600 million in capital, plus \$140 million in operating costs.
 - Final 1-hour NOx standard was published in 2010, ozone standard expected to be lowered in 2011 (reductions will be driven by NOx in many areas), implementation in 2013.
 - Facilities have had problems meeting new 1-hour NOx standard when modeling for projects

Other Pending Air Regulations Where Costs Could NOT Be Assigned to Mills

- Boiler Area Source/GACT
 - Rule sets HAP emission requirements for smaller biomass and liquid boilers at so called “area sources” such as box plants; rule does not apply to gas-fired boilers.
 - Impact of rule is minimal since EPA adopted work practices (tune-ups) rather than numeric limits for CO for existing biomass and liquid boilers.
 - Final rule March 2011, compliance within 3 years

- CAIR 3/Cross-State Rule for Industrial Boilers and Recovery Furnaces
 - \$870 million in capital; total O&M would be \$220 million
 - Assumes next phase of rule requires medium and large boilers burning majority coal or oil to significantly reduce SO₂ and NO_x
 - Possible promulgation in 2012 with compliance over the next five years

- Start-up, Shutdown & Malfunctions (SSM) Provisions Removed from MACT
 - \$100 million, plus \$3 million in O&M
 - If EPA compelled to eliminate SSM exemptions and venting allowances then installation of redundant controls or suffer periods of shutdown with no production would drive costs even higher. EPA has discretion to develop reasonable work practices to replace current SSM exemptions
 - EPA linking schedule with pulp and paper MACT rules, so complete by 2012

- Ozone NAAQS revisit
 - \$400 million in capital and \$30 million in O&M
 - Tighter standard will drive more VOC and NO_x controls than other rules require for smaller contributors in or near more numerous non-attainment areas
 - EPA plans to reset NAAQS in 2011; impacts would occur 4 to 5 years after finalization

- PM fine NAAQS Implementation
 - \$284 million in capital and \$40 million in O&M
 - Assume tighter annual standard will drive further SO₂ and NO_x controls. As in all the above NAAQS, EPA has the discretion to determine “ample margin of safety” necessary to protect public health.
 - Final in 2012 with controls needed for attainment 5 or so years out

- Revised NAAQS for SO₂
 - \$40 million in capital and \$7.5 million in operating costs
 - Final in June 2010 with controls on select sources in five years (2015)
 - Significant uncertainty in ability to meet increments modeling for projects

- Kraft Pulp NSPS Revisions
 - \$83 million in capital through 2020 and \$56 million six years after effective date given more mills trigger retrofit requirements
 - EPA can defer action on NSPS or set equivalent to MACT to avoid new costs
 - EPA linking schedule with pulp and paper MACT rules so complete by April 2012