Heavy-Duty Vehicle Greenhouse Gas (HDGHG) Emissions Inventory for Air Quality Modeling Technical Support Document

United States
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Air Quality Assessment Division
Office of Air Quality Planning and Standards
Office of Air and Radiation
U.S. Environmental Protection Agency

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ACRONYMS

AEO	Annual Energy Outlook
BEIS	Biogenic Emission Inventory System
btp	Bulk plant terminal-to-pump
C3	Category 3 (commercial marine vessels)
CAP	Criteria Air Pollutant
CARB	California Air Resources Board
CMAQ	Community Multiscale Air Quality
CSAPR	Cross-State Air Pollution (formerly Transport) Rule
E0	0% Ethanol gasoline
E10	10% Ethanol gasoline
EISA	Energy Independence and Security Act of 2007
EGU	Electric Generating Utility
FAA	Federal Aviation Administration
FIPS	Federal Information Processing Standard
HAP	Hazardous Air Pollutant
HDGHG	Heavy Duty Greenhouse Gas
HONO	HNO2, nitrous acid
IPM	Integrated Planning Model
LDGHG	Light Duty Greenhouse Gas
MOBILE6	Mobile Source Emission Factor Model, version 6
MOVES	Motor Vehicle Emissions Simulator
MY	Model Year
NEEDS	National Electric Energy Database System
NEI	National Emission Inventory
NMIM	National Mobile Inventory Model
OAQPS	EPA's Office of Air Quality Planning and Standards
ORL	One Record per Line (a SMOKE input format)
MP	Multipollutant
NO	Nitric oxide
NO2	Nitrogen dioxide
NOX	Nitrogen oxides
PFC	Portable Fuel Container
PEC	Elemental carbon component of PM2.5
PMFINE	Leftover "Other", or "crustal" component of PM2.5
PNO3	Particulate nitrate component of PM2.5
PSO4	Particulate sulfate component of PM2.5
POC	Organic carbon component of PM2.5
rbt	Refinery-to-bulk terminal
RFS2	Revised annual renewable fuel standard
SMOKE	Sparse Matrix Operator Kernel Emissions
SCC	Source Category Code
TAF	Terminal Area Forecast
TSD	Technical Support Document
VOC	Volatile Organic Compound
WRAP	Western Regional Air Partnership

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1 Introduction

This document provides the details of emissions data processing done in support of the Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) joint rulemaking effort under the Clean Air Act (CAA) and the Energy Independence and Security Act of 2007 (EISA) to establish fuel efficiency and greenhouse gas emissions standards for commercial medium-and heavy-duty on-highway vehicles and work trucks beginning with the 2014 model year (MY). This rulemaking effort is hereafter referred to in this technical support document (TSD) as the Heavy Duty Vehicle Greenhouse Gas (HDGHG) rule and consists of three emissions cases. Table 1-1 provides of list of the emissions cases created for this modeling effort.

Table 1-1. List of cases run in support of the HDGHG air quality modeling

Case Name	Internal EPA Abbreviation	Description
2005 Base case	2005cs_hdghg	2005 case created using average year fires data and an average year temporal allocation approach for Electrical Generating Units (EGUs), used to compute relative response factors with 2030 scenarios.
2030 Reference case	2030cs_hdghg_ref	2030 "reference" (baseline) scenario representing the best estimate for the future year without implementation of national heavy duty vehicle emissions standards.
2030 Control case	2030cs_hdghg_ctl	2030 "control" case scenario representing implementation of national emissions standards, phased in between 2014 and 2018, for (commercial medium and) heavy-duty vehicles.

The data used in the 2005 emissions cases are often the same as those described in the Transport Rule Final CAP-BAFM 2005-based, Version 4.2 Platform TSD (http://www.epa.gov/ttn/chief/emch/index.html#2005), but some different emissions data are used for this rulemaking. Specifically, the HDGHG modeling used data intended only for the rule development and not for general use. All of the documentation provided here describes what was done differently and specifically for the HDGHG effort in contrast to what is used in the v4.2 platform.

In HDGHG, we used a 2005 base case approach for the year 2005 emissions scenario. This approach is very similar to that in the recently promulgated Cross State Air Pollution Rule (CSAPR) Final Rule (formerly known as the "Transport Rule"). A base case approach uses average year fires and EGU temporal profiles from three years of EGU data. We use a base case approach because we want to reduce year-specific variability in some components of the inventory. For example, large fires vary in location and day of the year each year, and EGU shutdowns and high use on high energy demand days also vary by year. By using a base case approach, these two aspects of the inventory are maintained in future year modeling and therefore do not introduce potentially spurious year-specific artifacts in air quality modeling estimates. For HDGHG, the same biogenic emissions data as the v4.2 platform was used for the 2005 case, and also for both future-year cases. The only significant data changes between the 2005 and the 2030 future-year HDGHG cases are the emission inventories and speciation approaches.

For this effort, we have created and provided county-level emission summaries for criteria pollutants and select hazardous air pollutants (e.g. benzene, acetaldehyde, formaldehyde, acrolein, 1,3-butadiene, ethanol, naphthalene) by emissions modeling sector for the cases listed above. Summaries are included by month using average day emissions and separately with annual totals. These data have been provided to the EPA docket for this rule. In addition, the data will be posted on the Clearinghouse for Inventories and Emissions Factors (CHIEF) website in early August 2011 under the "HDGHG 2005 and 2030 emissions data" link at: http://www.epa.gov/ttn/chief/emch/index.html#2005.

In the remainder of this document, we provide a description of the approaches taken for the emissions in support of air quality modeling for HDGHG. In Section 2, we describe the ancillary data and 2005 inventory differences from the v4.2 platform. In Section 3, we describe the speciation differences among each of the cases run for HDGHG. In Section 4, we describe the 2030 Reference case as compared to the 2005 base case, and in Section 5, we describe the 2030 Control Case in comparison to the 2030 Reference case.

2 2005 Emission inventories and their preparation

As mentioned previously, the 2005 emissions modeling approach for HDGHG used much of the same data and approaches as the 2005 v4.2 platform. In this section, we identify the differences between the data used for HDGHG and that used for the 2005 v4.2 platform. Section 2.1 provides ancillary data differences that impact multiple sectors and Sections 2.2 through 2.3 provides differences for the point, area, and mobile sectors.

Table 2-1 below lists the platform sectors used for the HDGHG modeling platform. It also indicates which platform sectors include HAP emissions and the associated sectors from the National Emission Inventory (NEI). Subsequent sections refer to these platform sectors for identifying the emissions differences between the v4.2 platform and the HDGHG platform.

Table 2-1. Sectors Used in Emissions Modeling for the HDGHG Platform

Platform Sector	2005 NEI Sector	Description	Contains HAP emissions?
IPM sector: *ptipm*	Point	NEI EGU units at facilities mapped to the IPM model using the National Electric Energy Database System (NEEDS) database.	Yes
Non-IPM sector: *ptnonipm*	Point[+]	All NEI point source units not matched to the ptipm sector, including aircraft.	Yes
Average-fire sector: *avefire*	N/A	Average-year wildfire and prescribed fire emissions, county and annual resolution.	Yes
Agricultural sector: *ag*	Nonpoint	NH3 emissions from NEI nonpoint livestock and fertilizer application.	No
Area fugitive dust sector: *afdust*	Nonpoint	PM_{10} and $PM_{2.5}$ emissions from fugitive dust sources in the NEI nonpoint inventory.	No
Remaining nonpoint sector: *nonpt*	Nonpoint[+]	All nonpoint sources not otherwise included in other emissions modeling sectors.	Yes
Nonroad sector: *nonroad*	Mobile: Nonroad	Monthly nonroad emissions from the National Mobile Inventory Model (NMIM) using NONROAD2005 version nr05c-BondBase, which is equivalent to NONROAD2008a, since it incorporated Bond rule revisions to some of the base-case inputs and the Bond rule controls did not take effect until later. NMIM was used for all states except California. Monthly emissions for California created from annual emissions submitted by the California Air Resources Board (CARB) for the 2005v2 NEI.	Yes
Aircraft, locomotive, marine: *alm_no_c3*	Mobile: Nonroad	Primarily 2002 NEI non-rail maintenance locomotives, and category 1 and category 2 commercial marine vessel (CMV) emissions sources, county and annual resolution. Aircraft emissions are no longer in this sector and are now included in the Non-EGU sector (as point sources); also, category 3 CMV emissions are no longer in this sector and are now contained in the seca_c3 sector.	Yes

Platform Sector	2005 NEI Sector	Description	Contains HAP emissions?
C3 commercial marine: *seca_c3*	Mobile: nonroad	Annual point source-formatted, year 2005 category 3 (C3) CMV emissions, developed for the rule called "Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder", usually described as the Emissions Control Area (ECA) study (http://www.epa.gov/otaq/oceanvessels.htm). Utilized final projections from 2002, developed for the C3 ECA Proposal to the International Maritime Organization (EPA-420-F-10-041, August 2010).	Yes
Onroad, except gasoline PM: *on_noadj*	Mobile: onroad+	Three, monthly, county-level components: 1) California onroad, created using annual emissions for all pollutants, submitted by CARB for the 2005v2 NEI. NH3 (not submitted by CARB) from MOVES2010a. 2) Onroad gasoline and diesel vehicle emissions from MOVES2010a not subject to temperature adjustments: exhaust CO, NOX, VOC, NH3, benzene, formaldehyde, acetaldehyde, 1,3-butadiene, acrolein, naphthalene, brake and tire wear PM, and evaporative VOC, benzene, and naphthalene. 3) Onroad emissions for Hg from NMIM using MOBILE6.2, other than for California.	Yes
Onroad starting exhaust PM: *on_moves_startpm*	Mobile: onroad+	Monthly, county-level MOVES2010a-based onroad gasoline emissions subject to temperature adjustments. Limited to exhaust mode only for PM species and naphthalene. California emissions not included. This sector is limited to cold start mode emissions that contain different temperature adjustment curves from running exhaust (see on_moves_runpm sector).	No
Onroad running exhaust PM *on_moves_runpm*	Mobile: onroad+	Monthly, county-level draft MOVES2010a-based onroad gasoline emissions subject to temperature adjustments. Limited to exhaust mode only for PM species and naphthalene. California emissions not included. This sector is limited to running mode emissions that contain different temperature adjustment curves from cold start exhaust (see on_moves_startpm sector).	No
Biogenic: *biog*	N/A	Hour-specific, grid cell-specific emissions generated from the BEIS3.14 model, including emissions in Canada and Mexico. Unchanged from the 2005v4 platform.	No
Other point sources not from the NEI: *othpt*	N/A	Point sources from Canada's 2006 inventory and Mexico's Phase III 1999 inventory, annual resolution. Also includes annual U.S. offshore oil 2005v2 NEI point source emissions. Unchanged from the 2005v4 platform.	No
Other nonpoint and nonroad not from the NEI: *othar*	N/A	Annual year 2006 Canada (province resolution) and year 1999 Mexico Phase III (municipio resolution) nonpoint and nonroad mobile inventories. Unchanged from the 2005v4 platform.	No
Other onroad sources not from the NEI: *othon*	N/A	Year 2006 Canada (province resolution) and year 1999 Mexico Phase III (municipio resolution) onroad mobile inventories, annual resolution. Unchanged from the 2005v4 platform.	No

+ Some data included in modeling sector has been revised beyond what is included in the 2005 NEI v1 or v2.

As with the 2005 v4.2 platform, the primary emissions modeling tool used to create the air quality model-ready emissions was the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system (http://www.smoke-model.org/index.cfm). We used SMOKE version 2.6 to create emissions files for a 36-km national grid, and 12-km Eastern and 12-km Western grids for the 2005 base case (also known as the "2005cs_hdghg_05b" case).

2.1 Custom configuration for emissions modeling for HDGHG

Unlike the 2005 v4.2 platform, the configuration for HDGHG modeling included additional hazardous air pollutants (HAPs) and used slightly revised ancillary speciation data. Both of these differences are described in this section.

Table 2-2 lists the additional HAP pollutants processed for the HDGHG platform, which were not included in the 2005 v4.2 platform. However, since using the full multipollutant HAP version of the Community Multiscale Air Quality (CMAQ) model would have taken longer than the time available for our project, we used a "lite" version of the multipollutant CMAQ (Version 4.7) that required emissions only for the species listed in the footnote of Table 2-2.

Table 2-2. Model species produced by SMOKE for CB05 with SOA for HDGHG platform

Inventory Pollutant	Model Species	Model species description
CL2	CL2	Atomic gas-phase chlorine
HCl	HCL	Hydrogen Chloride (hydrochloric acid) gas
CO	CO	Carbon monoxide
NO_X	NO	Nitrogen oxide
	NO2	Nitrogen dioxide
	HONO	Nitrous acid
SO_2	SO2	Sulfur dioxide
	SULF	Sulfuric acid vapor
NH_3	NH3	Ammonia
VOC	ACROLEIN*	Acrolein from the HAP inventory
	ALD2	Acetaldehyde from VOC speciation
	ALD_PRIMARY*	Acetaldehyde from the HAP inventory
	ALDX	Propionaldehyde and higher aldehydes
	BENZENE	Benzene (not part of CB05)
	BUTADIENE13*	1,3-butadiene from the HAP inventory
	ETH	Ethene
	ETHA	Ethane
	ETOH	Ethanol
	FORM	Formaldehyde
	FORM_PRIMARY*	Formaldehyde from the HAP inventory
	IOLE	Internal olefin carbon bond (R-C=C-R)
	ISOP	Isoprene
	MEOH	Methanol
	OLE	Terminal olefin carbon bond (R-C=C)
	PAR	Paraffin carbon bond
	TOL	Toluene and other monoalkyl aromatics
	XYL	Xylene and other polyalkyl aromatics
Various additional VOC species from the biogenics model which do not map to the above model species	SESQ	Sesquiterpenes
	TERP	Terpenes
PM_{10}	PMC	Coarse PM > 2.5 microns and ≤ 10 microns
$PM_{2.5}$	PEC	Particulate elemental carbon ≤ 2.5 microns
	PNO3	Particulate nitrate ≤ 2.5 microns
	POC	Particulate organic carbon (carbon only) ≤ 2.5 microns
	PSO4	Particulate Sulfate ≤ 2.5 microns
	PMFINE	Other particulate matter ≤ 2.5 microns
Sea-salt species (non – anthropogenic emissions)	PCL	Particulate chloride
	PNA	Particulate sodium

- - ACROLEIN, ALD2_PRIMARY, BUTADIENE13, and FORM_PRIMARY are the extra "CMAQ-lite" HAPs that are not in the v4.2 platform.

In addition to the model species differences, the HDGHG platform had a few additional custom aspects in the 2005 cases. Table 2-3 lists the datasets used by the HDGHG platform that are different from the v4.2 platform. In addition, Appendix C provides a more detailed comparison of the ancillary datasets for the 2005 v4.2 platform versus the HDGHG platform.

Another consideration is the speciation across the HDGHG future-year cases as compared to 2005. Section 3 provides a detailed account of these differences. Otherwise, the future-year ancillary data were largely the same as those in 2005, with no substantial differences. All ancillary data files can be found at the 2005-based platform website (http://www.epa.gov/ttn/chief/emch/index.html#2005).

Table 2-3. Description of differences in ancillary data between the HDGHG 2005 case and the 2005 v4.2 platform

Ancillary Data Type	Difference between 2005 v4.2 platform and HDGHG platform
Speciation cross-references and Speciation profiles	The HDGHG data files are configured to support the multi-pollutant (MP) version of CMAQ, whereas the 2005 v4.2 platform data file is configured to support only the non-MP version. Therefore, the HDGHG data files include profiles for additional VOC HAP species.
Inventory tables	The HDGHG data file is configured to support the MP "lite" version of CMAQ, whereas the 2005 v4.2 platform data file is configured to support only the non-MP version.

2.2 Point, Nonpoint, Nonroad, and non-U.S. sources

With the exception of the extra VOC HAPs retained in HDGHG processing, the 2005 HDGHG emissions for all sectors except for U.S. onroad mobile sectors (on_noadj, on_moves_runpm, and on_moves_startpm) are identical to those provided in the 2005 Version 4.2-based Transport Rule Final TSD. All point source sectors (ptnonipm, point), nonpoint source sectors (nonpt, afdust, ag, avefire), nonroad sectors (alm_no_c3, nonroad, seca_c3) and Canada and Mexico sector (othar, othon, othpt) inventories are the same in the 2005 HDGHG platform as the 2005v4.2 emissions modeling platform. The 2005v4.2 TSD can be found at: ftp://ftp.epa.gov/EmisInventory/2005v4_2/transportrulefinal_eitsd_28jun2011.pdf.

2.3 2005 Onroad Mobile sources

Onroad mobile sources include three sectors for US onroad emissions (on_noadj, on_moves_startpm, on_moves_runpm). As discussed in the previous section, the three US nonroad sectors (nonroad, alm_no_c3, and seca_c3) and the Canada/Mexico onroad emissions (othon) are unchanged from the 2005v4.2 platform.

For onroad mobile, the MOVES-based emissions in the on_noadj sector and the on_moves_startpm and on_moves_runpm sectors (completely MOVES-based) emissions inventory data are from the Motor Vehicle Emission Simulator (MOVES2010, specifically, version MOVES2010a) model. The NH3 onroad emissions in California (on_noadj sector) use MOVES2010(a)-based emissions in HDGHG compared to the NMIM (MOBILE6)-based emissions in the 2005v4.2 platform.

The HDGHG onroad emissions keep additional HAPs as described in Section 2.1. In addition for these MOVES sectors, the temperature adjustment calculations applied to $PM_{2.5}$ species were the same as in the v4.2 platform.

For HDGHG, MOVES2010a was used in conjunction with an internal default database MOVESDB20100913, which contained performance updates from the MOVESDB20100826, the database originally released with MOVES2010a and used in the 2005v4.2 platform. Specifically, the MOVES2010a emissions updates for HDGHG include improved PM exhaust estimates (particularly for future year estimates). In addition, we used NO and NO_2 directly from MOVES2010a for HDGHG, rather than the default NO/NO_2 speciation from NO_X used in 2005v4.2 processing. Table 2-4 shows the default NO, NO_2, and HONO fractions used in 2005v4.2 versus the equations for HDGHG, where NO_MOVES and NO2_MOVES are the MOVES2010-provided NO and NO_2 emissions. The HONO, computed from total

MOVES NOX (sum of NO and NO2 from MOVES) is subtracted out of MOVES NO2 to conserve mass. The speciation of MOVES HONO, NO and NO2 is based on the molecular weight of NO_2 (46); that is, these NO_X components were speciated assuming they were inventoried as NO2-equivalent; all prior speciation of MOVES NO_X was also based on NO2 molecular weight equivalency.

Table 2-4. HONO, NO, and NO2 computations in HDGHG versus 2005v4.2 platform

CMAQ Specie	HDGHG	2005v4.2
NO	NO_MOVES	NOX * 0.9
NO2	0.992 * NO2_MOVES – 0.008 * NO_MOVES	NOX * 0.092
HONO	0.008 * (NO2_MOVES + NO_MOVES)	NOX * 0.008

With one notable exception discussed here, for onroad gasoline exhaust PM emissions, the allocation of MOVES PM2.5 emissions to SMOKE-ready format PM species is the same as the 2005v4.2 platform and is documented in Appendix D of the 2005v4.1 TSD: http://www.epa.gov/ttn/chief/emch/toxics/2005v4.1_appendices.pdf. The exception to these equations is that for HDGHG processing, NH_4 (ammonium) is removed from the computation of POC ($PM_{2.5}$-based organic carbon) in equation 9, which in turn, affects the PMFINE ("other", or "crustal" $PM_{2.5}$) computation in equation 10. In short, MOVES2010a for HDGHG included improved PM exhaust estimates, and for diesel exhaust, the larger sulfate (PSO4) component was creating more NH_4 in equation 7 than available "PM25OM" from MOVES2010a, where MOVES-provided species are related as follows:

PM25_TOTAL = PM25EC + **PM25OM** + PSO4

CMAQ requires the five CMAQ species to also sum to total PM2.5:

PM2.5 = **POC**+PEC+PNO3+PSO4+PMFINE

Appendix A in this document contains the revised text and equations, specifically, equation 7b for diesel exhaust. A recent study (SRI, 2009) also showed that, despite being sampled for NH_4 and other ionic species in the particle phase, no particle phase NH_4 was found in downstream filter tests. OTAQ experts agreed that NH_4 for diesel exhaust must therefore removed, but we did not have time to reprocess gasoline exhaust PM (on_moves_runpm and on_moves_startpm sector) emissions with NH_4 removed so the gasoline exhaust PM emissions do include some ammonium. However, PSO4 for gasoline exhaust is considerably smaller than diesel exhaust so the impact is likely negligible for air quality modeling. It is important to note that total PM2.5 was conserved for both gasoline and diesel exhaust (e.g., PM2_5_TOTAL from MOVES and PM2.5 for CMAQ are identical). Note that PM emissions from these diesel sources are not subject to temperature adjustments like the on_moves_startpm and on_moves_runpm sectors.

3 VOC speciation changes that represent fuel changes

A significant detail that is different in each of the HDGHG modeling cases than in the 2005v4.2 emissions modeling is the VOC speciation profiles used to split total VOC emissions into the VOC model species needed for CMAQ. In this section, we summarize the various speciation profile information used in configuring the various cases.

The VOC speciation approach used for the base-year case HD GHG 2005 has some notable differences from the 2005 v4.2 platform for many emissions modes (e.g., evaporative, exhaust) and processes (e.g., diesel, gasoline, refueling). Two significant updates in the 2005 HDGHG are: 1) headspace vapor speciation utilizes a combination of the E10 headspace vapor profile (8763) and E0 headspace vapor profile (8762) as opposed to using solely E0 for 2005[1], and 2) a new Heavy Duty Diesel vehicle exhaust mode profile (8774) for pre-2007 model year (MY) vehicles that replaces an older 2004-vintage medium-duty diesel profile (4674). See for Table 3-1 more details.

The VOC speciation approach used for each of the future-year cases is customized to account for the impact of fuel changes. These changes affect the on_noadj sector, the nonroad sector, and parts of the nonpt and ptnonipm sectors. The speciation changes from fuels in the nonpt sector are for portable fuel containers (PFCs) and fuel distribution operations associated with the bulk-plant-to-pump (btp) distribution. The speciation changes from fuels in the ptnonipm sector include btp distribution operations inventoried as point sources. Refinery to bulk terminal (rbt) fuel distribution speciation does not change across the modeling cases because this is considered upstream from the introduction of ethanol into the fuel. Mapping of fuel distribution SCCs to btp and rbt emissions categories can be found in Appendix A of the revised annual Renewable Fuel Standard (RFS2) Emissions Inventory for Air Quality Modeling Technical Support Document (EPA Report No. 420-R-10-005, January 2010, http://www.epa.gov/otaq/renewablefuels/420r10005.pdf).

Table 3-1 summarizes the different profiles utilized for the fuel-related sources in each of the sectors for 2005 and the future year cases. A comparison of the 2005v4.2 platform with the HDGHG 2005 case is also included.

[1] This was an oversight in the 2005v4.2 platform corrected for this modeling effort.

Table 3-1. Summary of VOC speciation profile approaches by sector across cases

Inventory Type and Mode	VOC speciation approach by fuels	VOC Profile Codes	2005 V4.2	2005 HDGHG	2030 Reference	2030 Control
Mobile Exhaust Diesel	medium-duty diesel exhaust, 2004-vintage	4674	onroad nonroad			
	pre-2007 Heavy Duty profile	8774		onroad nonroad		
	pre-2007 Medium Duty	8775			onroad except Class 6,7 & 8 start	onroad except Class 6,7 & 8 start
	weighted year 2030 heavy-duty start (parking area) emissions **without** HD controls	877RH			onroad class 8 start only	
	weighted year 2030 heavy-duty start (parking area) emissions **with** HD controls	877CH				onroad class 8 start only
	weighted year 2030 medium-duty start (parking area) emissions **without** HD controls	877RM			onroad class 6 & 7 start only	
	weighted year 2030 medium-duty start (parking area) emissions **with** HD controls	877CM				onroad class 6 & 7 start only
Mobile Exhaust Gasoline	Tier 1 E0 **and** E10 combinations	8750 8751	onroad nonroad	onroad nonroad		
	Tier 1 E0 **or** E10 by county	8750 8751			onroad nonroad	onroad nonroad
Mobile Evaporative Diesel	diesel evap headspace profile, Circle K Diesel single-sample	4547	onroad	onroad	onroad	onroad
	E0 **and** E10 combinations	8753 8754	nonroad	nonroad		
	E0 **or** E10 by county	8753 8754			nonroad	nonroad
Mobile Evaporative Gasoline	E0 **and** E10 combinations	8753 8754	onroad nonroad	onroad nonroad		
	E0 **or** E10 by county	8753 8754			onroad nonroad	onroad nonroad
Mobile Refueling, PFCs, gas distribution	E0 headspace	8762	All listed			
	E0 headspace **and** E10 headspace combinations	8762 8763		All listed		
	E0 headspace **or** E10 by county	8762 8763			All listed	All listed

Appendix C lists ancillary input data file names used for HDGHG emissions modeling that are updated from the v4.2 platform. All ancillary data files not unique to HDGHG emissions modeling are available on the 2005v4.2-based platform website previously referenced.

4 2030 Reference Case

The 2030 Reference case is intended to represent the emissions associated with use of the most likely volume of ethanol in the absence of the greenhouse gas emissions standards for commercial medium-and heavy-duty on-highway vehicles and work trucks beginning with the 2014 model year (MY). The reference case assumes no improvements in fuel consumption or greenhouse gas emissions in MY 2014 through 2018. The reference and control cases do not include fuel and emissions changes from the Energy Independence and Security Act of 2007 (EISA), or revised annual Renewable Fuel Standards (RFS2); however the Light Duty Greenhouse Gas (LDGHG) impacts are included in both cases.

The 2030 Reference case uses many of the same growth and control assumptions as those for the Final Cross-State Air Pollution Rule (CSAPR), because other than onroad mobile sources, both HDGHG and CSAPR use the same 2005v4.2-based emissions inventories. There are some differences between the 2012 and 2014 base case projections in CSAPR and the 2030 reference case for HDGHG:

1) The year 2030 includes some additional controls that were promulgated after 2014 (e.g., fuel sulfur rules in a couple of states).
2) Growth factors for several sources are year-specific; so while the methodology is the same as CSAPR, the future year emissions estimates differ (e.g., oil and gas in a couple states, onroad refueling, residential wood combustion).
3) Minor errors identified after CSAPR modeling was complete were fixed (e.g, we include agricultural dust projections for the couple of states that provided point source farms).

The remainder of Section 4 is very similar to Section 4 in the CSAPR emissions modeling TSD, available from ftp://ftp.epa.gov/EmisInventory/2005v4_2/transportrulefinal_eitsd_28jun2011.pdf, but with the updates described above.

The future base-case projection methodologies vary by sector. The 2030 reference case represents predicted emissions in the absence of any further controls beyond those Federal and State measures already promulgated before emissions processing on the Transport Rule began in December, 2010. For EGU emissions (ptipm sector), the emissions reflect state rules and federal consent decrees through December 1, 2010. For mobile sources (on_noadj, on_moves_runpm, and on_moves_startpm sectors), all national measures for which data were available at the time of modeling have been included. The future base-case scenarios do reflect projected economic changes and fuel usage for EGU and mobile sectors. For nonEGU point (ptnonipm sector) and nonpoint stationary sources (nonpt, ag, and afdust sectors), local control programs that might have been necessary for areas to attain the 1997 $PM_{2.5}$ NAAQS annual standard, 2006 PM NAAQS (24-hour) standard, and the 1997 ozone NAAQS are generally not included in the future base-case projections for most states. One exception are some NOx and VOC reductions associated with the New York, Virginia, and Connecticut State Implementation Plans (SIP), which were added as part of the comments received from the CSAPR and a larger effort to start including more local control information on stationary non-EGU sources; this is described further in Section 4.2. The following bullets summarize the projection methods used for sources in the various sectors, while additional details and data sources are given in Table 4-1.

- IPM sector (ptipm): Unit-specific estimates from IPM, version 4.10.
- Non-IPM sector (ptnonipm): Projection factors and percent reductions reflect CSAPR (Transport Rule) comments and emission reductions due to control programs, plant closures, consent decrees and settlements, and 1997 and 2001 ozone State Implementation Plans in NY, CT, and VA. We also used projection approaches for point-source livestock, and aircraft and gasoline stage II emissions that are consistent with projections used for the sectors that contain the bulk of these emissions. Terminal area forecast (TAF) data aggregated to the national level were used for aircraft to account for projected changes in landing/takeoff activity. Year-specific speciation was applied to some portions of this sector and was discussed in Section 3.
- Average fires sector (avefire): No growth or control.
- Agricultural sector (ag): Projection factors for livestock estimates based on expected changes in animal population from 2005 Department of Agriculture data; no growth or control for NH_3 emissions from fertilizer application.
- Area fugitive dust sector (afdust): Projection factors for dust categories related to livestock estimates based on expected changes in animal population; no growth or control for other categories in this sector.
- Remaining Nonpoint sector (nonpt): Projection factors that implement Transport Rule Proposal comments and reflect emission reductions due to control programs. Residential wood combustion projections based on growth in lower-emitting stoves and a reduction in higher emitting stoves. PFC projection factors reflecting impact of the final Mobile Source Air Toxics (MSAT2) rule. Gasoline stage II projection factors based on National Mobile Inventory Model (NMIM)-estimated VOC refueling estimates for future years. Oil and gas projection estimates are provided for the non-California Western Regional Air Partnership (WRAP) states as well as Oklahoma and Texas. Year-specific speciation was applied to some portions of this sector and was discussed in Section 3.
- Nonroad mobile sector (nonroad): Other than for California, this sector uses data from a run of NMIM that utilized the NR05d-Bond-final version of NONROAD (which is equivalent to NONROAD2008a), using future-year equipment population estimates and control programs to the year 2030 and using national level inputs. Final controls from the final locomotive-marine and small spark ignition OTAQ rules are included. California-specific data provided by the state of California, except NH_3 used 2030 NMIM. Year-specific speciation was applied to some portions of this sector and is discussed in Section 4.3.5.
- Locomotive, and non-Class 3 commercial marine sector (alm_no_c3): Projection factors for Class 1 and Class 2 commercial marine and locomotives which reflect Transport Rule comments and activity growth and final locomotive-marine controls.
- Class 3 commercial marine vessel sector (seca_c3): Base-year 2005 emissions grown and controlled to 2030, incorporating Transport Rule comments and controls based on Emissions Control Area (ECA) and International Marine Organization (IMO) global NO_X and SO_2 controls.
- Onroad mobile sector with no adjustment for daily temperature (on_noadj): MOVES2010a run (state-month) for 2030 with results disaggregated to the county level in proportion to NMIM 2030 emissions estimates. The reference case does not include HDGHG or RFS2 impacts, but does include LDGHG impacts. Temperature impacts at the monthly average resolution. California-specific data provided by the state of California, except NH_3 which was obtained from MOVES2010a. VOC speciation uses different future-year values to take into account both the increase in ethanol use, and the existence of Tier 2 vehicles that use a different speciation profile. Other than California, this sector includes all non-refueling onroad mobile emissions (exhaust, evaporative, brake wear and tire wear modes) except exhaust mode gasoline PM and naphthalene emissions that are provided in the on_moves_startpm and on_moves_runpm sectors.

- Onroad PM gasoline running mode sector (on_moves_startpm): Running mode MOVES2010a year 2030 future-year state-month estimates for PM and naphthalene, apportioned to the county level using NMIM 2030 state-county ratios matched to vehicle and road types. The reference case does not include HDGHG or RFS2 impacts, but does include LDGHG impacts. Use future-year temperature adjustment file for adjusting the 72°F emissions to ambient temperatures (for elemental and organic carbon) based on grid cell hourly temperature (note that lower temperatures result in increased emissions).
- Onroad PM gasoline start mode sector (on_moves_startpm): Cold start MOVES2010a future-year 2012 and 2014 state-month estimates for PM and naphthalene, apportioned to the county level using NMIM 2030 state-county ratios of local urban and rural roads by vehicle type. The reference case does not include HDGHG or RFS2 impacts, but does include LDGHG impacts. Use future-year temperature adjustment file for adjusting the 72°F emissions (for elemental and organic carbon) to ambient temperatures based on grid cell hourly temperatures (lower temperatures result in increased emissions).
- Other nonroad/nonpoint (othar): No growth or control.
- Other onroad sector (othon): No growth or control.
- Other nonroad/nonpoint (othar): No growth or control.
- Other point (othpt): No growth or control.
- Biogenic: 2005 emissions used for all future-year scenarios.

Table 4-1 summarizes the control strategies and growth assumptions by source type that were used to create the 2030 base-case emissions from the 2005v4.2 base-case inventories. All Mexico, Canada, and offshore oil emissions are unchanged in all future cases from those in the 2005 base case. Note that mercury (Hg) is listed in the pollutants column; however, we did not include Hg in our v4.2-based HDGHG modeling.

Lists of the control, closures, projection packets (datasets) used to create the HDGHG 2030 future reference case scenario inventories from the 2005 HDGHG base case are provided in Appendix D.

The remainder of this section is organized either by source sector or by specific emissions category within a source sector for which a distinct set of data were used or developed for the purpose of projections for the HDGHG Rule. This organization allows consolidation of the discussion of the emissions categories that are contained in multiple sectors, because the data and approaches used across the sectors are consistent and do not need to be repeated. Sector names associated with the emissions categories are provided in parentheses.

Table 4-1. Control strategies and growth assumptions for creating the 2030 Reference case emissions inventories from the 2005 base case

Control Strategies and/or growth assumptions (grouped by affected pollutants or standard and approach used to apply to the inventory)	**Pollutants affected**	**Approach/ Reference**
Non-EGU Point (ptnonipm sector) projection approaches		
MACT rules, national, VOC: national applied by SCC, MACT Boat Manufacturing Wood Building Products Surface Coating Generic MACT II: Spandex Production, Ethylene manufacture Large Appliances Miscellaneous Organic NESHAP (MON): Alkyd Resins, Chelating Agents, Explosives, Phthalate Plasticizers, Polyester Resins, Polymerized Vinylidene Chloride Reinforced Plastics Asphalt Processing & Roofing Iron & Steel Foundries Metal: Can, Coil Metal Furniture Miscellaneous Metal Parts & Products Municipal Solid Waste Landfills Paper and Other Web Plastic Parts Plywood and Composite Wood Products Carbon Black Production Cyanide Chemical Manufacturing Friction Products Manufacturing Leather Finishing Operations Miscellaneous Coating Manufacturing Organic Liquids Distribution (Non-Gasoline) Refractory Products Manufacturing Sites Remediation	VOC	EPA, 2007a
Consent decrees on companies (based on information from the Office of Enforcement and Compliance Assurance – OECA) apportioned to plants owned/operated by the companies	VOC, CO, NOx, PM, SO_2	1
DOJ Settlements: plant SCC controls for: Alcoa, TX Premcor (formerly Motiva), DE	All	2
Refinery Consent Decrees: plant/SCC controls	NOx, PM, SO_2	3
Hazardous Waste Combustion	PM	4
Municipal Waste Combustor Reductions –plant level	PM	5
Hospital/Medical/Infectious Waste Incinerator Regulations	NO_X, PM, SO_2	EPA, 2005
Large Municipal Waste Combustors – growth applied to specific plants	All (including Hg)	5
MACT rules, plant-level, VOC: Auto Plants	VOC	6
MACT rules, plant-level, PM & SO_2: Lime Manufacturing	PM, SO_2	7
MACT rules, plant-level, PM: Taconite Ore	PM	8
NESHAP: Portland Cement (09/09/10) – plant level based on **Industrial Sector Integrated Solutions (ISIS)** policy emissions in 2013. The ISIS results are from the ISIS-Cement model runs for the NESHAP and NSPS analysis of July 28, 2010 and include closures.	Hg, NO_X, SO2, PM, HCl	13; EPA, 2010
Livestock Emissions Growth from year 2002 to year 2030 (some farms in the point inventory)	NH3, PM	9
Gasoline Stage II growth and control from year 2005 to year 2030 based on MOVES 2030 reference and 2005 state-level ratios	VOC	11
New York ozone SIP controls	VOC, NO_X, HAP VOC	14
Additional plant and unit closures provided by state, regional, and the EPA agencies and additional consent decrees. Includes updates from CSAPR comments.	All	19

Emission reductions resulting from controls put on specific boiler units (not due to MACT) after 2005, identified through analysis of the control data gathered from the Information Collection Request (ICR) from the Industrial/Commercial/Institutional Boiler NESHAP.	NO_X, SO_2, HCl	Section 4.2.6
Reciprocating Internal Combustion Engines (RICE) NESHAP	NO_X, CO, PM, SO_2	15
Replaced 2005 with 2008 emissions for Corn Products International, Cook County, Illinois, due to the shutdown of 3 boilers and addition of a new boiler (subject to Prevention of Significant Deterioration and Requirements). Agency Identifier: 031012ABI (ILEPA)	All	16
State fuel sulfur content rules for fuel oil –*effective only in Maine, New Jersey, and New York*	SO_2	17
Nonpoint (nonpt sector) projection approaches		
Municipal Waste Landfills: projection factor of 0.25 applied	All	EPA, 2007a
Livestock Emissions Growth from year 2002 to year 2030	NH3, PM	9
Residential Wood Combustion Growth and Change-outs from year 2005 to year 2030	All	10
Gasoline Stage II growth and control from year 2005 to year 2030 based on MOVES 2030 reference and 2005 state-level ratios	VOC	11
Portable Fuel Container Mobile Source Air Toxics Rule 2 (MSAT2) inventory growth and control from year 2005 to year 2030	VOC	12
RICE NESHAP	NO_X, CO, VOC, PM, SO_2	15
Use Phase II WRAP 2018 Oil and Gas	VOC, SO_2, NO_X, CO	Section 4.2.7
Use 2008 Oklahoma and Texas Oil and Gas, and apply year 2021 projections for TX (last year available), and RICE NESHAP controls to Oklahoma emissions.	VOC, SO_2, NO_X, CO, PM	Section 4.2.7
New York, Connecticut, and Virginia ozone SIP controls	VOC	14, 18
State fuel sulfur content rules for fuel oil –*effective only in Maine, New Jersey, and New York*	SO_2	17

APPROACHES/REFERENCES- Stationary Sources:

1. Appendix B in the Proposed Toxics Rule TSD: http://www.epa.gov/ttn/chief/emch/toxics/proposed_toxics_rule_appendices.pdf
2. For Alcoa consent decree, used http:// cfpub.epa.gov/compliance/cases/index.cfm; for Motiva: used information sent by State of Delaware
3. Used data provided by the EPA, OAQPS, Sector Policies and Programs Division (SPPD).
4. Obtained from Anne Pope, the US EPA - Hazardous Waste Incinerators criteria and hazardous air pollutant controls carried over from 2002 Platform, v3.1.
5. Used data provided by the EPA, OAQPS SPPD expert.
6. Percent reductions and plants to receive reductions based on recommendations by rule lead engineer, and are consistent with the reference: EPA, 2007a
7. Percent reductions recommended are determined from the existing plant estimated baselines and estimated reductions as shown in the Federal Register Notice for the rule. SO_2 percent reduction are computed by 6,147/30,783 = 20% and PM_{10} and $PM_{2.5}$ reductions are computed by 3,786/13,588 = 28%
8. Same approach as used in the 2006 Clean Air Interstate Rule (CAIR), which estimated reductions of "PM emissions by 10,538 tpy, a reduction of about 62%." Used same list of plants as were identified based on tonnage and SCC from CAIR: http://www.envinfo.com/caain/June04updates/tiop_fr2.pdf
9. Except for dairy cows and turkeys (no growth), based on animal population growth estimates from the US Department of Agriculture (USDA) and the Food and Agriculture Policy and Research Institute. See Section 3.2.1.
10. Growth and Decline in woodstove types based on industry trade group data, See Section.
11. VOC emission ratios of year 2016 (linear interpolation between 2015 and 2020) -specific from year 2005 from the National Mobile Inventory Model (NMIM) results for onroad refueling including activity growth from VMT, Stage II control programs at gasoline stations, and phase in of newer vehicles with onboard Stage II vehicle controls.
12. VOC and benzene emissions for year 2016 (linear interpolation between 2015 and 2020) from year 2002 from MSAT2

rule (EPA, 2007b)

13. Data files for the cement sector provided by Elineth Torres, the EPA-SPPD, from the analysis done for the Cement NESHAP: The ISIS documentation and analysis for the cement NESHAP/NSPS is in the docket of that rulemaking-docket # EPA-HQ-OAR-2002-005. The Cement NESHAP is in the Federal Register: September 9, 2010 (Volume 75, Number 174, Page 54969-55066
14. New York NO_X and VOC reductions obtained from Appendix J in NY Department of Environmental Conservation Implementation Plan for Ozone (February 2008): http://www.dec.ny.gov/docs/air_pdf/NYMASIP7final.pdf. See Section 3.2.6.
15. Appendix F in the Proposed Toxics Rule TSD: http://www.epa.gov/ttn/chief/emch/toxics/proposed_toxics_rule_appendices.pdf
16. The 2008 data used came from Illinois' submittal of 2008 emissions to the NEI.
17. Based on available, enforceable state sulfur rules as of November, 2010: http://www.ilta.org/LegislativeandRegulatory/MVNRLM/NEUSASulfur%20Rules_09.2010.pdf , http://www.mainelegislature.org/legis/bills/bills_124th/billpdfs/SP062701.pdf , http://switchboard.nrdc.org/blogs/rkassel/governor_paterson_signs_new_la.html , http://green.blogs.nytimes.com/2010/07/20/new-york-mandates-cleaner-heating-oil/
18. VOC reductions in Connecticut and Virginia obtained from CSAPR comments.
19. Appendix D of Cross-State Air Pollution Rule: ftp://ftp.epa.gov/EmisInventory/2005v4_2/transportrulefinal_eitsd_appendices_28jun2011.pdf

Onroad mobile and nonroad mobile controls (list includes all key mobile control strategies but is not exhaustive)		
National Onroad Rules: Tier 2 Rule: Signature date February, 2000 2007 Onroad Heavy-Duty Rule: February, 2009 Final Mobile Source Air Toxics Rule (MSAT2): February, 2007 Renewable Fuel Standard: March, 2010	all	1
Local Onroad Programs: National Low Emission Vehicle Program (NLEV): March, 1998 Ozone Transport Commission (OTC) LEV Program: January,1995	VOC	2
National Nonroad Controls: Clean Air Nonroad Diesel Final Rule – Tier 4: June, 2004 Control of Emissions from Nonroad Large-Spark Ignition Engines and Recreational Engines (Marine and Land Based): "Pentathalon Rule": November, 2002 Clean Bus USA Program: October, 2007 Control of Emissions of Air Pollution from Locomotives and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder: October, 2008	all	3,4,5
Aircraft: Itinerant (ITN) operations at airports to year 2030	all	6
Locomotives: Energy Information Administration (EIA) fuel consumption projections for freight rail Clean Air Nonroad Diesel Final Rule – Tier 4: June 2004 Locomotive Emissions Final Rulemaking, December 17, 1997 Control of Emissions of Air Pollution from Locomotives and Marine: May 2008	all	EPA, 2009; 3; 4; 5
Commercial Marine: Category 3 marine diesel engines Clean Air Act and International Maritime Organization standards (April, 30, 2010) –*also includes CSAPR comments.* EIA fuel consumption projections for diesel-fueled vessels OTAQ ECA C3 Base 2030 inventory for residual-fueled vessels Clean Air Nonroad Diesel Final Rule – Tier 4 Emissions Standards for Commercial Marine Diesel Engines, December 29, 1999 Tier 1 Marine Diesel Engines, February 28, 2003	all	7, 3; EPA, 2009

APPROACHES/REFERENCES – Mobile Sources

1. http://epa.gov/otaq/hwy.htm
2. Only for states submitting these inputs: http://www.epa.gov/otaq/lev-nlev.htm
3. http://www.epa.gov/nonroad-diesel/2004fr.htm
4. http://www.epa.gov/cleanschoolbus/

5. http://www.epa.gov/otaq/marinesi.htm
6. Federal Aviation Administration (FAA) Terminal Area Forecast (TAF) System, January 2010: http://www.apo.data.faa.gov/main/taf.asp
7. http://www.epa.gov/otaq/oceanvessels.htm

4.1 Stationary source projections: EGU sector (ptipm)

The future-year data for the ptipm sector used in the air quality modeling were created using version 4.10 (v4.10) of the Integrated Planning Model (IPM) (http://www.epa.gov/airmarkt/progsregs/epa-ipm/index.html). The IPM is a multiregional, dynamic, deterministic linear programming model of the U.S. electric power sector. Version 4.10 reflects state rules and consent decrees through December 1, 2010 and incorporates information on existing controls collected through the Information Collection Request (ICR), and information from comments received on the IPM-related Notice of Data Availability (NODA) published on September 1, 2010. IPM v4.10 Final included the addition of over 20 GW of existing Activated Carbon Injection (ACI) reported to the EPA via the ICR. Units with SO_2 or NO_X advanced controls (e.g., scrubber, SCR) that were not required to run for compliance with Title IV, New Source Review (NSR), state settlements, or state-specific rules were modeled by IPM to either operate those controls or not based on economic efficiency parameters.

Updates to IPM 4.10 (with respect to the version released in the IPM NODA version) include adjustments to assumptions regarding the performance of acid gas control technologies, new costs imposed on fuel-switching (e.g., bituminous to sub-bituminous), correction of lignite availability to some plants, incorporation of additional planned retirements, a more inclusive implementation of the scrubber upgrade option, and the availability of a scrubber retrofit to waste-coal fired fluidized bed combustion units without an existing scrubber. Further details on the future-year EGU emissions inventory used for this rule can be found in the incremental documentation of the IPM v.4.10 platform, available at http://www.epa.gov/airmarkets/progsregs/epa-ipm/BaseCasev410.html. Note that this year 2030 IPM run includes the version 4.10 NODA CSAPR Proposal (not Final) emissions and does not include the Mercury and Air Toxics (MATS) Rule impacts (proposal or final), which was proposed on March 16, 2011. In addition, the Boiler MACT was not represented because the rule was not final at the time the HDGHG modeling was performed.

Directly emitted PM emissions (i.e., $PM_{2.5}$ and PM_{10}) from the EGU sector are computed via a post processing routine which applies emission factors to the IPM-estimated fuel throughput based on fuel, configuration and controls to compute the filterable and condensable components of PM. This methodology is documented in the IPM CSAPR TSD.

4.2 Stationary source projections: non-EGU sectors (ptnonipm, nonpt, ag, afdust)

To project U.S. stationary sources other than the ptipm sector, we applied growth factors and/or controls to certain categories within the ptnonipm, nonpt, ag and afdust platform sectors. This subsection provides details on the data and projection methods used for these sectors. In estimating future-year emissions, we assumed that emissions growth does not track with economic growth for many stationary non-IPM sources. This “no-growth” assumption is based on an examination of historical emissions and economic data. More details on the rationale for this approach can be found in Appendix D of the Regulatory Impact Assessment for the PM NAAQS rule (EPA, 2006).

The starting point was the emission projections done for the 2005v4.2 platform for the CSAPR, which incorporated responses to public comments on the modeling inventories. The 2012 and 2014 projection factors developed for the CSAPR (see http://www.epa.gov/ttn/chief/emch/index.html#final) were updated to reflect year 2030 projections.

Year-specific projection factors for year 2030 were used for creating the 2030 reference case unless noted otherwise. Growth factors (and control factors) are provided in the following sections where feasible. However, some sectors used growth or control factors that varied geographically and their contents could not be provided in the following sections (e.g., gasoline distribution varies by state and pollutant and has hundreds of records).

4.2.1 Livestock emissions growth (ag, afdust)

Growth in ammonia (NH_3) and dust (PM_{10} and $PM_{2.5}$) emissions from livestock in the ag and afdust and ptnonipm sectors was based on projections of growth in animal population. Table 4-2 provides the growth factors from the 2005 base-case emissions to 2030 for animal categories applied to the ag, afdust, and ptnonipm sectors for livestock-related SCCs. For example, year 2030 beef emissions are 3.85% larger than the 2005 base-case emissions. Except for dairy cows and turkey production, the animal projection factors are derived from national-level animal population projections from the U.S. Department of Agriculture (USDA) and the Food and Agriculture Policy and Research Institute (FAPRI). For dairy cows and turkeys, we assumed that there would be no growth in emissions. This assumption was based on an analysis of historical trends in the number of such animals compared to production rates. Although productions rates have increased, the number of animals has declined. Thus, we do not believe that production forecasts provide representative estimates of the future number of cows and turkeys; therefore, we did not use these forecasts for estimating future-year emissions from these animals. In particular, the dairy cow population is projected to decrease in the future as it has for the past few decades; however, milk production will be increasing over the same period. Note that the ammonia emissions from dairies are not directly related to animal population but also nitrogen excretion. With the cow numbers going down and the production going up we suspect the excretion value will be changing, but we assumed no change because we did not have a quantitative estimate.

The inventory for livestock emissions used 2002 emissions values therefore, our projection method projected from 2002 rather than from 2005.

Appendix E in the 2002v3 platform documentation provides the animal population data and regression curves used to derive the growth factors: http://www.epa.gov/scram001/reports/Emissions%20TSD%20Vol2_Appendices_01-15-08.pdf. Appendix F in the same document provides the cross references of livestock sources in the ag, afdust and ptnonipm sectors to the animal categories in Table 4-2.

Table 4-2. Growth factors from year 2005 to 2030 for Animal Operations

Animal Category	Projection Factor
Dairy Cow	1.0000
Beef	1.0385
Pork	1.1666
Broilers	1.6426
Turkeys	1.0000
Layers	1.4491
Poultry Average	1.4991
Overall Average	1.1745

4.2.2 Residential wood combustion growth (nonpt)

We projected residential wood combustion emissions based on the expected increase in the number of low-emitting wood stoves and the corresponding decrease in other types of wood stoves. As newer, cleaner woodstoves replace older, higher-polluting wood stoves, there will be an overall reduction of the emissions from these sources. The approach cited here was developed as part of a modeling exercise to estimate the expected benefits of the woodstoves change-out program (http://www.epa.gov/burnwise). Details of this approach can be found in Section 2.3.3 of the PM NAAQS Regulatory Impact Analysis (EPA, 2006).

The specific assumptions we made were:

- Fireplaces, source category code (SCC)=2104008001: increase 1%/year
- Old woodstoves, SCC=2104008002, 2104008010, or 2104008051: decrease 2%/year
- New woodstoves, SCC=2104008003, 2104008004, 2104008030, 2104008050, 2104008052 or 2104008053: increase 2%/year

For the general woodstoves and fireplaces category (SCC 2104008000) we computed a weighted average distribution based on 19.4% fireplaces, 71.6% old woodstoves, 9.1% new woodstoves using 2002v3 Platform missions for $PM_{2.5}$. These fractions are based on the fraction of emissions from these processes in the states that did not have the "general woodstoves and fireplaces" SCC in the 2002v3 NEI. This approach results in an overall decrease of 1.056% per year for this source category. Table 4-3 presents the projection factors used to project the 2005 base case (2002 emissions) for residential wood combustion.

Table 4-3. Projection Factors for growing year 2005 Residential Wood Combustion Sources

<table>
<tr><th>SCC</th><th>SCC Description</th><th>Projection Factor</th></tr>
<tr><td>2104008000</td><td>Total: Woodstoves and Fireplaces</td><td>0.7043</td></tr>
<tr><td>2104008001</td><td>Fireplaces: General</td><td rowspan="2">1.28</td></tr>
<tr><td>2104008070</td><td>Outdoor Wood Burning Equipment</td></tr>
<tr><td>2104008002</td><td>Fireplaces: Insert; non-EPA certified</td><td rowspan="3">0.44</td></tr>
<tr><td>2104008010</td><td>Woodstoves: General</td></tr>
<tr><td>2104008051</td><td>Non-catalytic Woodstoves: Non-EPA certified</td></tr>
<tr><td>2104008003</td><td>Fireplaces: Insert; EPA certified; non-catalytic</td><td rowspan="6">1.56</td></tr>
<tr><td>2104008004</td><td>Fireplaces: Insert; EPA certified; catalytic</td></tr>
<tr><td>2104008030</td><td>Catalytic Woodstoves: General</td></tr>
<tr><td>2104008050</td><td>Non-catalytic Woodstoves: EPA certified</td></tr>
<tr><td>2104008052</td><td>Non-catalytic Woodstoves: Low Emitting</td></tr>
<tr><td>2104008053</td><td>Non-catalytic Woodstoves: Pellet Fired</td></tr>
</table>

4.2.3 Gasoline Stage II growth and control (nonpt, ptnonipm)

Emissions from Stage II gasoline operations in the 2005 base case are contained in both nonpt and ptnonipm sectors. The only SCC in the nonpt inventory used for gasoline Stage II emissions is 2501060100 (Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage II: Total). The following SIC and SCC codes are associated with gasoline Stage II emissions in the ptnonipm sector:

- SIC 5541 (Automotive Dealers & Service Stations, Gasoline Service Stations, Gasoline service stations)
- SCC 40600401 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Vapor Loss w/o Controls)

- SCC 40600402 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Liquid Spill Loss w/o Controls)
- SCC 40600403 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Vapor Loss w/o Controls)
- SCC 40600499 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Not Classified

We used a consistent approach across nonpt and ptnonipm to project these gasoline stage II emissions. The approach involved computing state-level VOC-specific projection factors from the state-level MOVES2010a-based results for onroad refueling, using ratios of future–year 2030 refueling emissions to 2005 base-case emissions. The approach accounts for three elements of refueling growth and control: (1) activity growth (due to VMT growth as input into MOVES2010a), (2) emissions reductions from Stage II control programs at gasoline stations, and (3) emissions reductions resulting from the phase-in over time of newer vehicles with onboard Stage II vehicle controls. We assumed that all areas with Stage II controls in 2005 continue to have Stage II controls in 2030.

We computed VOC, benzene and naphthalene projection factors at a county-specific, annual resolution as shown below; note that naphthalene, while provided by MOVES2010a, is not used in the HDGHG Rule:

$PF\_VOC_{[state,\ future\ year]} = VOC\_RFL_{[state,\ future\ year]}/VOC\_RFL_{[state,\ 2005]}$,

$PF\_BENZENE_{[state,\ future\ year]} = BENZENE\_RFL_{[state,\ future\ year]}/\ BENZENE\ \_RFL_{[state,\ 2005]}$, and

$PF\_NAPHTHALENE_{[state,\ future\ year]} = PF\_VOC_{[state,\ future\ year]}$

where VOC_RFL is the VOC refueling emissions for onroad sources from MOVES2010a, and
BENZENE_RFL is the BENZENE refueling emissions for onroad sources from MOVES2010a

We applied these projection factors to both nonpt and ptnonipm sector gasoline stage II sources.

Chemical speciation uses certain VOC HAPs for some sources, specifically, benzene, acetaldehyde, formaldehyde, and methanol (BAFM). The VOC HAPs are used for sources that have consistent VOC and VOC HAPs using various criteria as described in the Section**Error! Reference source not found.** in the CSAPR TSD (ftp://ftp.epa.gov/EmisInventory/2005v4_2/transportrulefinal_eitsd_28jun2011.pdf), and these sources are called "integrated" sources. The nonpoint gasoline stage II emissions are an integrated source, and so the VOC HAPs are also projected based on ratios of future-year and base-year VOC. The only two VOC HAPs emitted from refueling are benzene and naphthalene, and both of these were projected consistently with VOC. However, naphthalene was not used in the chemical speciation (it is not B,A,F or M pollutant) and was therefore not used for this effort. Therefore, only benzene was used as part of the speciation for the nonpt sector gasoline stage II sources. The entire ptnonipm inventory is considered "no-integrate" because VOC and VOC HAP emission estimates were not found to be of the same (consistent) data source. Therefore ptnonipm gasoline stage II sources did not use the projected benzene as part of the speciation, but rather used VOC speciation to estimate benzene.

4.2.4 Portable fuel container growth and control (nonpt)

We obtained future-year VOC emissions from Portable Fuel Containers (PFCs) from inventories developed and modeled for the EPA's MSAT2 rule (EPA, 2007b). The 10 PFC SCCs are summarized below (note that the full SCC descriptions for these SCCs include "Storage and Transport; Petroleum and Petroleum Product Storage" as the beginning of the description).

- 2501011011 Residential Portable Fuel Containers: Permeation

- 2501011012 Residential Portable Fuel Containers: Evaporation
- 2501011013 Residential Portable Fuel Containers: Spillage During Transport
- 2501011014 Residential Portable Fuel Containers: Refilling at the Pump: Vapor Displacement
- 2501011015 Residential Portable Fuel Containers: Refilling at the Pump: Spillage
- 2501012011 Commercial Portable Fuel Containers: Permeation
- 2501012012 Commercial Portable Fuel Containers: Evaporation
- 2501012013 Commercial Portable Fuel Containers: Spillage During Transport
- 2501012014 Commercial Portable Fuel Containers: Refilling at the Pump: Vapor Displacement
- 2501012015 Commercial Portable Fuel Containers: Refilling at the Pump: Spillage

Additional information on the PFC inventories is available in Section 2.2.3 of the documentation for the 2002 Platform (http://www.epa.gov/ttn/chief/emch/index.html#2002).

The future-year emissions reflect projected increases in fuel consumption, state programs to reduce PFC emissions, standards promulgated in the MSAT2 rule, and impacts of the Renewable Fuel Standard (RFS) on gasoline volatility. Future-year emissions for PFCs were available for 2010, 2015, 2020, and 2030. Benzene was used in VOC speciation for the air quality model through the modification of VOC speciation profiles calculations (no other BAFM HAPs are emitted from PFCs).

4.2.5 Aircraft growth (ptnonipm)

These 2005 point-source emissions are projected to future years by applying activity growth using data on itinerant (ITN) operations at airports. The ITN operations are defined as aircraft take-offs whereby the aircraft leaves the airport vicinity and lands at another airport, or aircraft landings whereby the aircraft has arrived from outside the airport vicinity. We used projected ITN information available from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System: http://www.apo.data.faa.gov/main/taf.asp (publication date January 2010). This information is available for approximately 3,300 individual airports, for all years up to 2030. We aggregated and applied this information at the national level by summing the airport-specific (U.S. airports only) ITN operations to national totals by year and by aircraft operation, for each of the four available operation types: commercial, general, air taxi and military. We computed growth factors for each operation type by dividing future-year ITN by 2005-year ITN. We assigned factors to inventory SCCs based on the operation type.

The methods that the FAA used for developing the ITN data in the TAF are documented in: http://www.faa.gov/data_research/aviation/aerospace_forecasts/2009-2025/media/2009%20Forecast%20Doc.pdf

Table 4-4 provides the national growth factors for aircraft; all factors are applied to year 2005 emissions. For example, year 2030 commercial aircraft emissions are 50.59% higher than year 2005 emissions.

Table 4-4. Factors used to project 2005 base-case aircraft emissions to year 2030

SCC	SCC Description	Projection Factor
2275001000	Military aircraft	1.0275
2275020000	Commercial aircraft	1.5059
2275050000	General aviation	0.9916
2275060000	Air taxi	1.0259
27501015	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Military;Jet Engine: JP-5	1.0275
27502001	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Commercial;Piston Engine: Aviation Gas	1.5059
27502011	Internal Combustion Engines;Fixed Wing Aircraft L & TO	1.5059

SCC	SCC Description	Projection Factor
	Exhaust;Commercial;Jet Engine: Jet A	
27505001	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Civil;Piston Engine: Aviation Gas	0.9916
27505011	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Civil;Jet Engine: Jet A	0.9916
27601014	Internal Combustion Engines;Rotary Wing Aircraft L & TO Exhaust;Military;Jet Engine: JP-4	1.0275
27601015	Internal Combustion Engines;Rotary Wing Aircraft L & TO Exhaust;Military;Jet Engine: JP-5	1.0275

We did not apply growth factors to any point sources with SCC 27602011 (Internal Combustion Engines; Rotary Wing Aircraft L & TO Exhaust; Commercial; Jet Engine: Jet A) because the facility names associated with these point sources appeared to represent industrial facilities rather than airports. This SCC is only in one county, Santa Barbara, California (State/County FIPS 06083).

None of our aircraft emission projections account for any control programs. We considered the NO_X standard adopted by the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) in February 2004, which is expected to reduce NO_X by approximately 2% in 2015 and 3% in 2020. However, this rule, signed July 2011 (see http://www.epa.gov/otaq/aviation.htm), was not adopted as an EPA (or U.S.) rule prior to HDGHG modeling; therefore, the effects of this rule were not included in the future-year emissions projections.

4.2.6 Stationary source control programs, consent decrees & settlements, and plant closures (ptnonipm, nonpt)

We applied emissions reduction factors to the 2005 emissions for particular sources in the ptnonipm and nonpt sectors to reflect the impact of stationary-source control programs including consent decrees, settlements, and plant closures. Some of the controls described in this section were obtained from comments on the CSAPR proposal. Here we describe the contents of the controls and closures for the 2030 reference case. Detailed summaries of the impacts of the control programs are provided in Appendix D of the CSAPR TSD: ftp://ftp.epa.gov/EmisInventory/2005v4_2/transportrulefinal_eitsd_appendices_28jun2011.pdf.

Controls from the NO_X SIP call were assumed to have been implemented by 2005 and captured in the 2005 base case (2005v2 point inventory). This assumption was confirmed by review of the 2005 NEI that showed reductions from Large Boiler/Turbines and Large Internal Combustion Engines in the Northeast states covered by the NOx SIP call. The future-year base controls consist of the following:

- We did not include MACT rules where compliance dates were prior to 2005, because we assumed these were already reflected in the 2005 inventory. The EPA OAQPS Sector Policies and Programs Division (SPPD) provided all controls information related to the MACT rules, and this information is as consistent as possible with the preamble emissions reduction percentages for these rules.
- Various emissions reductions from the CSAPR comments, including but not limited to: fuel switching at units, shutdowns, future-year emission limits, ozone SIP VOC controls for some sources in Virginia and Connecticut, and state and local control programs.
- Evolutionary information gathering of plant closures (i.e., emissions were zeroed out for future years) were also included where information indicated that the plant was actually closed after the 2005 base year and prior to CSAPR and HDGHG modeling that began in the fall of 2010. We also applied unit and plant closures received from the CSAPR comments. However, plants projected to close in the future (post-2010) were not removed in the future years because these projections can be inaccurate

due to economic improvements. We also applied cement kiln (unit) and cement plant closures discussed later in Section 4.2.6.1. More detailed information on the overall state-level impacts of all control programs and projection datasets, including units and plants closed in the 2012 and 2014 base-case ptnonipm inventories are provided in Appendix D of the CSAPR TSD: ftp://ftp.epa.gov/EmisInventory/2005v4_2/transportrulefinal_eitsd_appendices_28jun2011.pdf. The magnitude of all unit and plant closures on the non-EGU point (ptnonipm) sector 2005 base-case emissions is shown in Table 4-5 below.

Table 4-5. Summary of Non-EGU Emission Reductions Applied to the 2005 Inventory due to Unit and Plant Closures

	CO	**NH_3**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**VOC**
Reductions	125,162	636	109,237	21,143	12,600	190,734	26,750

- In addition to plant closures, we included the effects of the Department of Justice Settlements and Consent Decrees on the non-EGU (ptnonipm) sector emissions. We also included estimated impacts of HAP standards per Section 112, 129 of the Clean Air Act on the non-EGU (ptnonipm) and nonpoint (nonpt) sector emissions, based on expected CAP co-benefits to sources in these sectors.
- Numerous controls have compliance dates beyond 2008; these include refinery and the Office of Compliance and Enforcement (OECA) consent decrees, Department of Justice (DOJ) settlements, as well as most national VOC MACT controls. Additional OECA consent decree information is provided in Appendix B of the Proposed Toxics Rule TSD: http://www.epa.gov/ttn/chief/emch/toxics/proposed_toxics_rule_appendices.pdf. The detailed data used are available at the website listed in Section 1.
- Refinery consent decrees controls at the facility and SCC level (collected through internal coordination on refineries by the EPA).
- Fuel sulfur fuel limits were enforceable for Maine, New Jersey and New York. These fuel limits were incremental and not applicable until after 2012.
- Criteria air pollutant (cap) reductions a cobenefit to RICE NESHAP controls, including SO_2 RICE cobenefit controls.
- We applied New York State Implementation Plan available controls for the 1997 8-hour Ozone standard for non-EGU point and nonpoint NO_X and VOC sources based on NY State Department of Environmental Conservation February 2008 guidance. These reductions are found in Appendix J in: http://www.dec.ny.gov/docs/air_pdf/NYMASIP7final.pdf. See Section 3.2.6 in the CSAPR TSD: ftp://ftp.epa.gov/EmisInventory/2005v4_2/transportrulefinal_eitsd_28jun2011.pdf.

Most of the control programs were applied as replacement controls, which means that any existing percent reductions ("baseline control efficiency") reported in the NEI were removed prior to the addition of the percent reductions due to these control programs. Exceptions to replacement controls are "additional" controls, which ensure that the controlled emissions match desired reductions regardless of the baseline control efficiencies in the NEI. We used the "additional controls" approach for many permit limits, settlements and consent decrees where specific plant and multiple-plant-level reductions/targets were desired and at municipal waste landfills where VOC was reduced 75% via a MACT control using projection factors of 0.25.

4.2.6.1 Reductions from the Portland Cement NESHAP

As indicated in Table 4-1, the Industrial Sectors Integrated Solutions (ISIS) model (EPA, 2010) was used to project the cement industry component of the ptnonipm emissions modeling sector to 2013. There were no future year estimates for year 2030, so 2013 estimates were used for the 2030 Reference case. This approach provided reductions of criteria and hazardous air pollutants, including mercury. The ISIS cement emissions were developed in support for the Portland Cement NESHAPs and the NSPS for the Portland cement manufacturing industry.

The ISIS model produced a Portland Cement NESHAP policy case of multi-pollutant emissions for individual cement kilns (emission inventory units) that were relevant for years 2013 through 2017. These ISIS-based emissions included information on new cement kilns, facility and unit-level closures, and updated policy case emissions at existing cement kilns. The units that opened or closed before 2010 were included in the projections as were the ISIS-based policy case predictions of emissions reductions and activity growth.

The ISIS model results for the future show a continuation of the recent trend in the cement sector of the replacement of lower capacity, inefficient wet and long dry kilns with bigger and more efficient preheater and precalciner kilns. Multiple regulatory requirements such as the NESHAP and NSPS currently apply to the cement industry to reduce CAP and HAP emissions. Additionally, state and local regulatory requirements might apply to individual cement facilities depending on their locations relative to ozone and $PM_{2.5}$ nonattainment areas. The ISIS model provides the emission reduction strategy that balances: 1) optimal (least cost) industry operation, 2) cost-effective controls to meet the demand for cement, and 3) emission reduction requirements over the time period of interest. Table 4-6 shows the magnitude of the ISIS-based cement industry reductions in the future-year emissions that represent 2013 (and 2030 for HDGHG), and the impact that these reductions have on total stationary non-EGU point source (ptnonipm) emissions.

Table 4-6. Future-year ISIS-based cement industry annual reductions (tons/yr) for the non-EGU (ptnonipm) sector

Pollutant	Cement Industry emissions in 2005	Decrease in cement industry emissions in 2030 vs 2005	% decrease in ptnonipm from cement reduction
NO_X	193,000	56,740	2.4%
$PM_{2.5}$	14,400	7,840	1.8%
SO_2	128,400	106,000	5.0%
VOC	6,900	5,570	0.4%
HCl	2,900	2,220	4.5%

4.2.6.2 Boiler reductions not associated with the MACT rule

The Boiler MACT ICR collected data on existing controls. We used an early version of a data base developed for that rulemaking entitled "survey_database_2008_results2.mdb" (EPA-HQ-OAR-2002-0058-0788) which is posted under the Technical Information for the Boiler MACT major source rule (http://www.epa.gov/ttn/atw/boiler/boilerpg.html). We extracted all controls that were installed after 2005, determined a percent reduction, and verified with source owners that these controls were actively in use. In many situations we learned that the controls were on site but were not in use. A summary of the plant-unit specific reductions that were verified to be actively in use are summarized in Table 4-7.

Table 4-7. State-level non-MACT Boiler Reductions from ICR Data Gathering

State	Pollutant	Pre-controlled Emissions (tons)	Controlled Emissions (tons)	Reductions (tons)	Percent Reduction %
Michigan	NO_X	907	544	363	40
North Carolina	SO_2	652	65	587	90
Virginia	SO_2	3379	338	3041	90
Washington	SO_2	639	383	256	40
North Carolina	HCl	31	3	28	90

4.2.6.3 RICE NESHAP

There are three rulemakings for National Emission Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines (RICE). These rules reduce HAPs from existing and new RICE sources. In order to meet the standards, existing sources with certain types of engines will need to install controls. In addition to reducing HAPs, these controls also reduce CAPs, specifically, CO, NO_X, VOC, PM, and SO_2. In 2014 and beyond, compliance dates have passed for all three rules; thus all three rules are included in the 2030 HDGHG emissions projection.

The rules can be found at http://www.epa.gov/ttn/atw/rice/ricepg.html and are listed below:

- National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; Final Rule (69 FR 33473) published 06/15/04
- National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; Final Rule (FR 9648) published 03/03/10
- National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; Final Rule (75 FR 51570) published 08/20/2010

The difference among these three rules is that they focus on different types of engines, different facility types (major for HAPs, versus area for HAPs) and different engine sizes based on horsepower (HP). In addition, they have different compliance dates. We project CAPs from the 2005 NEI RICE sources, based on the requirements of the rule for existing sources only because the inventory includes only existing sources and the current projection approach does not estimate emissions from new sources.

A complete discussion on the methodology to estimate RICE controls is provided in Appendix F in the Proposed MATS Rule TSD:
http://www.epa.gov/ttn/chief/emch/toxics/proposed_toxics_rule_appendices.pdf. Impacts of the RICE controls on stationary non-EGU emissions (nonpt and ptnonipm sectors), excluding WRAP, Texas, and Oklahoma oil and gas emissions (see Section 4.2.7) are provided in Table 4-8.

Table 4-8. National Impact of RICE Controls on 2030 Non-EGU Projections

	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Reductions	116,434	111,749	1,595	1,368	21,957	14,669

4.2.6.4 Fuel sulfur rules

Fuel sulfur rules that were signed (enforceable) at the time of the HDGHG emissions processing are limited to Maine, New Jersey and New York. Several other states have fuel sulfur rules that were in development but not finalized prior to CSAPR and HDGHG Rule emissions processing: http://www.ilta.org/LegislativeandRegulatory/MVNRLM/NEUSASulfur%20Rules_09.2010.pdf.

The fuel sulfur content for all home heating oil SCCs in 2005 is assumed to by 3000 part per million (ppm). Effective July 1, 2012, New York requires all heating oil sold in New York to contain no more than 15ppm of sulfur, thus reducing SO_2 emissions by 99.5% for post-2012 (2030) projections. These New York sulfur content reductions are further discussed here: http://switchboard.nrdc.org/blogs/rkassel/governor_paterson_signs_new_la.html.

The New Jersey year 2017 standard of 15ppm (assuming 500ppm baseline for Kersone) sulfur content yields a 96.25% SO_2 emissions reduction for kersone (fuel #1). The New Jersey sulfur content reductions are discussed here: http://njtoday.net/2010/09/01/nj-adopts-rule-limiting-sulfur-content-in-fuel-oil/.

The Maine fuel sulfur rule effective January 1, 2014 reduces sulfur to 15ppm, resulting in a 99.5% reduction from 3000 ppm. These Maine sulfur content reductions are discussed here: http://www.mainelegislature.org/legis/bills/bills_124th/billpdfs/SP062701.pdf.

The impact of these fuel sulfur content reductions on SO2 is shown in Table 4-9.

Table 4-9. Impact of Fuel Sulfur Controls on 2014 Non-EGU Projections

State	SO_2 Reductions
Maine	18,470
New Jersey	998
New York	54,431
Total	**73,898**

4.2.7 Oil and gas projections in TX, OK, and non-California WRAP states (nonpt)

For the 2005v4.2 platform, we incorporated updated 2005 oil and gas emissions from Texas and Oklahoma. For Texas oil and gas production, we used the last available future year, year 2021, estimates from the Texas Commission of Environmental Quality (TCEQ) and used them as described in: http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/ei/5820783985FY0901-20090715-ergi-Drilling_Rig_EI.pdf.

We also received 2008 data for Oklahoma that we used as the best available data to represent 2030. We utilized the latest available future year, year 2018, Phase II WRAP oil and gas emissions data for the non-California Western Regional Air Partnership (WRAP) states to represent year 2030. RICE NESHAP reductions, which are effective by year 2014, were applied to the year 2008 Oklahoma oil and gas inventory but not applied to the 2021 TCEQ oil and gas estimates or 2018 WRAP Phase II oil and gas inventory.

For Oklahoma, we applied CO, NO_X, SO_2 and VOC emissions reductions from the RICE NESHAP, which we assumed has some applicability to this industry (see Appendix F in the Proposed Toxics Rule TSD: http://www.epa.gov/ttn/chief/emch/toxics/proposed_toxics_rule_appendices.pdf).
Table 4-10 shows the 2005 and 2030 NOX and SO2 emissions including RICE reductions for Oklahoma.

Table 4-10. Oil and Gas NO_X and SO_2 Emissions for 2005 and 2030 including additional reductions due to the RICE NESHAP

	NOX		PM2.5		SO2		VOC	
	2005	**2030**	**2005**	**2030**	**2005**	**2030**	**2005**	**2030**

Alaska	836	453			62	1	68	12
Arizona	13	15					37	49
Colorado	32,188	33,517			350	11	35,500	43,639
Montana	10,617	13,880			640	6	9,187	14,110
Nevada	71	63			1	0	105	163
New Mexico	61,674	74,648			369	12	215,636	267,846
North Dakota	6,040	20,869			688	4	8,988	17,968
Oklahoma	39,668	42,402	1,918	2,231	1,014	2	155,908	163,598
Oregon	61	44					19	14
South Dakota	566	557			43	0	370	562
Texas	42,854	26,061	2,945	435	5,977	33	4,337	1,504
Utah	6,896	6,297			149	1	43,403	81,890
Wyoming	36,172	34,142			541	3	166,939	304,748
Total	**237,656**	**252,948**	**4,862**	**2,666**	**9,834**	**73**	**640,498**	**896,104**

4.3 Mobile source projections

The 2030 HDGHG Reference case inventories are identical to 2030 HDGHG Control case inventories except for the MOVES2010a-based (onroad) emissions (and some gasoline distribution emissions in the ptnonipm and nonpt sectors). The 2030 Control case inventories are discussed in Section 5.

Mobile source monthly inventories of onroad and nonroad mobile emissions were created for 2030 using a combination of the NMIM and MOVES2010a models. Future-year emissions reflect onroad mobile control programs including the Light-Duty Vehicle Tier 2 Rule, the Onroad Heavy-Duty Rule, and the Mobile Source Air Toxics (MSAT2) final rule. Nonroad mobile emissions reductions for these years include regulations affecting locomotives, various nonroad engines including diesel engines and various marine engine types, fuel sulfur content, and evaporative emissions.

Onroad mobile sources are comprised of several components and are discussed in the next subsection (4.3.1). Nonroad mobile emission projections are discussed in subsection 4.3.1.1. Locomotives and Class 1 and Class 2 commercial marine vessel (C1/C2 CMV) projections are discussed in subsection 4.3.2, and Class 3 (C3) CMV projected emissions are discussed in subsection 4.3.3.

4.3.1 Onroad mobile (on_noadj, on_moves_runpm, on_moves_startpm)

The onroad emissions were primarily based on the 2010 version of the Motor Vehicle Emissions Simulator (MOVES2010a) – the same version that was used for 2005 HDGHG. The same MOVES-based $PM_{2.5}$ temperature adjustment factors were applied as were used in 2005 for running mode emissions; however, cold start emissions used year-specific temperature adjustment factors. The use of the same temperature adjustments nationwide for gasoline PM is not a limitation, since the temperature adjustments in MOVES for gasoline PM do not depend on county-specific inputs.

California onroad (on_noadj)

California onroad inventory: California year 2030 complete CAP/HAP onroad inventories are monthly onroad emissions and are based on March 2007 California Air Resources Board (CARB) data (Martin Johnson: mjohnson@arb.ca.gov). Like year 2005 emissions, future-year California NH_3 emissions are from MOVES runs for California, disaggregated to the county level using NMIM. We estimated HAP emissions by applying HAP-to-CAP ratios computed from California 2005 NEI submittal provided by EPA in 12/2007. This was done because the CARB submittal from March 2007 did not include estimates for HAPs. We retained only those HAPs that were also estimated by NMIM for nonroad mobile sources; all other HAPs were dropped.

Onroad mobile sector with no adjustment for daily temperature (on_noadj)

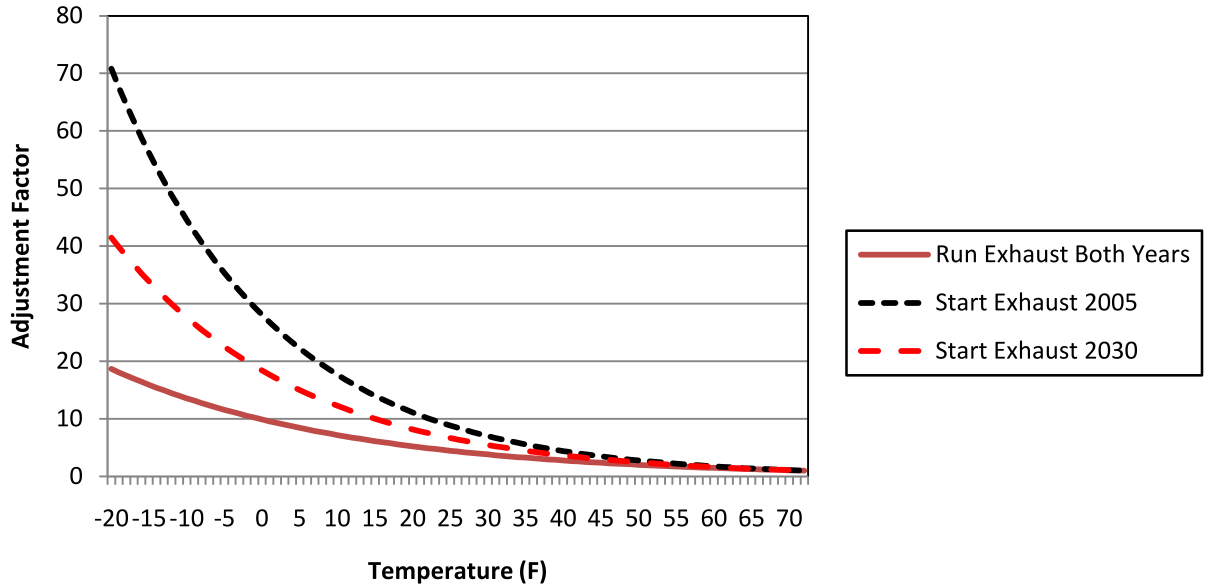
As discussed in Section 2, the MOVES2010a model was used for all vehicles, road types, and pollutants. Vehicle Miles Travelled (VMT) was projected using growth rates from the Department of Energy's AEO2011. We used MOVES2010a to create emissions by state, SCC, pollutant, emissions mode and month. We then allocated these emissions to counties using ratios based on 2030 NMIM county-level data by state, SCC, pollutant, and emissions mode. While the EPA intends to replace this approach with a county-specific implementation of MOVES for use in future regulatory actions, this approach was the best approach available at the time of this modeling.

Onroad PM gasoline running and cold start mode sectors (on_moves_startpm and on_moves_runpm)

MOVES-based cold start and running mode emissions consist of gasoline exhaust speciated PM and naphthalene. These pre-temperature-adjusted emissions at 72°F are projected to year 2030 from year 2005 inventories using the 2030-specific runs of MOVES2010a. VMT were projected using growth rates from the AEO2009. As with the on_noadj sector, the 2030 MOVES2010a data were created at the state-month level, and the 2030 NMIM results were used to disaggregate the state level results to the county level.

MOVES-based temperature adjustment factors were applied to gridded, hourly emissions using gridded, hourly meteorology. As seen in Figure 4-1, for year 2030, we used the same temperature adjustment factors as the 2005 base case for both start and running modes. However, cold start temperature adjustment factors decrease in future years, and for year 2030 processing, we updated the temperature adjustment curves for these cold start emissions. Note that running exhaust temperature adjustment factors are the same for all years. Also, it is worth noting that the running mode gasoline exhaust emissions are considerably larger than cold start mode gasoline exhaust emissions before application of the temperature adjustments.

Figure 4-1. MOVES exhaust temperature adjustment functions for 2005 and 2030



4.3.1.1 Nonroad mobile (nonroad)

This sector includes monthly exhaust, evaporative and refueling emissions from nonroad engines (not including commercial marine, aircraft, and locomotives) derived from NMIM for all states except California. Like the onroad emissions, NMIM provides nonroad emissions for VOC by three emission modes: exhaust, evaporative and refueling. Unlike the onroad sector, nonroad refueling emissions for nonroad sources are not included in the nonpoint (nonpt) sector and so are retained in this sector.

With the exception of California, U.S. emissions for the nonroad sector (defined as the equipment types covered by NMIM) were created using a consistent NMIM-based approach as was used for 2005, but projected for 2030. The 2030 NMIM runs utilized the NR05d-Bond-final version of NONROAD (which is equivalent to NONROAD2008a). The future-year emissions account for increases in activity (based on NONROAD model default growth estimates of future-year equipment population) and changes in fuels and engines that reflect implementation of national regulations and local control programs that impact each year differently due to engine turnover. We have not included voluntary programs such as programs encouraging either no refueling or evening refueling on Ozone Action Days and diesel retrofit programs.

The national regulations incorporated in the modeling are those promulgated prior to December 2009, and beginning about 1990. Recent rules include:

- "Clean Air Nonroad Diesel Final Rule - Tier 4": (http://www.epa.gov/nonroaddiesel/2004fr.htm), published June 29, 2004, and,
- Control of Emissions from Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based), November 8, 2002 ("Pentathalon Rule").
- OTAQ's Locomotive Marine Rule, March 2008: (http://www.epa.gov/otaq/regs/nonroad/420f08004.htm)
- OTAQ's Small Engine Spark Ignition ("Bond") Rule, November 2008: (http://www.epa.gov/otaq/equip-ld.htm)

All states except California:

OTAQ provided several runs of NMIM emissions for the LDGHG (control case) Rule that were blended together to create the 2030 HDGHG nonroad sector emissions. We used these same nonroad emissions for both the reference and control cases in HDGHG. Table 4-11 shows how the various NMIM runs were combined to create the non-California nonroad mobile inventories. The first component "2002v3-based 2030 Base Case" is from the 2030 Base case in our 2002v3 platform for the SCCs listed in Table 4-11. OTAQ also provided diesel recreational marine (pleasure craft) emissions in November 2009.

Table 4-11. Components of 2030 HDGHG Nonroad Sector

NMIM file	SCCs	Description of Nonroad SCCs
2002v3-based 2030 Base Case	2267x	LPG equipment
	2268x	CNG equipment
	2270x	Diesel engines
	2285002015, 2285006015	Railway maintenance
LdGhgN2030e0_nponzseg11dies.txt	22820200x	Diesel recreational-marine
LdGhgN2030e10.txt	2260x	2-stroke gasoline engines
	2265x	4-stroke gasoline engines
	228200x, 228201x	Gasoline recreational marine

All NMIM data are based on AEO2007 fuels and NMIM county database NCD20080727. We converted emissions from monthly totals to monthly average-day values based the on number of days in each month. CO_2 and all of California emissions were removed prior to creating SMOKE one record per line (ORL) files.

California nonroad:
California monthly nonroad emissions are year 2030 and are based on March 2007 California Air Resources Board (CARB) data (Martin Johnson: mjohnson@arb.ca.gov). NH3 emissions are from NMIM runs for California (same data as were used in 2030 from the 2002 v3 platform). We allocated refueling emissions to the gasoline equipment types based on evaporative mode VOC emissions from the 2002 v3 platform 2030 NMIM data, and the refueling emissions were computed by multiplying SCC 2505000120 emissions by 0.61, to adjust to remove double counting with Portable Fuel Container inventory for California. We estimated HAP emissions by applying HAP-to-CAP ratios computed from the California data provided for the 2005 NEI v2, collected by EPA on 12/2007. This was done because the CARB submittal from March 2007 did not include estimates for HAPs. We retained only those HAPs that are also estimated by NMIM for nonroad mobile sources; all other HAPs were dropped.

4.3.2 Locomotives and Class 1 & 2 commercial marine vessels (alm_no_c3)

Future year locomotive and Class 1 and Class 2 commercial marine vessel (CMV) emissions were calculated using projection factors that were computed based on national, annual summaries of locomotive emissions in 2002 and year 2030. These national summaries were used to create national by-pollutant, by-SCC projection factors; these factors include final locomotive-marine controls and are provided in Table 4-12.

Table 4-12. Factors applied to year 2005 emissions to project locomotives and Class 1 and Class 2 Commercial Marine Vessel Emissions to 2030

SCC	SCC Description	Pollutant	Projection Factor
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	CO	0.956
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	NH_3	1.285
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	NO_X	0.372
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	PM_{10}	0.350
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	$PM_{2.5}$	0.356
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	SO_2	0.045
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	VOC	0.402
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	CO	1.640
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	NH_3	1.627
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	NO_X	0.357
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	PM_{10}	0.260
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	$PM_{2.5}$	0.263
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	SO_2	0.006
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	VOC	0.293
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	CO	0.403
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	NH_3	1.627
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	NO_X	0.350
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	PM_{10}	0.272
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	$PM_{2.5}$	0.275
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	SO_2	0.001
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	VOC	0.387
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	CO	1.188
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	NH_3	1.627
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	NO_X	0.241
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	PM_{10}	0.148
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	$PM_{2.5}$	0.149
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	SO_2	0.005
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	VOC	0.136
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	CO	1.172
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	NH_3	1.627
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	NO_X	0.237
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	PM_{10}	0.146
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	$PM_{2.5}$	0.146
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	SO_2	0.005
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	VOC	0.134
2285002010	Railroad Equipment;Diesel;Yard Locomotives	CO	1.649
2285002010	Railroad Equipment;Diesel;Yard Locomotives	NH_3	1.627
2285002010	Railroad Equipment;Diesel;Yard Locomotives	NO_X	0.851
2285002010	Railroad Equipment;Diesel;Yard Locomotives	PM_{10}	0.690
2285002010	Railroad Equipment;Diesel;Yard Locomotives	$PM_{2.5}$	0.704
2285002010	Railroad Equipment;Diesel;Yard Locomotives	SO_2	0.007
2285002010	Railroad Equipment;Diesel;Yard Locomotives	VOC	1.074

The future-year locomotive emissions account for increased fuel consumption based on Energy Information Administration (EIA) fuel consumption projections for freight rail, and emissions reductions resulting from emissions standards from the Final Locomotive-Marine rule (EPA, 2009). This rule lowered diesel sulfur content and tightened emission standards for existing and new locomotives and marine diesel emissions to lower future-year PM, SO_2, and NO_X, and is documented at: http://www.epa.gov/otaq/regs/nonroad/420f08004.htm. Voluntary retrofits under the National Clean Diesel Campaign (http://www.epa.gov/otaq/diesel/index.htm) are not included in our projections.

We applied HAP factors for VOC HAPs by using the VOC projection factors to obtain 1,3-butadiene, acetaldehyde, acrolein, benzene, and formaldehyde.

Class 1 and 2 CMV gasoline emissions (SCC = 2280004000) were not changed for future-year processing. C1/C2 diesel emissions (SCC = 2280002100 and 2280002200) were projected based on the Final Locomotive Marine rule national-level factors provided in Table 4-12. Similar to locomotives, VOC HAPs were projected based on the VOC factor.

Delaware provided updated future-year NO_X, SO_2, and PM emission estimates for C1/C2 CMV as part of the Transport Rule comments. These updated emissions were applied to the 2030 inventory and override the C1/C2 projection factors in Table 4-12.

4.3.3 Class 3 commercial marine vessels (seca_c3)

The seca_c3 sector emissions data were provided by OTAQ in an ASCII raster format used since the SO_2 Emissions Control Area-International Marine Organization (ECA-IMO) project began in 2005. The (S)ECA Category 3 (C3) commercial marine vessel 2002 base-case emissions were projected to year 2005 for the 2005 base case and to year 2030 for the HDGHG future reference case, which includes ECA-IMO controls. An overview of the ECA-IMO project and future-year goals for reduction of NO_X, SO_2, and PM C3 emissions can be found at: http://www.epa.gov/oms/regs/nonroad/marine/ci/420f09015.htm

The resulting coordinated strategy, including emission standards under the Clean Air Act for new marine diesel engines with per-cylinder displacement at or above 30 liters, and the establishment of Emission Control Areas is at: http://www.epa.gov/oms/oceanvessels.htm

These projection factors vary depending on geographic region and pollutant; where VOC HAPs are assigned the same growth rates as VOC. The projection factors used to create the 2030 seca_c3 sector emissions are provided in Table 4-13. Note that these factors are relative to 2002. Factors relative to 2005 can be computed from the 2002-2005 factors.

The geographic regions are described in the ECA Proposal technical support document: http://www.epa.gov/oms/regs/nonroad/marine/ci/420r09007-chap2.pdf. These regions extend up to 200 nautical miles offshore, though less at international boundaries. North and South Pacific regions are divided by the Oregon-Washington border, and East Coast and Gulf Coast regions are divided east-west by roughly the upper Florida Keys just southwest of Miami.

The factors to compute HAP emission are based on emissions ratios discussed in the 2005v4 documentation (ftp://ftp.epa.gov/EmisInventory/2005v4/2005_emissions_tsd_07jul2010.pdf). As with the 2005 base case, this sector uses CAP-HAP VOC integration.

Table 4-13. NO_X, SO_2, and $PM_{2.5}$ Factors to Project Class 3 Commercial Marine Vessel emissions to 2030

Region	NOX	SO2	PM2.5	VOC
Alaska East	1.702	0.095	0.312	2.487
Alaska West	2.052	0.456	0.571	2.396
East Coast	1.072	0.123	0.470	3.464
Gulf Coast	0.688	0.079	0.303	2.217
Hawaii East	1.416	0.147	0.506	3.839
Hawaii West	2.783	0.733	0.871	3.842
North Pacific	0.874	0.098	0.348	2.528
South Pacific	1.232	0.166	0.589	4.225
Great Lakes	1.090	0.057	0.214	1.621
Outside ECA	2.427	0.623	0.745	3.417

4.4 Canada, Mexico, and Offshore sources (othar, othon, and othpt)

Emissions for Canada, Mexico, and offshore sources were not projected to future years, and are therefore the same as those used in the 2005 base case. Therefore, the Mexico emissions are based on year 1999, offshore oil is based on year 2005, and Canada is based on year 2006. For both Mexico and Canada, their responsible agencies did not provide future-year emissions that were consistent with the base year emissions.

5 2030 Control Case

The 2030 HDGHG Control case is intended to represent the emissions associated with use of the most likely volume of ethanol after application of the greenhouse gas emissions standards for commercial medium-and heavy-duty on-highway vehicles and work trucks beginning with the 2014 model year (MY). The control case assumes improvements in fuel consumption or greenhouse gas emissions in MY 2014 through 2018. Similar to the reference case, the control case does not include fuel and emissions changes from the Energy Independence and Security Act of 2007 (EISA), or the revised annual Renewable Fuel Standards (RFS2); however the Light Duty Greenhouse Gas (LDGHG) impacts are included in both this control case and the reference case discussed in section 4.

The 2030 Control case inventories differ from the reference case in only two components:

1) Gasoline distribution impacts in the non-EGU point (ptnonipm) and nonpoint sectors, and
2) MOVES2010a-based onroad mobile impacts to medium and heavy duty vehicles.

5.1 2030 Control Case Point and Nonpoint sources

The point sources for the 2030 HDGHG Control Case include the same emissions as the 2030 Reference Case for the following point source emissions modeling sectors: US EGU point source (ptipm), sources from Mexico, Canada, and the Gulf of Mexico (othpt). The nonpoint sources for the 2030 HDGHG Control Case include the same emissions as the 2030 Reference Case for the following nonpoint source emissions modeling sectors: area fugitive dust (afdust), agricultural ammonia (ag), average-year fires (avefire) and sources from Mexico and Canada (othar).

The HDGHG year 2030 control case changes to the point and nonpoint emissions are limited to Annual Energy Outlook (AEO) year2010-based upstream adjustments: refinery supply estimates and estimated reductions in consumption that impact crude production and transport/distribution emissions from the HDGHG control strategy for medium and heavy duty vehicles. The only sectors impacted by these control case adjustments are the ptnonipm (point) and nonpt (nonpoint) sectors. VOC speciation changes from the reference to the control case are discussed in Section 3.

Upstream adjustments to oil refining, crude production, and transport were supplied by OTAQ on 12/16/2010 in the Excel® workbook "HDGHG_AQADJ_121610.xlsx". These adjustments reduce all pollutant emissions from the 2030 reference case and are summarized below in Table 5-1.

Table 5-1. Upstream HDGHG Control Case adjustments

Category	Sectors Impacted	% Reduction	Cumulative Emissions Reductions			
			NO_X	$PM_{2.5}$	SO2	VOC
Production	nonpt and ptnonipm	0.13%	1,667	308	1,821	1,794
Refinery	nonpt and ptnonipm	1.27%				
Transport	nonpt and ptnonipm	0.13%				

5.2 2030 Control Case Mobile sources

The onroad mobile and nonroad mobile sources for the 2030 HDGHG Control Case include the same emissions as the 2030 Reference Case for the following emissions modeling sectors: US nonroad mobile (nonroad), US locomotives and non-C3 commercial marine (alm_no_c3), C3 commercial marine (seca_c3), Canada and Mexico onroad mobile emissions (othon) and Canada and Mexico nonroad emissions (also in the othar sector with Canada and Mexico stationary sources). California onroad mobile emissions were also not changed in the control case except for NH_3, where MOVES control case emissions replaced MOVES reference case NH_3 estimates.

The HDGHG year 2030 control case changes to the mobile sectors are limited to the MOVES2010a-based onroad non-California (except NH_3) inventories and impact the following onroad mobile emissions modeling sectors: on_moves_runpm, on_moves_startpm and on_noadj.

Similar to the 2005 HDGHG and 2030 HDGHG reference cases, we allocated the state-SCC MOVES data to county-SCC using ratios developed from the same 2030 NMIM county-SCC data as used in the 2030 HDGHG reference case. Other than the different MOVES2010a emissions data, we used the same processing steps as described for the 2005 base and 2030 reference cases. VOC speciation changes from the reference to the control case are discussed in Section 3.

Control case onroad mobile reductions are provided in Table 5-2. Small increases in $PM_{2.5}$ are the result of slight increases in auxiliary power unit emissions.

Table 5-2. Onroad mobile reductions from HDGHG controls

	NO_X	$PM_{2.5}$	SO2	VOC
Reductions	215,639	-237	304	22,953
% Reduction from Reference case	11.9%	-0.2%	1.3%	2.4%

6 References

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APPENDIX A

Modified HDGHG Equations to adapt pre-speciated diesel emissions from MOVES to air quality modeling species needed for CMAQ

As shown in equation (1) below, MOVES provides total $PM_{2.5}$, PEC and PSO4. A remainder term, *R*, makes up the difference between the two species and the total $PM_{2.5}$.

$$\text{MOVES total } PM_{2.5} = PEC + PSO4 + R \tag{1}$$

The *R* term includes POM, which consists of POC and the hydrogen and oxygen atoms attached to the carbon as part of the organic matter, PNO3, soil oxides and metals (also known as "crustal" and called METAL here), ammonium, and water, and thus can be also written as:

$$R = POM + PNO3 + METAL + NH4 + H_20 \tag{2}$$

To correctly calculate the five $PM_{2.5}$ species needed for CMAQ, we first needed to break out the POC, PNO3, and PMFINE from *R*. Different calculations are used for light-duty diesel vehicles and heavy-duty diesel vehicles, since the speciation profiles for these are different. The speciation profiles used for these calculations are:

For both light duty diesel vehicles and heavy duty diesel vehicles, the SPECIATE 4.0 PM2.5 speciation profiles "3914" (HHDV) and "92042" (LDDV) will be used to help calculate the other species. At the time, OTAQ did not provide a justification for choosing this profile, but the fractions of metals and PNO3 are small and so presumably the choice does not matter too much as long as the smallest of those fractions is representative.

We computed the primary nitrate based on speciation profile 92011 from the SPECIATE4.1 database (Hsu et al., 2006) using equation (3) shown below.

$$PNO3 = PEC \times F_{NO3} / F_{EC} \tag{3}$$

where,

F_{EC} = Fraction of elemental carbon in speciation profile:
- LDDV: 57.4805% (based on profile 92042)[2]
- HDDV: 77.1241% (based on profile 3914)

F_{NO3} = Fraction of nitrate in speciation profile
- LDDV: 0.1141% (based on profile 3914, intentionally inconsistent)
- HDDV: 0.1141% (based on profile 3914)

To identify which sources should get the LDDV and which should get the HDDV approach, see Table 1, below.

Since CMAQ's PMFINE species is the sum of soil oxides, metals, ammonium, and water, we needed to calculate all of its components. First, the metals and ammonium are computed using equations (4) and (5). Equation (5) is based on stoichiometric calculations.

[2] All profile fractions provided in email from Catherine Yanca on 11/6/2009, 1:49pm in attachment "Equations for diesel MOVES speciation use in CMAQ 110609.doc"

$$\text{METAL} = \text{PEC} \times F_{metal} / F_{EC} \quad (4)$$

$$\text{NH4} = (\text{PNO3}/MW_{NO3} + 2 \times \text{PSO4}/MW_{SO4}) \times MW_{NH4} \quad (5)$$

where,

F_{metal} = Fraction of metals in speciation profile (0.002663[3])
MW_{SO4} = Molecular weight of sulfate (96.0576)
MW_{NO3} = Molecular weight of nitrate (62.0049)
MW_{NH4} = Molecular weight of ammonium (18.0383)

The final component of PMFINE is the non-carbon mass of organic carbon. To calculate the non-carbon mass, we first needed to compute organic carbon from the remainder term, *R*.

A key assumption is that POM is a factor of 1.2 greater than the mass of primary organic carbon, which is also used in the CMAQ postprocessing software at EPA.

$$\text{POM} = 1.2 \times \text{POC} \quad (6)$$

Using this assumption and assuming that the H_20 is negligible, the equation needed for the calculation of POC is shown in equations 7a and 7b for gasoline exhaust and diesel exhaust, respectively. As discussed in Section 2.3, for HDGHG, the NH4 component was removed for diesel exhaust only.

Gasoline Exhaust: $$\text{POC} = 5/6 \times (R - \text{METAL} - \text{NH4} - \text{PNO3}) \quad (7a)$$
Diesel Exhaust: $$\text{POC} = 5/6 \times (R - \text{METAL} - \text{PNO3}) \quad (7b)$$

See Appendix B of the 2005v4 TSD for more complete discussion on PM speciation for gasoline exhaust processes: ftp://ftp.epa.gov/EmisInventory/2005v4/2005_emissions_tsd_appendices_11may2010.pdf.

From equation (6), the non-carbon portion of the organic carbon matter is 20%, of the POC. By definition, PMFINE is the sum of the non-carbon portion of the mass, METAL and NH4. Thus, we computed PMFINE_72 using equations (8a and 8b) shown below for gasoline and diesel exhaust.

Gasoline Exhaust: $$\text{PMFINE\_72} = \text{METAL} + \text{NH4} + 0.2 \times \text{POC\_72} \quad (8a)$$
Diesel Exhaust: $$\text{PMFINE\_72} = \text{METAL} + 0.2 \times \text{POC\_72} \quad (8b)$$

Equations 7a and 8a (with NH4) will be obsolete in all subsequent MOVES post-processing; we did not have time to reprocess the gasoline exhaust emissions for HDGHG; however, the computed NH4 component in gasoline exhaust was much smaller than for diesel exhaust so this impact should be negligible.

For mobile sources, we assumed that PMC is 8.6% of the $PM_{2.5}$ mass. Equation (9) shows how we calculated it.

$$\text{PMC} = 0.086 \times (\text{PMFINE} + \text{PEC} + \text{POC} + \text{PSO4} + \text{PNO3}) \quad (9)$$

Table A-1. List of SCC groups for application of LDDV or HDDV approach

Approach	SCC list
LDDV	2230001000 through 2230060334
HDDV	2230071110 through 2230075330

[3] Value provided by Catherine Yanca and Joe Somers to OAQPS in email provided 11/5/2009

APPENDIX B

Inventory Data Files Used for Each HDGHG Modeling Case – SMOKE Input Inventory Datasets

In any of the following dataset names where the placeholder <mon> has been provided, this is intended to mean 12 separate files with the <mon> placeholder replaced with either jan, feb, mar, apr, may, jun, jul, aug, sep, oct, nov, or dec, each associated with a particular month of the year.

Table B-1. List of inventory data associated with HDGHG modeling cases.

Case	Sector	SMOKE Input Files
2005 Base (2005cs_hdghg_05b)	ptipm	Annual: ptinv_ptipm_2005cs_cap_27dec2010_txt_29dec2010_v1_orl.txt
		Annual: ptinv_ptipm_2005cs_hap_27dec2010_txt_27dec2010_v0_orl.txt
		Daily: ptday_ptipm_caphap_noncem_2005cs_05b_<month>_ida.txt
		Daily: ptday_ptipm_caphap_cem_2005cs_05b_<month>_ida.txt
	ptnonipm	ptinv_ptnonipm_xportfrac_cap2005v2_2005cs_orl_06jan2011_v4_orl.txt
		ptinv_ptnonipm_hap2005v2_2005cs_orl_04jan2011_v2_orl.txt
		ptinv_ptnonipm_caphap_ethanol_plant_additions_2005_30jun2010_v3_orl.txt
		ptinv_ptnonipm_xportfrac_2005cap_v1_from_2005ai_ND_ADM_plant_30jun2010_v0_orl.txt
		ptinv_ptnonipm_2005hap_v1_from_2005ai_ND_ADM_plant_30jun2010_v0_orl.txt
	afdust	arinv_afdust_2002ad_xportfrac_26sep2007_v0_orl.txt
	ag	arinv_ag_cap2002nei_06nov2006_v0_orl.txt
	alm_no_c3	arinv_lm_no_c3_hap2002v4_20feb2009_v0_orl.txt
		arinv_lm_no_c3_cap2002v3_22dec2010_v1_orl.txt
	nonpt	arinv_nonpt_pf4_cap_nopfc_04jan2011_v5_orl.txt
		arinv_nonpt_pf4_hap_nopfc_nobafmpesticidesplus_04jan2011_v3_orl.txt
		arinv_pfc_2002_caphap_27dec2007_v0_orl.txt
		arinv_nonpt_cap_2005_WRAP_OilGas_04feb2009_v0_orl.txt
		arinv_nonpt_cap_2005_TCEQ_Oklahoma_OilGas_28may2010_v0_orl.txt
	nonroad	arinv_nonroad_caps_2005v2_<month>_revised_08sep2008_v0_orl.txt
		arinv_nonroad_calif_caphap_2005v2_revised_<month>_23jun2010_v0_orl.txt
		arinv_nonroad_haps_2005v2_<month>_revised_05sep2008_v0_orl.txt
	on_noadj	mbinv_on_noadj_MOVES_with_NO_NO2_HONO_2005cs_hdghg_<month>_24FEB2011_24feb2011_v0_orl.txt
		mbinv_onroad_calif_caphap_2005v2_revised_<month>_16feb2011_v1_orl.txt
	on_moves_runpm	mbinv_on_moves_runpm_2005cs_hdghg_<month>_03FEB2011_03feb2011_v0_orl.txt
	on_moves_startpm	mbinv_on_moves_startpm_2005cs_hdghg_<month>_03FEB2011_03feb2011_v0_orl.txt
	seca_c3	ptinv_eca_imo_CANADA_SCC_fix_vochaps_2005_09DEC2010_09dec2010_v0_orl.txt
		ptinv_eca_imo_CANADA_SCC_fix_caps_2005_09DEC2010_09dec2010_v0_orl.txt
		ptinv_eca_imo_fixFIPS_US_wDE_andSCC_fix_caps_2005_09DEC2010_09dec2010_v0_orl.txt
		ptinv_eca_imo_fixFIPS_US_andSCC_fix_vochaps_2005_09DEC2010_09dec2010_v0_orl.txt
All Cases	avefire	arinv_avefire_2002ce_21dec2007_v0_ida.txt
		arinv_avefire_2002_hap_18nov2008_v0_orl.txt
	othar	arinv_nonroad_mexico_interior1999_21dec2006_v0_ida.txt
		arinv_nonroad_mexico_border1999_21dec2006_v0_ida.txt
		arinv_nonpt_mexico_interior1999_21dec2006_v0_ida.txt
		arinv_nonpt_mexico_border1999_21dec2006_v0_ida.txt
		arinv_canada_offroad_cap_2006_04feb2009_v0_orl.txt
		arinv_canada_marine_cap_2006_03feb2009_v0_orl.txt
		arinv_canada_oarea_cap_2006_02mar2009_v3_orl.txt

Case	Sector	SMOKE Input Files
		arinv_canada_aircraft_cap_2006_04feb2009_v0_orl.txt
		arinv_canada_rail_cap_2006_03feb2009_v0_orl.txt
		arinv_canada_ag_cap_2006_03feb2009_v0_orl.txt
		arinv_canada_afdust_xportfrac_cap_2006_03feb2009_v0_orl.txt
	othon	mbinv_canada_onroad_cap_2006_04feb2009_v0_orl.txt
		mbinv_onroad_mexico_border1999_21dec2006_v0_ida.txt
		mbinv_onroad_mexico_interior1999_21dec2006_v0_ida.txt
	othpt	ptinv_canada_point_2006_orl_09mar2009_v2_orl.txt
		ptinv_canada_point_cb5_2006_orl_10mar2009_v0_orl.txt
		ptinv_canada_point_uog_2006_orl_02mar2009_v0_orl.txt
		ptinv_mexico_border99_03mar2008_v1_ida.txt
		ptinv_mexico_interior99_05feb2007_v0_ida.txt
		ptinv_ptnonipm_offshore_oil_cap2005v2_20nov2008_20nov2008_v0_orl.txt
2030 Reference and Control	Ptipm	Annual: ptinv_PTINV_EPA410_BC_15b_summer_2030_02FEB2011_ORL_04feb2011_v0_orl.txt
		Daily: ptday_ptipm_caphap_noncem_2030cs_hdghg_ref_05b_<month>_ida.txt
		Daily: ptday_ptipm_caphap_cem_2030cs_hdghg_ref_05b_<month>_ida.txt
	afdust	arinv_afdust_2030cs_10feb2011_v0_orl.txt
	ag	arinv_ag_cap2030cs_10feb2011_v0_orl.txt
	alm_no_c3	arinv_lm_no_c3_hap2030cs_10feb2011_v0_orl.txt
		arinv_lm_no_c3_cap2030cs_10feb2011_v0_orl.txt
	Nonroad	arinv_nonroad_capshaps_LDGHG_2030_CONTROL_<month>_15DEC09_15dec2009_v0_orl.txt
		arinv_nonroad_calif_caphap_2030v31_<month>_17apr2008_v0_orl.txt
	seca_c3	ptinv_eca_imo_CANADA_SCC_fix_vochaps_2030_08FEB2011_08feb2011_v0_orl.txt
		ptinv_eca_imo_CANADA_SCC_fix_caps_2030_08FEB2011_08feb2011_v0_orl.txt
		ptinv_eca_imo_fixFIPS_US_wDE_andSCC_fix_caps_2030_08FEB2011_08feb2011_v0_orl.txt
		ptinv_eca_imo_fixFIPS_US_andSCC_fix_vochaps_2030_08FEB2011_08feb2011_v0_orl.txt
2030 Reference Only (2030cs_hdghg_ref_05b)	ptnonipm	ptinv_ptnonipm_xportfrac_cap2030cs_10feb2011_v0_orl.txt
		ptinv_ptnonipm_hap2030cs_10feb2011_v0_orl.txt
		ptinv_ptnonipm_caphap_ethanol_plant_additions_2005_30jun2010_v3_orl.txt
		ptinv_ptnonipm_xportfrac_2005cap_v1_from_2005ai_ND_ADM_plant_30jun2010_v0_orl.txt
		ptinv_ptnonipm_2005hap_v1_from_2005ai_ND_ADM_plant_30jun2010_v0_orl.txt
		ptinv_ptnonipm_cornproducts17031_hap_cap_2008t_27aug2010_v0_orl.txt
		ptinv_ptnonipm_capHG_cementISIS_2016cr_16AUG2010_16aug2010_v0_orl.txt
	nonpt	arinv_nonpt_2030cs_pf4_cap_nopfc_11feb2011_v0_orl.txt
		arinv_nonpt_2030cs_pf4_hap_nopfc_nobafmpesticidesplus_11feb2011_v0_orl.txt
		arinv_pfc_caphap2030_02apr2008_v0_orl.txt
		arinv_nonpt_cap_2018PhaseII_WRAP_OilGas_24aug2009_v0_orl.txt
		arinv_nonpt_2030cs_from_cap_2008_TCEQ_Oklahoma_OilGas_11feb2011_v0_orl.txt
	on_noadj	mbinv_on_noadj_MOVES_with_NO_NO2_HONO_2030cs_hdghg_ref_<month>_23FEB2011_23feb2011_v0_orl.txt
		mbinv_onroad_calif_caphap_2030v31_<month>_14feb2011_v1_orl.txt
	on_moves_runpm	mbinv_on_moves_runpm_2030cs_hdghg_ref_<month>_04FEB2011_04feb2011_v0_orl.txt

Case	Sector	SMOKE Input Files
	on_moves_startpm	mbinv_on_moves_startpm_2030cs_hdghg_ref_<month>_04FEB2011_04feb2011_v0_orl.txt
2030 Control Only (2030cs_hdghg_ctl_05b)	Ptnonipm	ptinv_ptnonipm_xportfrac_cap2030cs_hdghg_ctl_25feb2011_v0_orl.txt
		ptinv_ptnonipm_hap2030cs_hdghg_ctl_25feb2011_v0_orl.txt
		ptinv_ptnonipm_caphap_ethanol_plant_additions_2005_30jun2010_v3_orl.txt
		ptinv_ptnonipm_xportfrac_2005cap_v1_from_2005ai_ND_ADM_plant_30jun2010_v0_orl.txt
		ptinv_ptnonipm_2005hap_v1_from_2005ai_ND_ADM_plant_30jun2010_v0_orl.txt
		ptinv_ptnonipm_cornproducts17031_hap_cap_2008t_27aug2010_v0_orl.txt
		ptinv_ptnonipm_capHG_cementISIS_2016cr_16AUG2010_16aug2010_v0_orl.txt
	Nonpt	arinv_nonpt_2030cs_hdghg_ctl_pf4_cap_nopfc_25feb2011_v0_orl.txt
		arinv_nonpt_2030cs_hdghg_ctl_pf4_hap_nopfc_nobafmpesticidesplus_25feb2011_v0_orl.txt
		arinv_pfc_caphap2030_02apr2008_v0_orl.txt
		arinv_nonpt_cap_2030cs_hdghg_ctl_from_2018PhaseII_WRAP_OilGas_25feb2011_v0_orl.txt
		arinv_nonpt_2030cs_hdghg_from_2030cs_TCEQ_Oklahoma_OilGas_25feb2011_v0_orl.txt
	on_noadj	mbinv_on_noadj_MOVES_with_NO_NO2_HONO_2030cs_hdghg_ctl_<month>_25FEB2011_25feb2011_v0_orl.txt
		mbinv_onroad_calif_caphap_2030v31_<month>_14feb2011_v1_orl.txt
	on_moves_runpm	mbinv_on_moves_runpm_2030cs_hdghg_ctl_<month>_25FEB2011_25feb2011_v0_orl.txt
	on_moves_startpm	mbinv_on_moves_startpm_2030cs_hdghg_ctl_<month>_25FEB2011_25feb2011_v0_orl.txt

APPENDIX C

Ancillary Data Files Used for HDGHG 2005 Case Compared to 2005 v4.2 Platform Data Files

To match the Datasets and Versions listed in this table to actual data files, combine the Dataset name and the version number in the following pattern: <Dataset Name>_<Date>_<Version number>.txt, where <Date> is the last date of change for that version and will have a unique value for the combination of Dataset Name and Version number.

Table C-1. Detailed list of ancillary data differences between the HDGHG 2005 and the 2005 v4.2 platform

Description	Environment Variable	Sectors	2005 v4.2 platform		2005 HDGHG platform		Comment and Impact	Impact?
			Dataset	**Vsn**	**Dataset**	**Vsn**		
Inventory table	INVTABLE	All sectors	invtable_hapcapintegate_cb05soa_nomp_nohg	3	invtable_hapcap_cb05soa	10	HDGHG used a toxics "lite" approach for processing the emissions and 2005 v4.2 platform used an approach without most toxics. Impacts only the species included in the air quality modeling. HDGHG also includes speciated NO, NO2 and HONO from MOVES2010a onroad mobile sources.	Yes
Inventory table	INVTABLE	avefire, ptnonipm, ptipm	invtable_hapcapnohapuse_cb05soa_nomp_nohg	1	invtable_hapcap_cb05_no_bafm	3	Approach for implementing "no HAP use" approach for these sectors was different in HDGHG, but the result was the same.	No
Combination Profiles	GSPRO_COMBO	onroad, nonroad, ptnonipm, nonpt	gspro_combo_2005	2	gspro_combo_2005	6	Different fuel mixes for refueling, PFCs, and gasoline distribution in ptnoipm and nonpt in HDGHG –see Section 3 in HDGHG TSD.	Yes
VOC to TOG pollutant conversions	GSCNV	All sectors	gscnv_cmaq_cb05_tx_pf4	3	gscnv_cb05_soa	1	Contains all 3 2005v4.2 GSCNV datasets appended into a single dataset. Updated for HDGHG profiles.	Yes
VOC to TOG pollutant conversions	GSCNV	All sectors	gscnv_cmaq_cb05_hspace_toxic	0	n/a		Headspace profiles for NONHAP TOG	No
VOC to TOG pollutant conversions	GSCNV	All sectors	gspro_cmaq_cb05_hspace_BAF	1	n/a		Headspace profiles for benzene	No
Speciation profiles -static	GSPRO	All sectors	gspro_static_cmaq	9	gspro_static_cmaq	12	Added NO, NO2, and HONO for MOVES2010a species.	Yes
Speciation profiles for TOG	GSPRO	All sectors	gspro_tog_cb05_soa_pf4_pretier2	1	gspro_tog_cb05_soa	1	Excluded ald2_primary and form_primary from v4 platform since not needed	No
Speciation profiles Other VOC HAP	GSPRO	All sectors	n/a		gspro_other_hapvoc_no_benz-benz	0	For HDGHG, this dataset has the HAP VOC species that get passed through from inventory to the multipollutant inputs created for HDGHG.	Yes
Speciation profiles for non-	GSPRO	All sectors	gspro_nonhaptog_cb05_tx_pf4_pretier2	1	gspro_nonhaptog_cb05	1	Updated HDGHG profiles and also appends the next three listed GSPRO datasets from v4.2 in this	Yes

Description	Environment Variable	Sectors	2005 v4.2 platform		2005 HDGHG platform		Comment and Impact	Impact ?
			Dataset	Vsn	Dataset	Vsn		
HAP TOG							table	
Speciation profile 8762/8763 for toxics	GSPRO	All sectors	gspro_cmaq_cb05_hspace_toxic	0	n/a		toxics from NONHAPTOG for headspace profiles 8762 and 8763	No
Speciation profile 8762/8763 for nontoxics	GSPRO	All sectors	gspro_cmaq_cb05_hspace_nontoxic	0	n/a		toxics from TOG for headspace profiles 8762 and 8763	No
Speciation profile 8762/8763 for TOG to BAF	GSPRO	All sectors	gspro_cmaq_cb05_hspace_BAF	1	n/a		benzene from TOG for headspace profiles 8762 and 8763	No
Speciation xref for NONHAPVOC, not year-specific	GSREF	All sectors	gsref_nonhapvoc_general_ldghg_cr_update	6	gsref_nonhapvoc_general_hdghg	1	Reassigned nonroad diesel exhaust and pleasure craft from code 4674 to 8774.	Yes
Speciation xref for NONHAPVOC, year-specific	GSREF	All sectors	gsref_nonhapvoc_2005_ldghg_cr_update	6	gsref_nonhapvoc_2005_hdghg	1	Replaced 8762 (E0) headspace refueling/distribution with COMBO E0/E10 profile, add pre-2007 HD trucks profile (8774)	Yes
Speciation xref for VOC, not year-specific	GSREF	All sectors	gsref_voc_general_ldghg	6	gsref_voc_general_hdghg	2	Reassigned nonroad diesel exhaust and pleasure craft from code 4674 to 8774.	Yes
Speciation xref for VOC, year-specific	GSREF	All sectors	gsref_voc_2005_ldghg	5	gsref_voc_2005_hdghg	3	Replaced 8762 (E0) headspace refueling/distribution with COMBO E0/E10 profile, add pre-2007 HD trucks profile (8774)	Yes
Speciation xref - static	GSREF	All sectors	gsref_static_cap_pf4	0	gsref_static_cap_pf4	1	Allows MOVES2010a NO, NO2, and HONO to pass through as-is.	Yes
SCC Descriptions	SCCDESC	All sectors	sccdesc_pf31	10	sccdesc_pf31	11	New SCC found for Hg processing ptnonipm	No

Appendix D

Summary of HDGHG Rule 2030 Reference Case Non-EGU Control Programs, Closures and Projections

Lists of control, closure, projection packet datasets used to create HDGHG year 2030 Reference case inventories from the 2005 HDGHG base case are provided in Tables D-1 and D-2.

Table D-1. Datasets used to Create HDGHG 2030 Inventories for Non-EGU Point Sources

Name	Type	Dataset	Version	Description
CLOSURES LotusNotes, ABCG, plus Timin 2016cr	Plant Closure	CLOSURES_LotusNotes_Linda_Timin_2016cr_23AUG2010	1	Plant and unit closures identified through EPA review.
CLOSURES TR1 comments and consent decrees 2014cs	Plant Closure	CLOSURES_TR1_2014cs_01FEB2011	0	Plant and unit closures through 2014 identified as a result of Transport Rule comments.
CLOSURES cement ISIS 2013 policy	Plant Closure	CLOSURES_cementISIS_2016cr_17AUG2010	1	Cement plant and unit closures identified via the ISIS 2013 policy case.
closures: 2005 to 2012ck	Plant Closure	CLOSURES_2005ck_to_2012ck_CoST_format	0	Plant and unit closures identified 2008 or before.
CONTROL ADDITIONAL OECA 2005cr to 2016cr	Control	CONTROLS_additional_NEIpf4_OECA_2005cr_2016cr_29JUL2010	1	Controls that implement OECA consent decrees.
CONTROL REPLACE DOJ 2005cr to 2016cr	Control	CONTROLS_replacement_NEIpf4_DOJ_2005cr_2016cr_02AUG2010.txt	0	Controls resulting from the 2002v3 DOJ Texas settlement.
CONTROL REPLACE HWI 2005cr to 2016cr	Control	CONTROLS_replacement_NEIpf4_HWI_2005cr_2016cr_02AUG2010.txt	1	Hazardous Waste Incinerator controls for CAPs and Haps carried over from 2002v31.
CONTROL REPLACE IndustrialBoiler nonMACT 2005cr to 2016cr	Control	CONTROLS_replacement_IndBoilers_nonMACT_by2008_20AUG2010	0	Industrial boiler controls not related to application of the MACT but derived from the Boiler MACT ICR database dated 4/30/10.
CONTROL REPLACE LMWC 2005cr to 2016cr	Control	CONTROLS_replacement_NEIpf4_LMWC_2005cr_2016cr_02AUG2010.txt	0	Controls for large municipal combustors carried over from 2002v31.
CONTROL REPLACE MACT 2005cr to 2016cr	Control	CONTROLS_replacement_NEIpf4_MACT_2005cr_2016cr_02AUG2010.txt	0	MACT controls carried over from 2002v3 and updated as appropriate.
CONTROL REPLACE NY SIP 2005cr to 2016cr	Control	CONTROLS_replacement_NYSIP_O3_SCC_2016cr_26AUG2010	0	Controls that reflect enforceable controls for NOx and VOC from the New York ozone SIP.
CONTROL REPLACE Refineries 2005cr to 2016cr	Control	CONTROLS_replacement_NEIpf4_refineries_2005cr_2016cr_02AUG2010.txt	0	Controls for refineries specified by EPA expert refinery staff.
CONTROL RICE 2016cr_05b	Control	CONTROLS_replacement_RICE_2016cr_21SEP2010	1	Controls for 2014 and 2016 that represent three separate RICE NESHAPs
CONTROL RICE SO2 2014cs_05b	Control	CONTROLS_replacement_RICE_SO2_2014cs_05JAN2011	1	SO2 reductions from the Ultra-low Sulfur Diesel requirement for CI engines
CONTROL SULF rules: ME, NY, NJ 2018 and beyond	Control	CONTROLS_SULF_rules_2018_and_beyond_03FEB2011	1	SO2 reductions due to state sulfur content rules for fuel oil.

CONTROL St Gobain and LaFarge 2017	Control	CONTROLS_rep_Lafarge_StGobain_2017cs_25JAN2011.txt	0	Controls for NOx, SO2, PM., and HCl resulting from Saint Gobain and Lafarge consent decrees
CONTROL TR1 Final CONTROL packet: 2021	Control	CONTROLS_TR1_2021_09FEB2011	1	Controls for TCEQ oil and gas and non-ISIS related cement controls.
CONTROL TR1 Final consent decrees 2019	Control	CONTROLS_additional_TR1final_consent_decrees_2005cs_to_2019cs	1	Controls related to consent decrees identified during the Transport Rule comment period.
CONTROL cement ISIS 2013 policy	Control	CONTROLS_replacement_cementISIS_2016cr_17AUG2010	0	Controls for cement plants based on 2013 ISIS policy case
PROJECTION 2005 to 2030 ag emissions	Projection	PROJECTION_2005cs_2030_ag_09FEB2011	0	Projection factors for agriculture based on animal population stats.
PROJECTION LMWC 2005cr to 2016cr	Projection	PROJECTION_2005cr_2016cr_LMWC_29JUL2010	0	Projection factors for Solid and Liquid Municipal Waste Combustors.
PROJECTION TR1 comments 2005cs to 20XXcs -ptnonipm	Projection	PROJECTION_2005cs_20XX_TR1_ptnonipm_01FEB2011	0	Projection factors derived from Transport Rule comments.
PROJECTION aircraft 2005cs to 2030 JAN2010 FAATAF	Projection	PROJECTION_2005cs_2030_aircraft_JAN2010_based_FAATAF_10FEB2011	0	Projection factors for aircraft derived from the FAA Terminal Area Forecast System.
PROJECTION cement ISIS 2013 policy	Projection	PROJECTION_cementISIS_2016cr_17AUG2010	0	Projection factors that implement the 2013 ISIS policy case for cement.
PROJECTION refueling 2005cs to 2030cs_hdghg_ref	Projection	PROJECTION_2005cs_2030cs_hdghg_ref_onroad_refueling_04FEB2011	0	Projection factors for gasoline stage 2 refueling.

Table D-2. Datasets used to Create HDGHG 2030 Inventories for Nonpoint Sources

Control Program Name	**Type**	**Dataset**	**Version**	**Description**
CONTROL REPLACE NY SIP 2005cr to 2016cr	Control	CONTROLS_replacement_NYSIP_O3_SCC_2016cr_26AUG2010	0	Controls that reflect enforceable controls for NOx and VOC from the New York ozone SIP.
CONTROL RICE 2016cr_05b	Control	CONTROLS_replacement_RICE_2016cr_21SEP2010	1	Controls for 2014 and 2016 that represent three separate RICE NESHAPs
CONTROL RICE SO2 2014cs_05b	Control	CONTROLS_replacement_RICE_SO2_2014cs_05JAN2011	0	SO2 reductions from the Ultra-low Sulfur Diesel requirement for CI engines
CONTROL SULF rules: ME, NY, NJ 2018 and beyond	Control	CONTROLS_SULF_rules_2018_and_beyond_03FEB2011	0	SO2 reductions due to state sulfur content rules for fuel oil.
CONTROL TR1 Final CONTROL packet: 2021	Control	CONTROLS_TR1_2021_09FEB2011	0	Controls for TCEQ oil and gas and non-ISIS related cement controls.
PROJECTION 2005 to 2030 ag sector	Projection	PROJECTION_2005cs_2030_ag_09FEB2011	0	Projection factors for agriculture based on animal population stats.
PROJECTION RWC and landfills 2005 to 2030	Projection	PROJECTION_2005cs_2030cs_RWC_landfills_08FEB2011	0	Projection factors for residential wood combustion and landfills.
PROJECTION refueling 2005cs to 2030cs_hdghg_ref	Projection	PROJECTION_2005cs_2030cs_hdghg_ref_onroad_refueling_04FEB2011	0	Projection factors for gasoline stage 2 refueling.