

MEMORANDUM

Date: February 23, 2010

To: File

From: U.S. EPA Office of Air & Radiation

Re: Estimation of eligible sectors and emissions under H.R. 2454

I. Summary

EPA developed an analysis of “presumptively eligible” industrial sectors under H.R. 2454 and their corresponding emissions levels, as requested by Senators Bayh, Brown, McCaskill, Specter, and Stabenow in a letter to Carol Browner dated September 11, 2009.

This document outlines the methodology used for eligibility and emissions calculations, summarizes the results, discusses the major changes from previous EPA analysis, and includes a section with additional detail on several sectors.

Detailed results of the analysis are included in the December 2009 Interagency Report, “The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries: An Interagency Report Responding to a Request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown.”¹

The methodology detailed in this document reflects revisions to the report made as of February 23, 2010.

II. Eligibility Methodology

EPA followed the methodology described under Sec. 401 of H.R. 2454 in developing its list of presumptively eligible sectors. We interpreted the steps for determining eligibility as follows:

Energy Intensity:

1. We used 2004-2006 average Annual Survey of Manufactures (ASM) energy expenditure and value of shipments data at the 6 digit NAICS level.
 - a. Energy expenditures were calculated by summing the values in the “Purchased Fuels” and “Purchased Electricity” data fields. The value of shipments data were taken from the “Total Value of Shipments” data field.
 - b. The average values for each sector excluded any year for which any of the above data were withheld.²
2. For those sectors that were not represented at the 6 digit level in the Annual Survey of Manufactures (i.e., because they were aggregated into broader sectors),

¹ Available at <http://www.epa.gov/climatechange/economics/economicanalyses.html>

² We used data reported in the most recent ASM (e.g., 2004 data from the 2005 ASM, 2005 data from the 2006 ASM). Where the data were not available in the most recent ASM but were available in a previous release of the ASM (e.g., 2004 data from the 2004 ASM), we used the available data. For example, this method had implications for petrochemicals, for which only 2004 data from the 2004 ASM were available (data were withheld in 2005 and 2006 ASMs).

we used 2007 Economic Census data for energy expenditures and value of shipments to determine energy intensity.

3. The use of Manufacturing Energy Consumption Survey (MECS) data was not required, as necessary data for all sectors were available from the Annual Survey of Manufactures and Economic Census.

Trade Intensity:

1. We used average 2004-2006 International Trade Commission import and export data,³ with average 2004-2006 Annual Survey of Manufactures Value of Shipments data. The average Value of Shipments used for this calculation could be different from that used for energy intensity to the extent that lack of data on energy purchases for particular sectors in particular years led to the use of a subset of Value of Shipments data from the 2004 to 2006 period in the energy intensity calculations. We also calculated trade intensities separately using 2007 data.
2. Import data were “Landed Duty-Paid Imports for Consumption.”
3. Export data were “FAS Value Domestic Exports.”
4. Trade data are not available for all sectors. In particular, 3 sectors have energy intensity >4.5% with unavailable trade data, and 8 sectors have energy intensity between 3.5% and 4.5% with unavailable trade data.
5. The trade intensity we report is the greater of average 2004-2006, or 2007.

III. Emissions Methodology

Default Method:

For 25 of the “presumptively eligible” sectors, the Energy Information Administration (EIA) provided CO₂ emissions data for direct combustion and indirect electricity emissions based on the 2006 Manufacturing Energy Consumption Survey (MECS).⁴ MECS estimates represent 90% of the total estimated direct combustion and indirect electricity emissions for all “presumptively eligible” sectors. EIA also provided emissions estimates based on MECS for an additional 19 non-“presumptively eligible” sectors. The analysis does not include non-CO₂ combustion emissions, which are likely to be very small.

Direct emissions from industrial processes are as reported in the 2009 U.S. GHG Inventory for year 2006.⁵ Process emissions were assigned to particular industries (defined by 6-digit NAICS codes) in coordination with EPA’s emissions inventory team.

³ <http://dataweb.usitc.gov>

⁴ <http://www.eia.doe.gov/emeu/mecs/contents.html>

⁵ U.S. Environmental Protection Agency (2009). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2004* EPA 430 R 09-004. Washington, DC: April 2009.
<http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

Alternate Method:

For combustion and electricity emissions for remaining sectors, EPA used an input-output approach to estimating emissions, where all emissions were calculated using bottom-up energy expenditure and electricity use data from the Annual Survey of Manufactures and the Economic Census. Using energy expenditure data, rather than the energy consumption data collected for the MECS sectors, introduces several uncertainties, primarily with regard to the price paid for a given quantity of energy purchased.

Direct Emissions from Fuel Combustion:

1. We took total purchased fuel costs from the 2006 Annual Survey of Manufactures (ASM), or 2007 Economic Census data where 6-digit ASM data were not available.
2. We took fuel use data from the detailed 2002 Bureau of Economic Analysis benchmark "Use" input/output table for three commodities: "Petroleum Refineries" (324110), "Natural Gas Distribution" (221200), and "Coal Mining" (212100).
3. For each sector, we apportioned shares of total fuel expenditures in the ASM data to petroleum, natural gas, and coal use according to the sector-specific shares for each fuel type found in the BEA table. Where sectors did not concord exactly between BEA and ASM, we used a broader BEA sector to share out energy costs for a given ASM sector.
4. For each sector, we converted energy expenditures for a given fuel to energy consumption (MMBTU) using Energy Information Administration 2002 Manufacturing Energy Consumption Survey (MECS) price data for that fuel at the corresponding 3 digit NAICS level (2006 price data were not released as of February 23, 2010).
 - a. Where MECS prices were not available/ suppressed for the 3 digit sector, we used the average price for the manufacturing sector..
 - b. For mining, we used mining price data from the 2002 Economic Census, which we expect to update when 2007 Census data are released.
5. We converted consumption to CO₂ emissions using factors for each fuel type from Table A-33 of the U.S. GHG Inventory. The analysis does not include non-CO₂ combustion emissions, which are likely to be very small.
6. We summed the emissions from the three fuel types to obtain an estimate of total emissions from direct fuel combustion for each sector.
7. The analysis does not include non-CO₂ combustion emissions, which are likely to be very small.

Indirect Emissions from Electricity Use:

1. We took the quantity of electricity purchased (kWh) from ASM 2006 data, or 2007 Economic Census data where 6-digit ASM data were not available.
2. We used EIA's 2006 national average CO₂ emissions factor (1405 lb CO₂/MWh) to convert to CO₂ emissions. This number is slightly different from the most recent emission factor available in EPA's eGRID database for 2005, which is derived from direct emissions monitoring in the power sector rather than fuel use

data. The EPA emission factor is slightly lower than MECS. The analysis does not include non-CO₂ combustion emissions, which are likely to be very small.

GHG Intensity Calculation:

1. We used 2006 ASM Total Value of Shipments data for each 6 digit NAICS sector.
2. We assume an allowance price of \$20/ton CO₂e per Section 763 of H.R. 2454.
3. We multiplied total direct and indirect emissions by the allowance price and divided by value of shipments to obtain the intensity percentage.
4. For sectors aggregated in the 2006 ASM, we substituted with 2007 Economic Census Value of Shipments data. For sectors analyzed using the Alternate Method, years of data match. For the 8 “presumptively eligible” sectors analyzed using the default method (2006 MECS) and aggregated in 2006, years of data did not match. Two alternative methods to develop a 2006 Value of Shipments estimate could be used; one would calculate a ratio of value of shipments of the sectors in question based on 2007 Economic Census data and apply that back to the 2006 aggregated data. The other would derive a Value of Shipments based on MECS consumption ratios reported in MECS Tables 6.1 and 3.2. However, both methods solve one element of uncertainty while introducing additional uncertainties and thus were not introduced. Therefore, there is some uncertainty in GHG intensities, particularly in the relative ranking of sectors with similar GHG intensities.

IV. Summary of Results

Forty-four industrial sectors, plus several mining sectors, are considered to be “presumptively eligible” under the H.R. 2454 carbon leakage provisions. Total emissions of these eligible sectors are estimated at 730 MMTCO₂e.

V. Summary of Major Changes in Results

The analysis described here is an update to a June 10, 2009 analysis that EPA developed for House Energy and Commerce Committee staff. Below we detail the major changes in the results.

Eligibility Changes from EPA’s June analysis:

The table below shows sectors that were found to be eligible in the current analysis, but not in the June 10, 2009 analysis, and vice versa. Differences are the result of newly available disaggregated 2007 Economic Census data and 2007 trade data. Finally, we show the net effect of the change in eligible sectors on emissions totals.

	PRESUMPTIVELY ELIGIBLE SECTORS- NEW	Energy Intensity	Trade Intensity	Emissions (MMTCO₂e)
311213	Malt Manufacturing	9%	30%	1.0
311613	Rendering and Meat Byproduct Processing	8%	28%	4.2
313111	Yarn Spinning Mills	5%	32%	3.3
322130	Paperboard Mills	12%	25%	33.3
331511	Iron Foundries	6%	15%	9.4
	NO LONGER PRESUMPTIVELY ELIGIBLE SECTORS			
325132	Synthetic Organic Dye and Pigment Manufacturing	3%	47%	-1.0
325191	Gum and Wood Chemical Manufacturing	4%	28%	-0.6
325193	Ethyl Alcohol Manufacturing	8%	10%	-7.9
327124	Clay Refractory Manufacturing	4%	35%	-0.6
	EMISSIONS			
	+			51.2
	-			-10.1
	Net Effect			+41.1

Iron and Steel:

EPA's previous estimates of emissions from iron and steel mills (NAICS code 331111) included process emissions as described in Section III. Previously, process emissions from the U.S. GHG Inventory were added to combustion estimates for iron and steel mills. However, iron and steel process emissions, as defined by the most recent U.S. GHG Inventory published in April 2009 (updated according to the 2006 IPCC guidelines, the latest guidance), are comprised predominantly of emissions from the use of fuels and raw materials in the production process (e.g. natural gas, fuel oil, coal, coke oven gas, blast furnace gas). A detailed comparison of emissions sources in MECS and the U.S. inventory has led to the conclusion that MECS emissions estimates for fuel combustion in the sector account for all direct iron and steel emissions (including those considered process emissions in the U.S. GHG Inventory) except for a small amount of emissions from raw non-energy materials, such as dolomite and limestone, sinter, scrap steel consumption, and consumption of carbon electrodes at Electric Arc Furnaces. Therefore, in this analysis separate process emissions from the U.S. GHG Inventory are not included in the calculation of this sector's emissions, as this would lead to significant double counting of emissions.

Paperboard Mills Classification Change in Trade Data:

Beginning with U.S. international trade data for July 2009, the Foreign Trade Division of the U.S. Census redefined its classification codes related to paper and paperboard (322121, 322130, 322222, 322233, 323118, and 339944).⁶ EPA conducted a preliminary analysis using 2004-2007 trade data with the redefined classification codes. In this

⁶ http://www.census.gov/foreign-trade/statistics/notices/20090928_naics.html

analysis, Paper Mills (322121) have a trade intensity of 17% (30% before the classification change) and Paperboard Mills (322130) have a trade intensity of 25% (0.8% before the change). Therefore, both sectors are likely to be “presumptively eligible” industrial sectors under the H.R. 2454 criteria, subject to a final rulemaking. The emissions of the Paperboard Mills sector are estimated at 33 MMTCO_{2e}.

VI. Additional Notes

Sectors without Trade Data:

Several sectors at or near the energy intensity threshold do not have trade data reported. These include 311313 (Beet Sugar Manufacturing), 331513 (Steel Foundries), and 332811 (Metal Heat Treating).

Beet Sugar: When it comes to sugar, trade data are available only at the aggregated 5-digit level (31131, Sugar Manufacturing). According to U.S. ITC staff, that is because the marketplace does not distinguish sugar made from one raw material from sugar made from a different raw material. US sugar manufacturing (31131) has an energy intensity of 4%, so it falls short of presumptive eligibility. US sugar's trade intensity is 17%.

Steel Foundries and Metal Heat Treating: These two sectors meet the energy intensity threshold (5% and 6%, respectively), but do not have trade data reported. Communications with Census Bureau staff indicated that these are considered "process" industries and do not necessarily manufacture a primary product or similar group of products over a specific time period. It is thus not possible to assign these industries to particular Harmonized Tariff System codes (the codes used to classify imports and exports). These industries, or the comparable NAICS, were never assigned in the Foreign Trade commodity correlation. The emissions of these two sectors are estimated at 6.3 MMTCO_{2e}.

Sectors with Export Value greater than Value of Shipments:

Several sectors have export values greater than their Value of Shipments, including 325192 (Cyclic Crude and Intermediate Manufacturing) and 331419 (Primary Smelting and Refining of Nonferrous Metal (except Copper and Aluminum)). This inconsistency results in greater than 100% trade intensity. Communications with Census Bureau staff indicated that they continue to investigate cases of this. There may be classification differences, timing differences, and different groups of companies under the same classification that account for the differences. There can also be a difference in the reported value interpretation between the export value and the shipment value.

Mining Sectors:

The bill requires (per Sec. 764(a)(2)(B)) that EPA “aggregate data for the beneficiation or other processing (including agglomeration) of metal ores, including iron and copper ores, soda ash, or phosphate, with subsequent steps in the process of metal and phosphate manufacturing, regardless of the NAICS code under which such activity is classified.”

However, while the bill requires that only the data related to beneficiation and other processing of the mineral ore be aggregated, these data are not publicly available and therefore the entirety of the mining sector data was included in the eligibility and emissions estimates. For eligibility, we did do a rough estimate of the percentage of energy expenditures that would need to be attributed to beneficiation for the aggregate mining/manufacturing sector to qualify, and compared that to published studies. The results for each mining sector are detailed below. However, to make a final eligibility determination, beneficiation-specific data would be needed for the mining sectors.

Iron ore: Because iron and steel mills (NAICS 331111) are already eligible and well within the criteria for eligibility, aggregating beneficiation processes of iron ore mining into the sector does not affect the eligibility of iron & steel mills, regardless of the share of energy expenditures in iron ore mining that is attributable to beneficiation.

Copper ore: Without this bill provision, neither Copper Ore and Nickel Ore Mining (212234) nor its corresponding manufacturing sector, Primary Smelting and Refining of Copper (331411) are “presumptively eligible.” Several data sources, including a 1980 DOE study and several independent studies from the 1990s, estimate that copper ore processing constitutes a majority of energy use in copper mining.⁷ While the ratio of energy use to energy cost is not necessarily 1:1, our calculations estimate that ~15-30% of copper ore and nickel ore mining energy expenditures would need to be from beneficiation and other processing for the aggregate sector to qualify. Therefore, we consider the sector, and its corresponding manufacturing sector, likely to be “presumptively eligible.”

Phosphate Rock: Combining the complete data set for phosphate rock mining and phosphate fertilizer manufacturing yields a joint energy intensity of 7% and trade intensity of 22%. However, at least one data source, DOE’s 2002 report *Energy and Environmental Profile of the U.S. Mining Industry*⁸ identifies beneficiation of phosphate as “not as energy intensive as other minerals” (p.8-10). The report states that “mining requires 98 percent of the total energy needed, while beneficiation uses the remaining two percent” (p.8-10). While the ratio of energy use to energy cost is not necessarily 1:1, we calculate that beneficiation would need to constitute ~15-20% of phosphate mining energy costs in order for the aggregate sector to be presumptively eligible. Therefore, the phosphate aggregate sector is likely not “presumptively eligible.”

Soda ash mining and beneficiation are classified under NAICS 212391 (“Potash, Soda, and Borate Mineral Mining”), while soda ash manufacturing is classified under the presumptively eligible NAICS 325181 (“Alkalies and Chlorine Manufacturing”). However, soda ash manufacturing is typically co-located with mining and beneficiation activities and in practice is reported under either NAICS. We have added soda ash beneficiation to the list of eligible sectors (included with Alkalies and Chlorine Manufacturing), but anticipate that emissions changes from this addition are minimal, as process emissions from soda ash are already included in EPA’s estimates. Data on energy

⁷ Personal communication with USGS Copper Commodity Specialist, 5/11/09

⁸ <http://www1.eere.energy.gov/industry/mining/pdfs/phosphate.pdf>, accessed 5/19/09

use and emissions of soda ash beneficiation specifically are currently not readily available.

Appendix A: Source of Combustion & Electricity Emissions Data for Presumptively Eligible Industrial Sectors

2002 NAICS Code	2002 NAICS Title	Year of Data Used	Combustion & Electricity Emissions Data Source
311213	Malt manufacturing	2007	Economic Census
311221	Wet Corn Milling	2006	MECS
311613	Rendering and Meat Byproduct Processing	2007	Economic Census
313111	Yarn Spinning Mills	2007	Economic Census
314992	Tire Cord and Tire Fabric Mills	2006	Annual Survey of Manufactures
321219	Reconstituted Wood Product Manufacturing	2006	Annual Survey of Manufactures
322110	Pulp Mills	2006	MECS
322121	Paper (except Newsprint) Mills	2006	MECS
322122	Newsprint Mills	2006	MECS
322130	Paperboard Mills	2006	MECS
325110	Petrochemical Manufacturing	2006	MECS
325131	Inorganic Dye and Pigment Manufacturing	2007	Economic Census
325181	Alkalies and Chlorine Manufacturing (incl soda ash beneficiation)	2006	MECS
325182	Carbon Black Manufacturing	2006	MECS
325188	All Other Basic Inorganic Chemical Manufacturing	2006	MECS
325192	Cyclic Crude and Intermediate Manufacturing	2006	MECS
325199	All Other Basic Organic Chemical Manufacturing	2006	MECS
325211	Plastics Material and Resin Manufacturing	2006	MECS
325212	Synthetic Rubber Manufacturing	2006	MECS
325221	Cellulosic Organic Fiber Manufacturing	2007	Economic Census
325222	Noncellulosic Organic Fiber Manufacturing	2006	MECS
325311	Nitrogenous Fertilizer Manufacturing	2006	MECS
327111	Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories Manufacturing	2006	Annual Survey of Manufactures
327112	Vitreous China, Fine Earthenware, and Other Pottery Product Manufacturing	2006	Annual Survey of Manufactures
327113	Porcelain Electrical Supply Manufacturing	2006	Annual Survey of Manufactures
327122	Ceramic Wall and Floor Tile Manufacturing	2006	Annual Survey of Manufactures
327123	Other Structural Clay Product Manufacturing	2006	Annual Survey of Manufactures
327125	Nonclay Refractory Manufacturing	2007	Economic Census
327211	Flat Glass Manufacturing	2006	MECS
327212	Other Pressed and Blown Glass and Glassware Manufacturing	2006	MECS
327213	Glass Container Manufacturing	2006	MECS
327310	Cement Manufacturing	2006	MECS
327410	Lime Manufacturing	2006	MECS
327992	Ground or Treated Mineral and Earth Manufacturing	2006	Annual Survey of Manufactures
327993	Mineral Wool Manufacturing	2006	MECS
331111	Iron and Steel Mills	2006	MECS
331112	Electrometallurgical Ferroalloy Product Manufacturing	2006	MECS
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	2006	Annual Survey of Manufactures
331311	Alumina Refining	2006	MECS
331312	Primary Aluminum Production	2006	MECS
331411	Primary Smelting and Refining of Copper	2007	Economic Census
331419	Primary Smelting and Refining of Nonferrous Metal (except Copper and Aluminum)	2007	Economic Census
331511	Iron Foundries	2006	MECS
335991	Carbon and Graphite Product Manufacturing	2006	Annual Survey of Manufactures
212210	Iron Ore Mining	2002	Economic Census
212234	Copper Ore and Nickel Ore Mining	2002	Economic Census

Appendix B: NAICS/ U.S. GHG Inventory Process Emissions Concordance

NAICS Codes	Presumptively Eligible Industrial Sector	U.S. Inventory Process Emissions Category	2006 Process Emissions
325110	Petrochemicals	Petrochemical Production	0.65
325181	Alkalies and chlorine	Soda Ash Production and Consumption	4.2
325182	Carbon black	Petrochemical Production	2.95
325188	All other basic inorganic chemicals	Titanium Dioxide, Magnesium	5.1
325199	All other basic organic chemicals	Adipic Acid Production	5.9
325311	Nitrogenous fertilizer	Ammonia Production & Urea Consumption	12.3
		Nitric Acid Production	18.2
327211	Flat glass	Limestone and Dolomite Use	0.1
327212	Other pressed and blown glass and glassware; incl. optical fiber	Limestone and Dolomite Use	0.1
327213	Glass containers	Limestone and Dolomite Use	0.1
327310	Cement	Cement Production	46.6
327410	Lime Manufacturing	Lime Production	15.1
331111	Iron and steel	Iron and Steel & Metallurgical Coke Production	76.8 (not included in report, see p.5 of this document)
331112	Electrometallurgical ferroalloy products	Ferroalloy Production	1.5
331312	Primary aluminum production	Aluminum Production	6.7
331419	Primary Smelting and Refining of Nonferrous Metal (except Copper and Aluminum)	Zinc Production	0.5
		Lead Production	0.3
Additional mfg categories			
325120	Industrial Gas Manufacturing	HCFC-22 Production	13.8
325312	Phosphatic Fertilizer Manufacturing	Phosphoric Acid Production	1.2
327910	Abrasive Product Manufacturing	Silicon Carbon Production and Consumption	0.2