EPA NONROAD Model Updates of 2008

NONROAD2008 is an update of the NONROAD model and it supersedes all previous versions of this model. There is a corresponding update to the NMIM model.

The main change for NONROAD2008 is the inclusion of emission reductions associated with two rules finalized in 2008:

* Diesel (CI) recreational marine standards in the Locomotive/Marine final rule
(Federal Register Vol 73, No. 88, page 25098, May 6, 2008).
* Small Spark Ignition (SI) and SI Recreational Marine final rule
(Federal Register Vol 73, No. 196, page 59034, October 8, 2008),

Since the main difference between NONROAD2008 and NONROAD2005 is the accounting for new exhaust and evaporative emission controls, the newer version predicts substantially less HC and CO, and somewhat less NOx and PM emissions than NONROAD2005 with use of comparable scenario inputs.

Any comparison depends greatly on pollutant, equipment type, year evaluated, and fuel choice -- especially how much ethanol is in the gasoline.

EPA NONROAD Model Updates of 2008

Besides addition of controls associated with these new rules, there are some other model changes

* Added ability to model effects of ethanol blends on fuel tank and hose permeation, two new inputs:
  - ethanol blend market share
  - volume percent ethanol (average) in the blend

* Revised fuel tank and hose permeation emission factors for small SI (less permeation)

* Updated some inputs for Phase 2 engines (especially decreased CO deterioration)

* Added hot soak and running loss inputs for handheld equipment and SI recreational marine

* Revised fuel consumption and 2-stroke PM emission factors for SI recreational marine engines

* Updated diesel recreational marine Tier 2 emission factors per certification data as of mid-2006

The charts compare model outputs by year for one basic scenario

* Nationwide 50 states + DC (Calif is treated like any other state)

* Default equipment populations, activity, and growth

* Use of the "Daily" Temperature and RVP option

* Ethanol blend (E10) market shares increasing from 13% in 2000 to 79% in 2012

* Diesel sulfur content decreasing over time to meet 15 ppm standard

NONROAD Model Nationwide Average Fuel Properties
Used for Model Version Comparisons

Year	Diesel Sulfur ppm		Ethanol Blends	
	Land	Marine	Market Share %	Vol %
2000	2284	2640	13.5	8.2
2001	2284	2635	14.5	8.2
2002	2284	2637	17.0	8.2
2003	2284	2637	22.2	8.2
2004	2284	2637	27.3	8.2
2005	2284	2637	31.0	9.3
2006	2242	2588	41.5	9.3
2007	1139	1332	46.3	9.3
2008	351	435	57.5	9.3
2009	351	435	75.1	9.3
2010	165	319	78.8	9.5
2011	32	236	78.8	9.5
2012	32	124	78.8	9.5
2013	32	44	78.8	9.5
2014	20	52	78.8	9.5
2015	11	56	78.8	9.5
2016	11	56	78.8	9.5
2017	11	56	78.8	9.5
2018	11	55	78.8	9.5
2019	11	55	78.8	9.5
2020+	11	55	78.8	9.5

EPA NONROAD Model Updates of 2008

Can Option (OPT) files from NONROAD2005 be used in NONROAD2008?

If you wish to properly model the effects of ethanol gasoline blends on permeation emissions, you must create new Option files that include the two new lines that specify ethanol blend market share and volume percent ethanol in the blend.

If you open an older option file in the Graphic User Interface (GUI), you will get a warning that there is a problem with the ethanol blend inputs; you can take care of this by entering appropriate values in the Scenario: Options form.

If you are only modeling exhaust emissions, or just diesel fueled equipment, or there is no ethanol in your gasoline, then Option files created with NONROAD2005 can be used with NONROAD2008.

Option files from model versions earlier than NONROAD2005 are not compatible with NONROAD2005 or NONROAD2008.

EPA NONROAD Model Updates of 2008

Have the technical reports and User's Guide been updated for NONROAD2008?

For this limited release of NONROAD2008 the Users Guide and technical reports have not yet been updated.

Details of the changes and the basis of those changes from NONROAD2005 can be found in the technical documentation for (a) the 2008 Small SI and SI Recreational Marine FRM (RIA and docket memos) and (b) the 2008 Loco/Marine FRM.

The User's Guide and technical reports were updated for NONROAD2005. Those documents can be downloaded from the NONROAD model web site at:

www.epa.gov/otaq/nonrdmdl.htm

EPA NONROAD Model Updates of 2008

Should I use NONROAD2008 or NMIM2008?

NMIM2008 (the National Mobile Inventory Model) is a consolidated emissions modeling system using EPA's MOBILE6.2 and NONROAD2008 models.

www.epa.gov/otaq/nmim.htm

NMIM generates county inventories using MOBILE6.2 and NONROAD2008 at scales ranging from individual counties to the nation. Its primary improvement over NONROAD2008 is the inclusion of all the required county temperature and fuel property data for the nation in a single database. In addition to the pollutants produced by NONROAD2008, NMIM2008 produces inventories for gaseous hazardous air pollutants (HAPs), polyaromatic

Since NMIM2008 incorporates NONROAD2008, the common pollutant inventories produced by each (i.e., HC, CO, CO2, NOx, PM, and SO2) will be the same, provided the same inputs are used.

NMIM2008 will need to be used if toxic inventories are required.

NONROAD2008 must be used if equipment populations or fuel consumption estimates are required, or if output by model year is required.

EPA NONROAD Model Updates of 2008

What is EPA's policy guidance on the use of NONROAD2008 versus NONROAD2005 for SIP and conformity purposes?

NONROAD2008 is a significant update of the NONROAD model and should be used in analyses to meet any regulatory requirements that call for the development of new nonroad inventories.

EPA NONROAD Model Updates of 2008

What additional changes are currently underway or being considered for the next version of the NONROAD model?

Work is underway to transform NONROAD into a database driven java application for incorporation into the MOVES model, so that modeling of nonroad equipment and onroad vehicles can be accomplished using the same comprehensive model.

The current plan is to include a draft version of the nonroad modeling capability in the release of Final MOVES2009 (for onroad vehicles) near the end of 2009. That version would not be expected to yield substantially different results compared to NONROAD2008.

For more information on MOVES, see http://www.epa.gov/otaq/models.htm

EPA NONROAD Model Contact Information

Web: www.epa.gov/otaq/nonrdmdl.htm

Email: nonroad@epa.gov
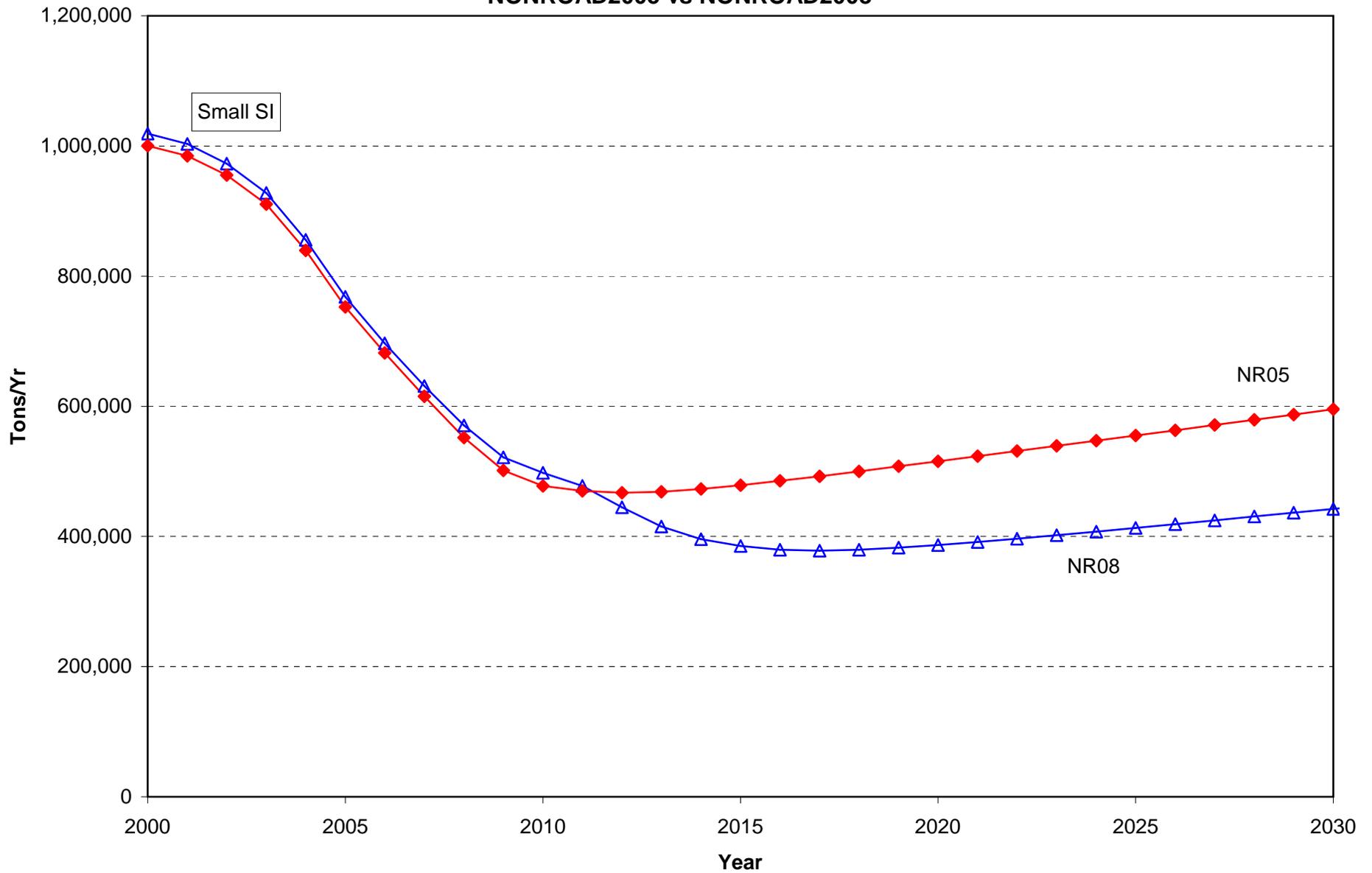
Mail:

U.S. Environmental Protection Agency

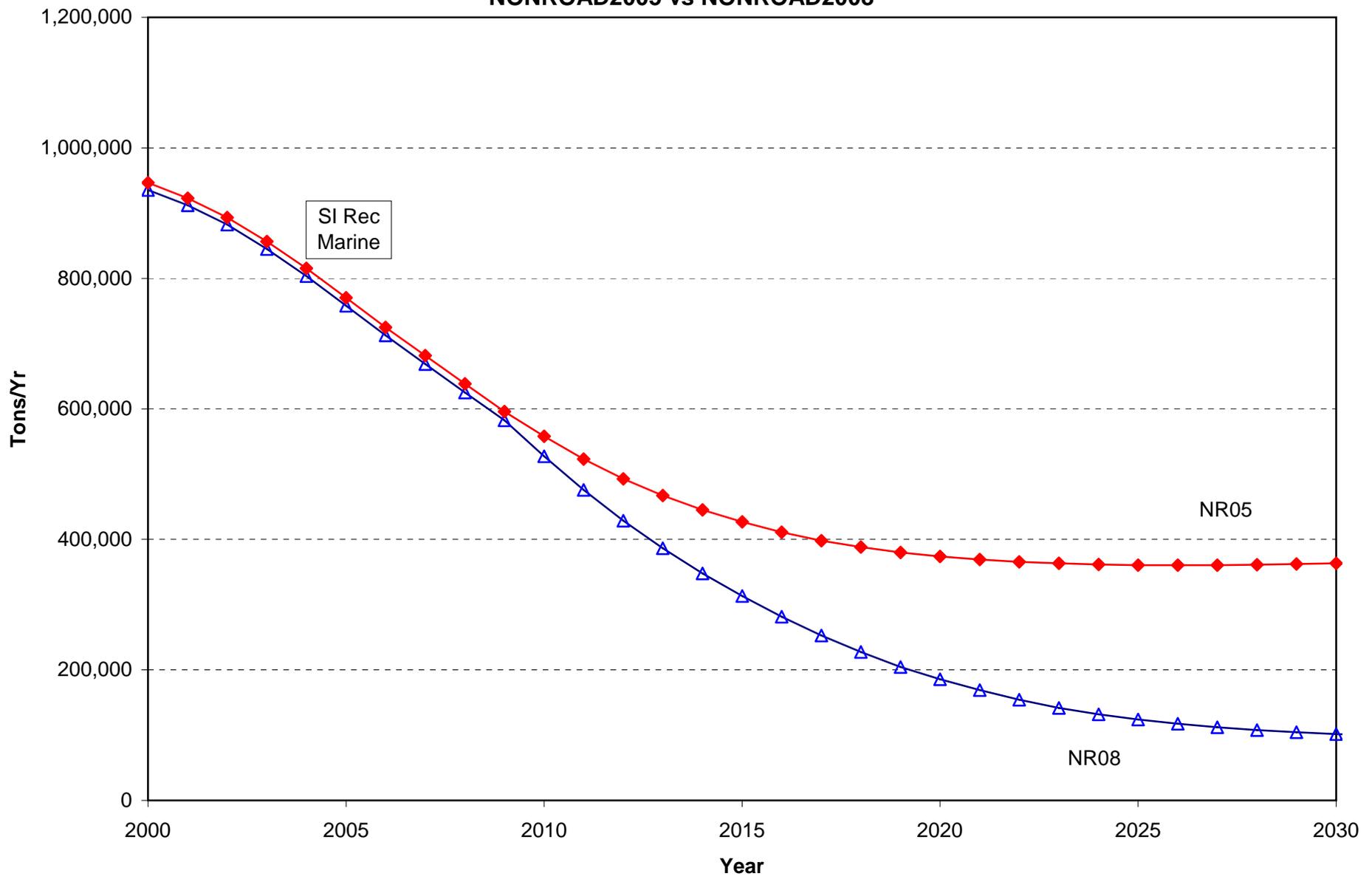**Assessment and Standards Division**

Air Quality and Modeling Center

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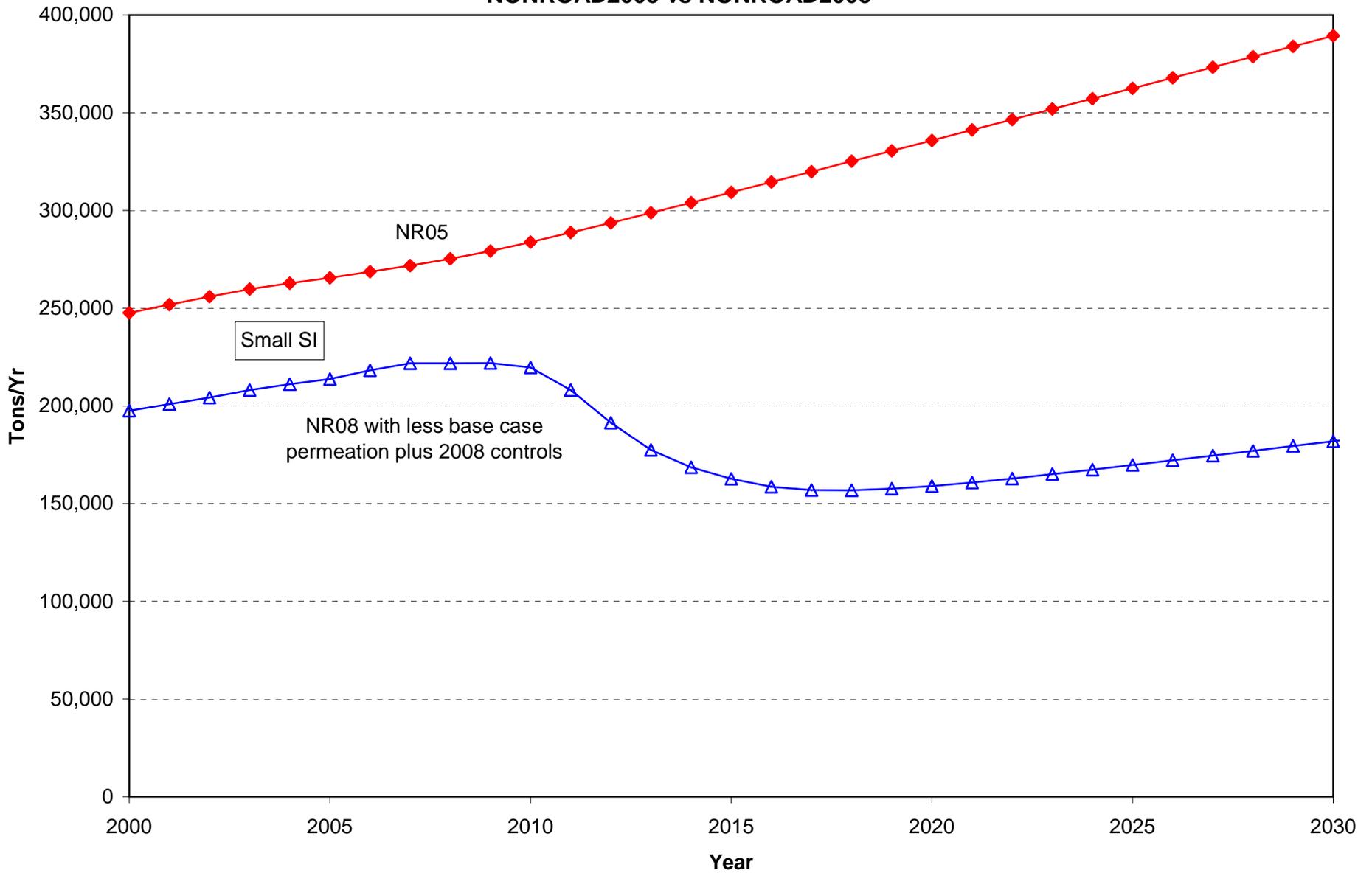
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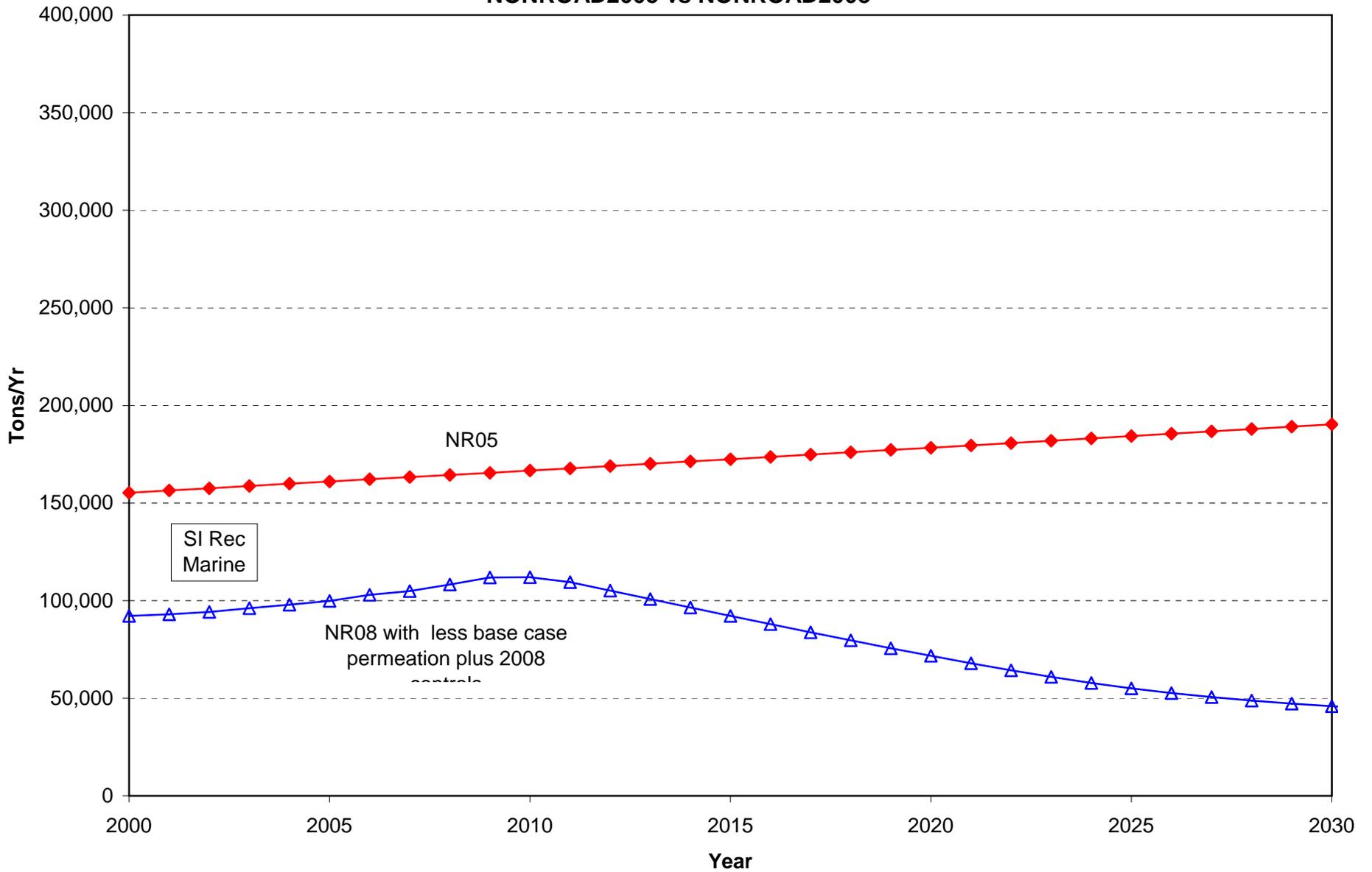
**Small SI THC exhaust Changes
NONROAD2005 vs NONROAD2008**

Small SI

Tons/Yr

NR05

NR08

Year

NR08-EI-ConfE.xls: SmSIctl-THCexh   April 2009 International Emission Inventory Conference

**SI Recreational Marine THC exhaust Changes
NONROAD2005 vs NONROAD2008**

SI Rec Marine

NR05

NR08

1,200,000

1,000,000

800,000

600,000

400,000

200,000

0

Tons/Yr

2000 2005 2010 2015 2020 2025 2030

Year

April 2009 International Emission Inventory Conference

Small SI THC evap Changes
NONROAD2005 vs NONROAD2008

NR05

Small SI

NR08 with less base case
permeation plus 2008 controls

Tons/Yr

Year

SI Recreational Marine THC evap Changes
NONROAD2005 vs NONROAD2008

NR05

SI Rec Marine

NR08 with less base case permeation plus 2008 controls

Tons/Yr

Year

NR08-EI-ConfE.xls: SIrecmarCtl-THCevp

April 2009 International Emission Inventory Conference

Small SI NOx Changes
NONROAD2005 vs NONROAD2008

Small SI

NR05

NR08

Tons/Yr

Year

NR08-EI-ConfE.xls: SmSIctl-NOx

April 2009 International Emission Inventory Conference
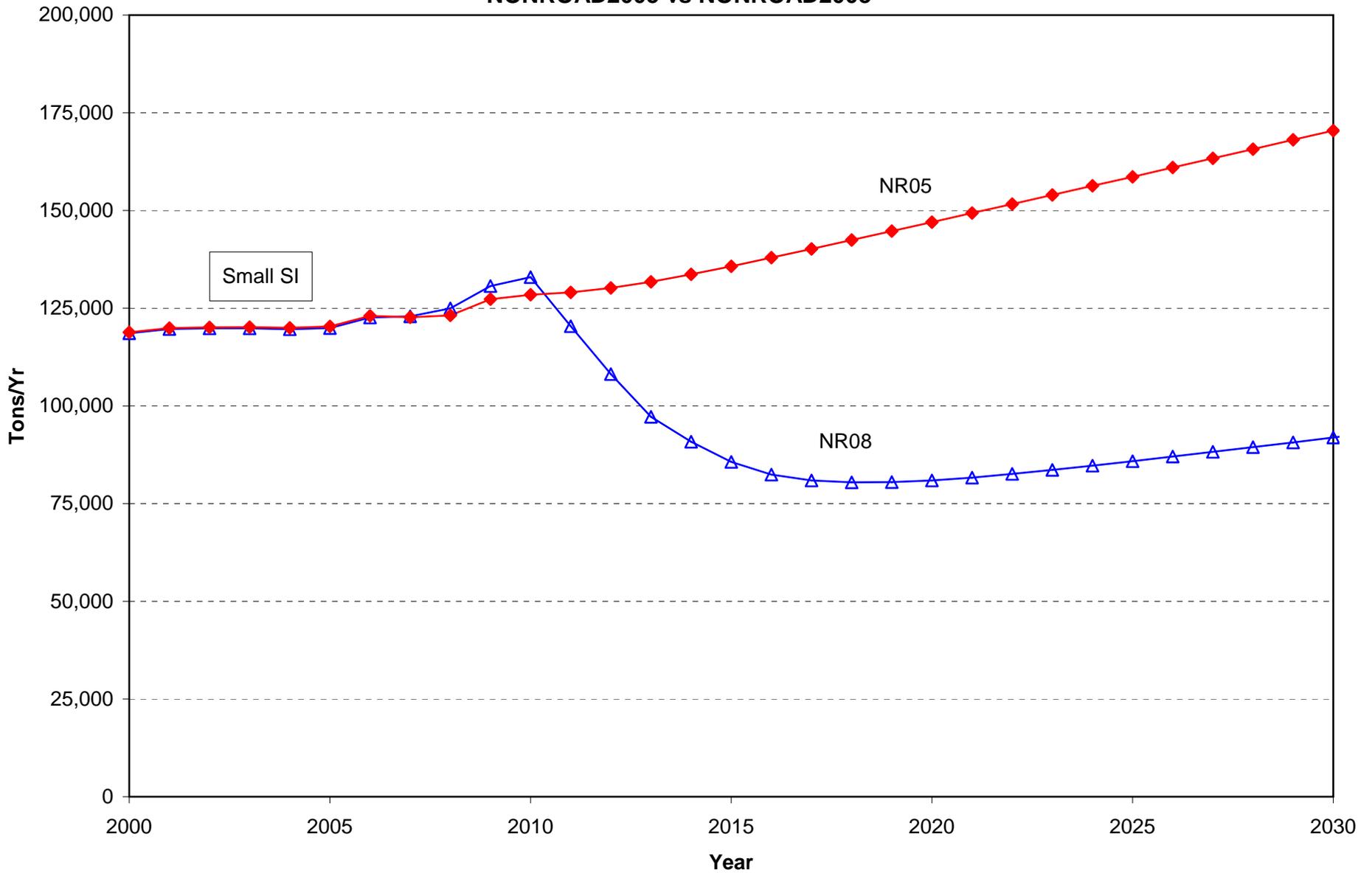
SI Recreational Marine NOx Changes
NONROAD2005 vs NONROAD2008
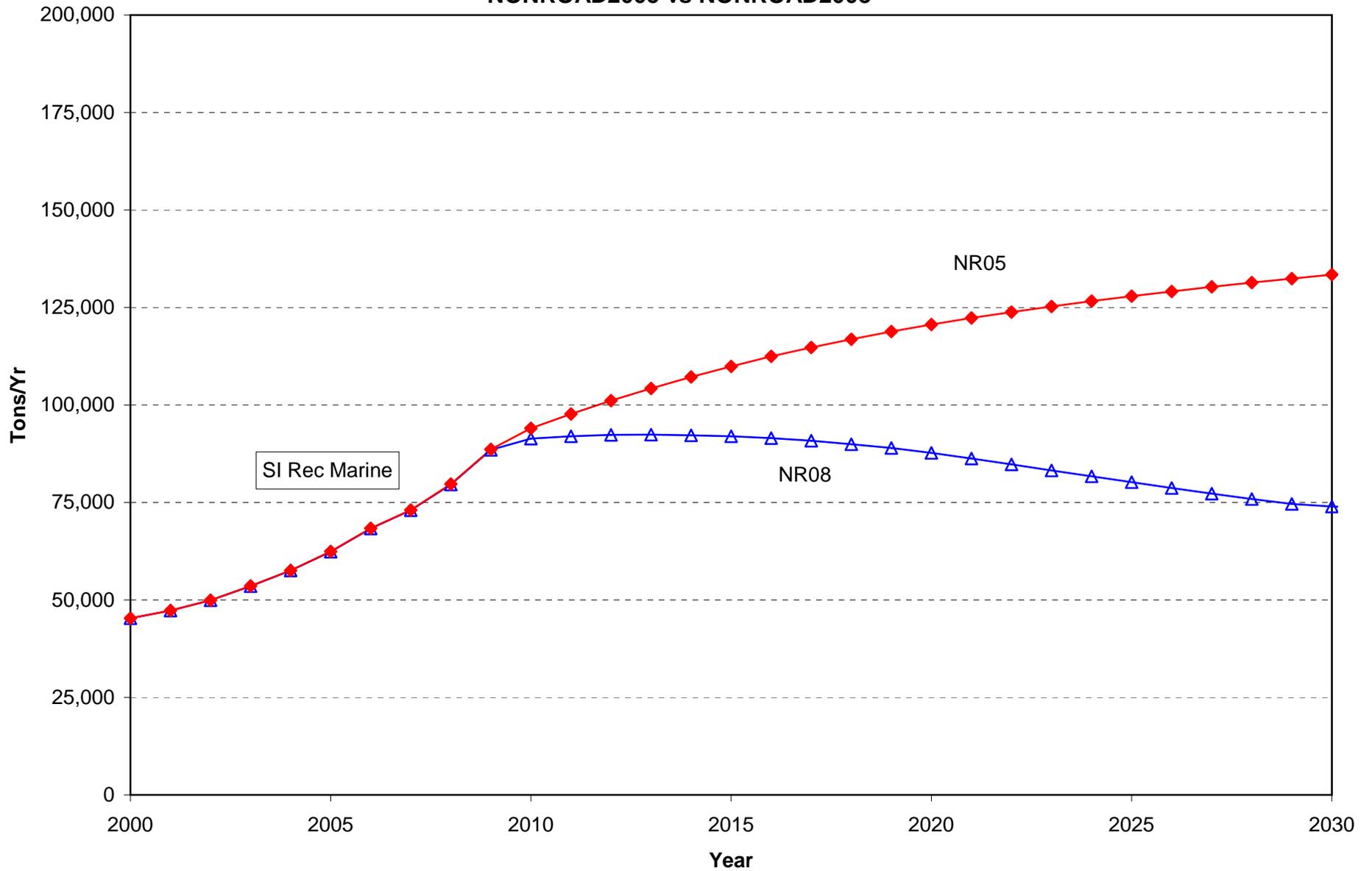
Spark Ignition CO Changes
NONROAD2005 vs NONROAD2008

Tons/Yr (y-axis): 0 to 30,000,000

Year (x-axis): 2000 to 2030

Labels: Small SI, NR05, NR08 with corrected Phase 2 engine CO deterioration, SI Rec Marine, NR05, NR08
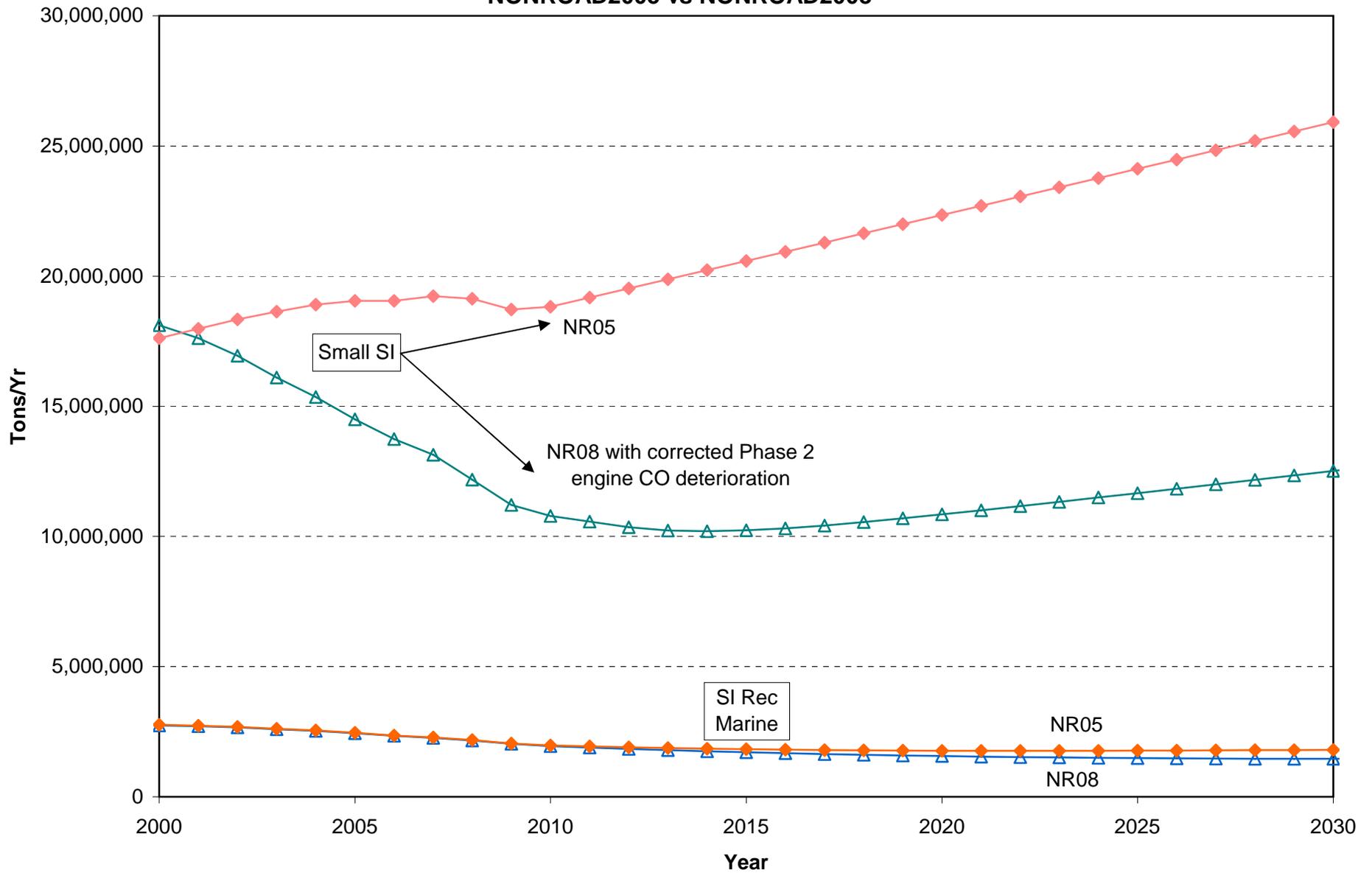
Spark Ignition PM2.5 Changes
NONROAD2005 vs NONROAD2008

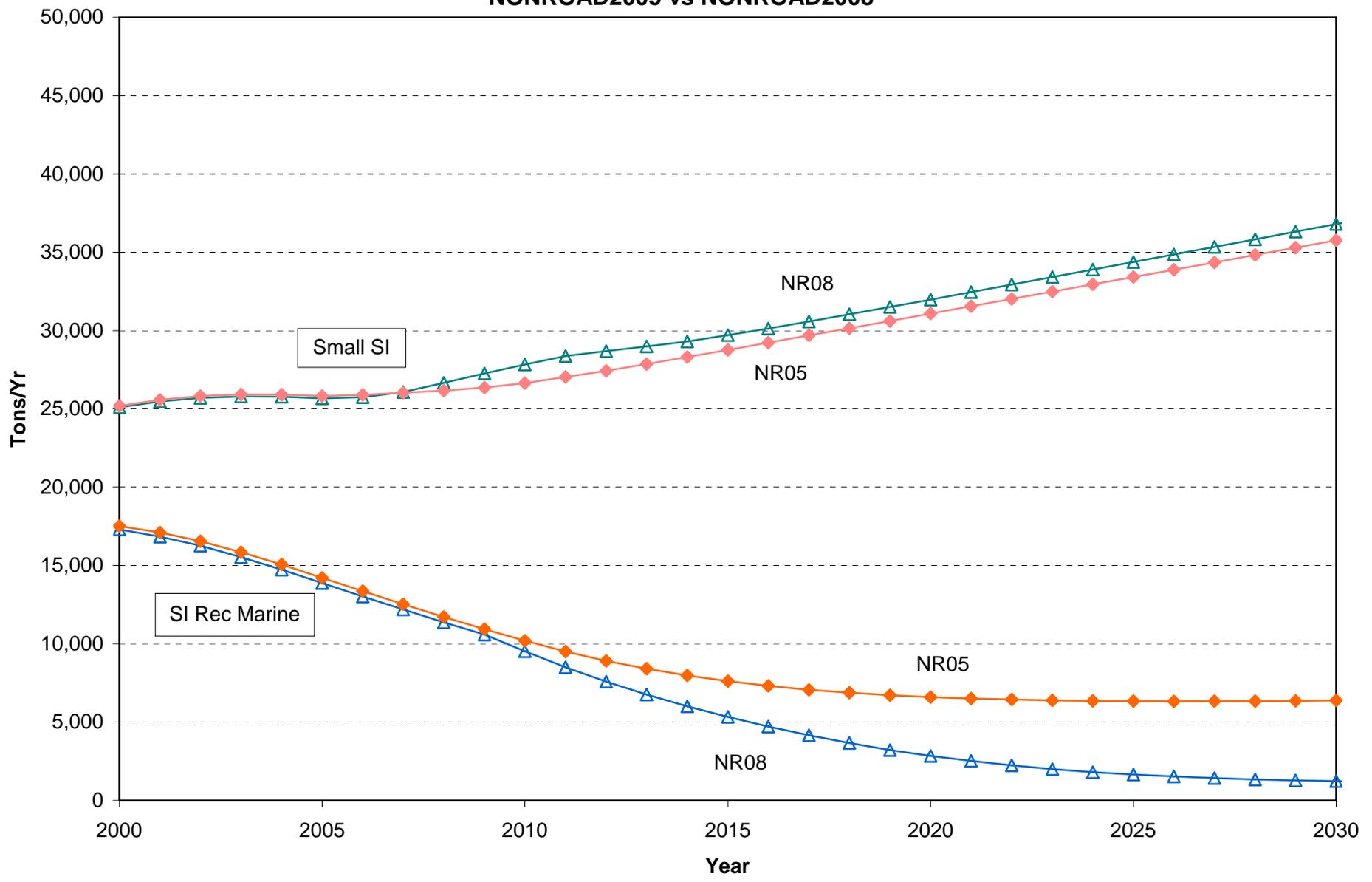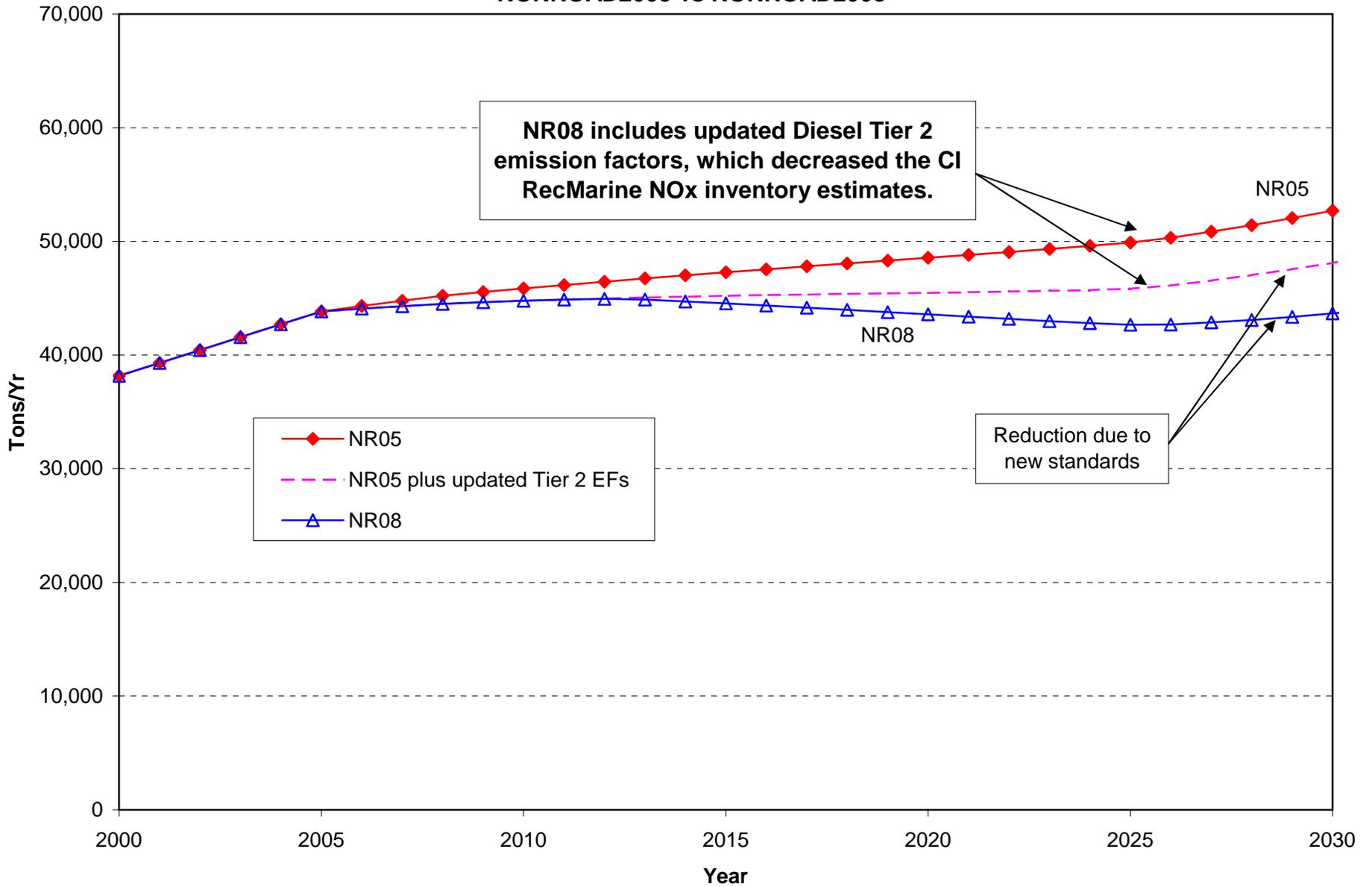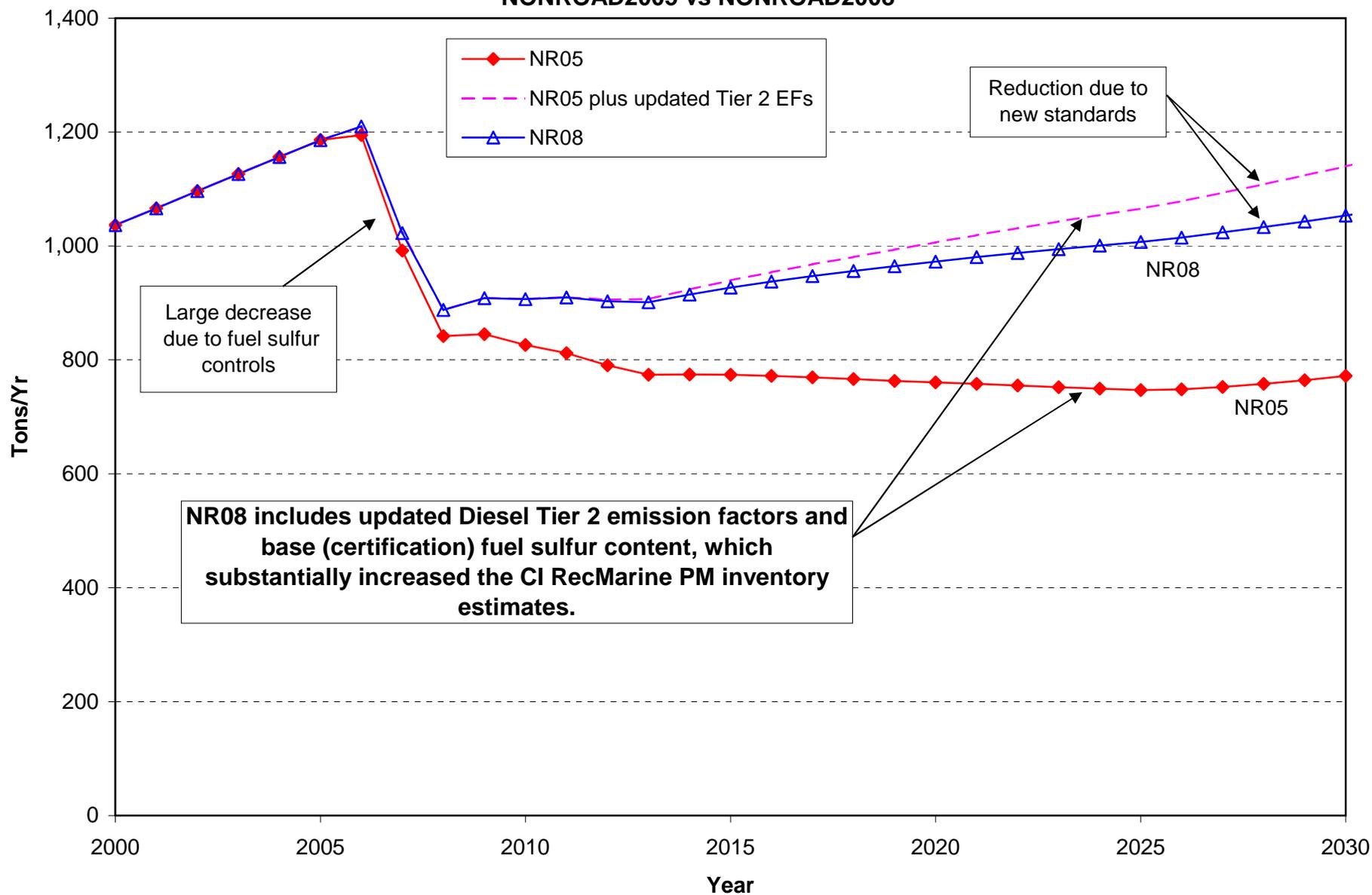Diesel Recreational Marine THC Changes
NONROAD2005 vs NONROAD2008
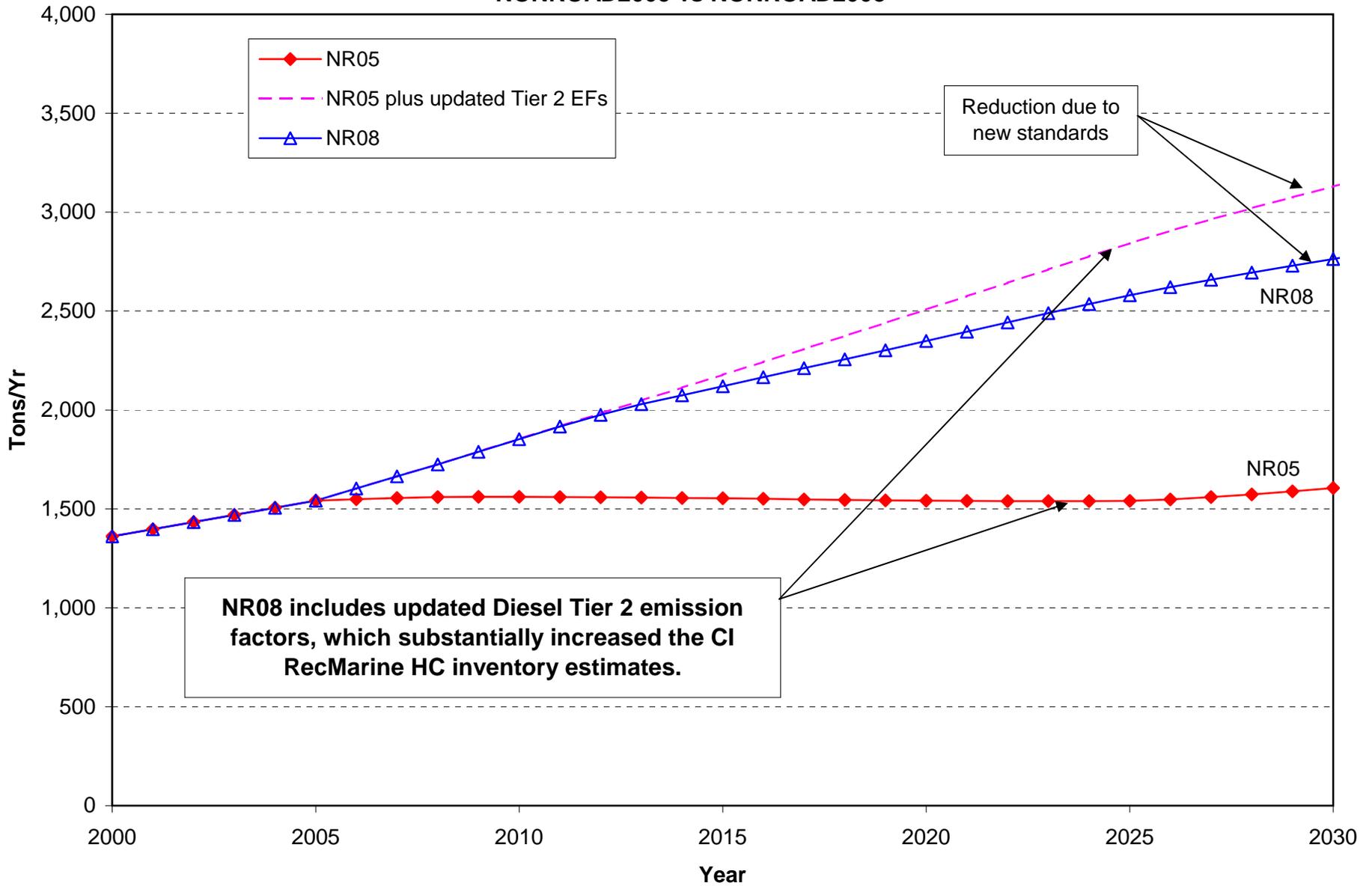
Diesel Recreational Marine NOx Changes
NONROAD2005 vs NONROAD2008

NR08 includes updated Diesel Tier 2 emission factors, which decreased the CI RecMarine NOx inventory estimates.

NR05

NR08

Reduction due to new standards

Tons/Yr

Year

Legend:
- NR05
- NR05 plus updated Tier 2 EFs
- NR08

Diesel Recreational Marine PM2.5 Changes
NONROAD2005 vs NONROAD2008

Legend:
- NR05
- NR05 plus updated Tier 2 EFs
- NR08

Reduction due to new standards

Large decrease due to fuel sulfur controls

NR08 includes updated Diesel Tier 2 emission factors and base (certification) fuel sulfur content, which substantially increased the CI RecMarine PM inventory estimates.

NR08

NR05

Y-axis: Tons/Yr

X-axis: Year

NONROAD CI+SI Total VOC (exh+evap)

NR05

NR08
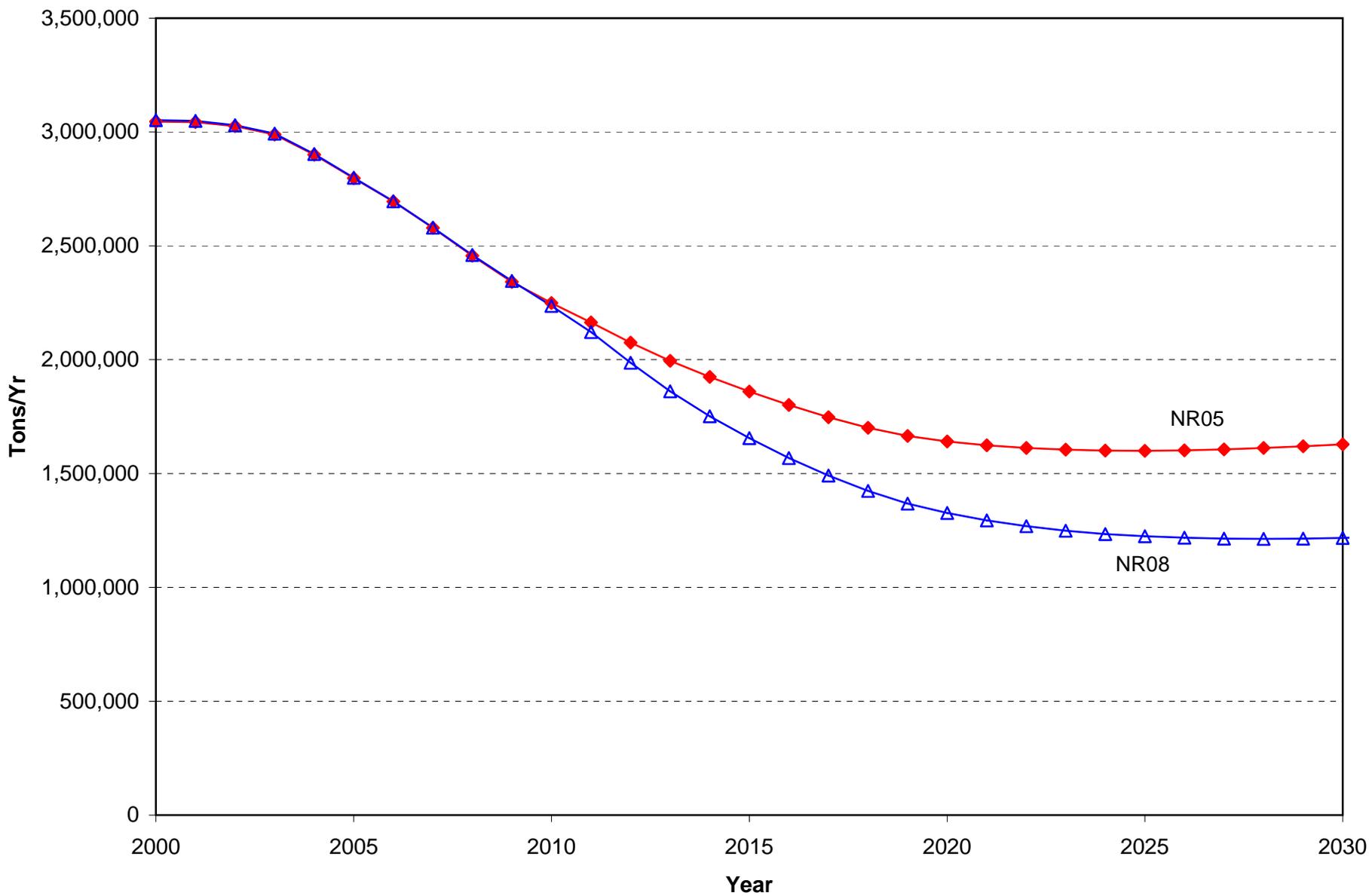
NONROAD CI+SI Total NOx

NR05

NR08
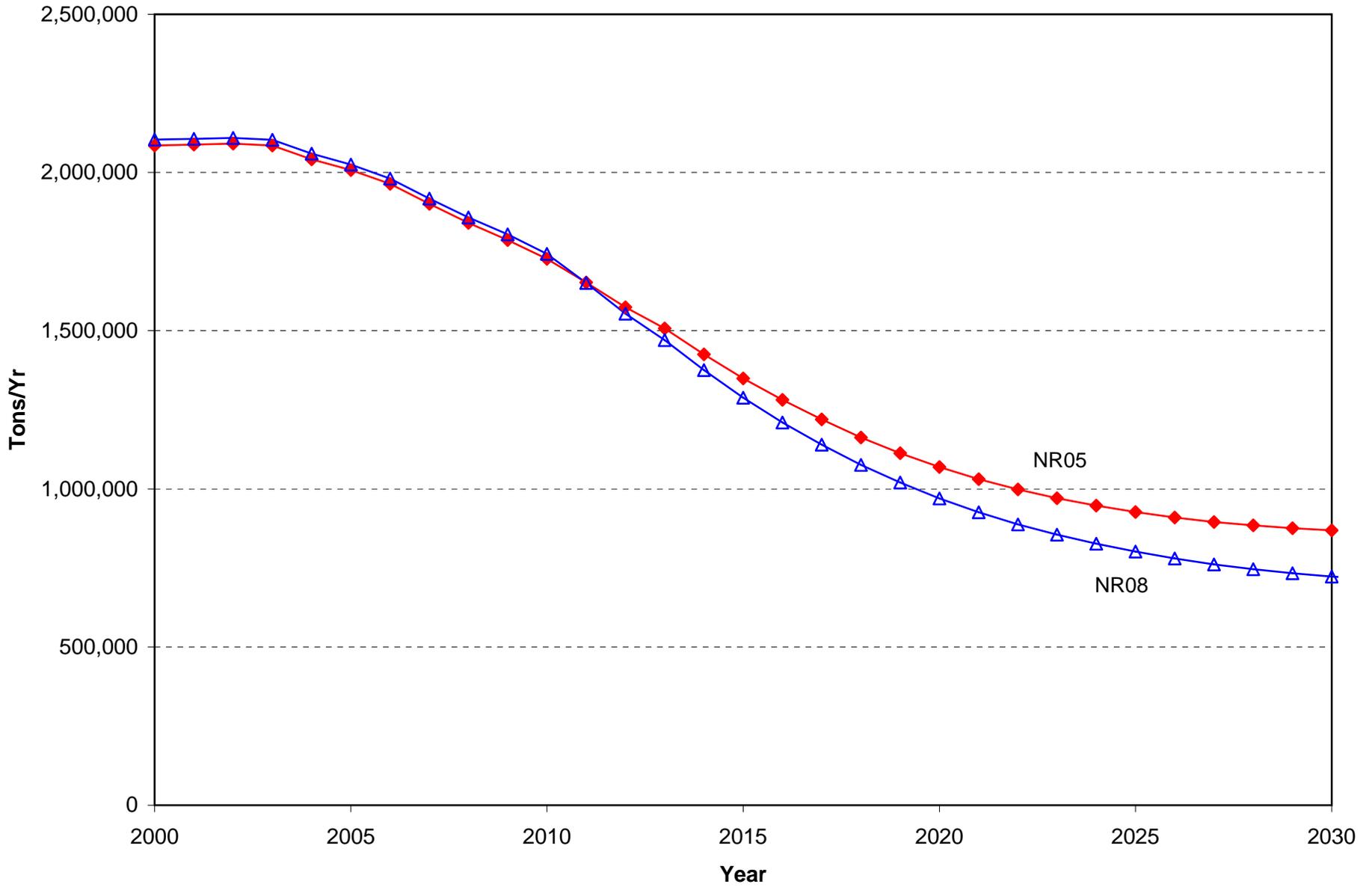
NONROAD CI+SI Total PM2.5

Tons/Yr vs Year

NR05

NR08

NONROAD CI+SI Total CO

NR05

NR08

Most of decrease in CO in NR08 vs NR05 is due to correction of CO Deterioration Rates for Small SI
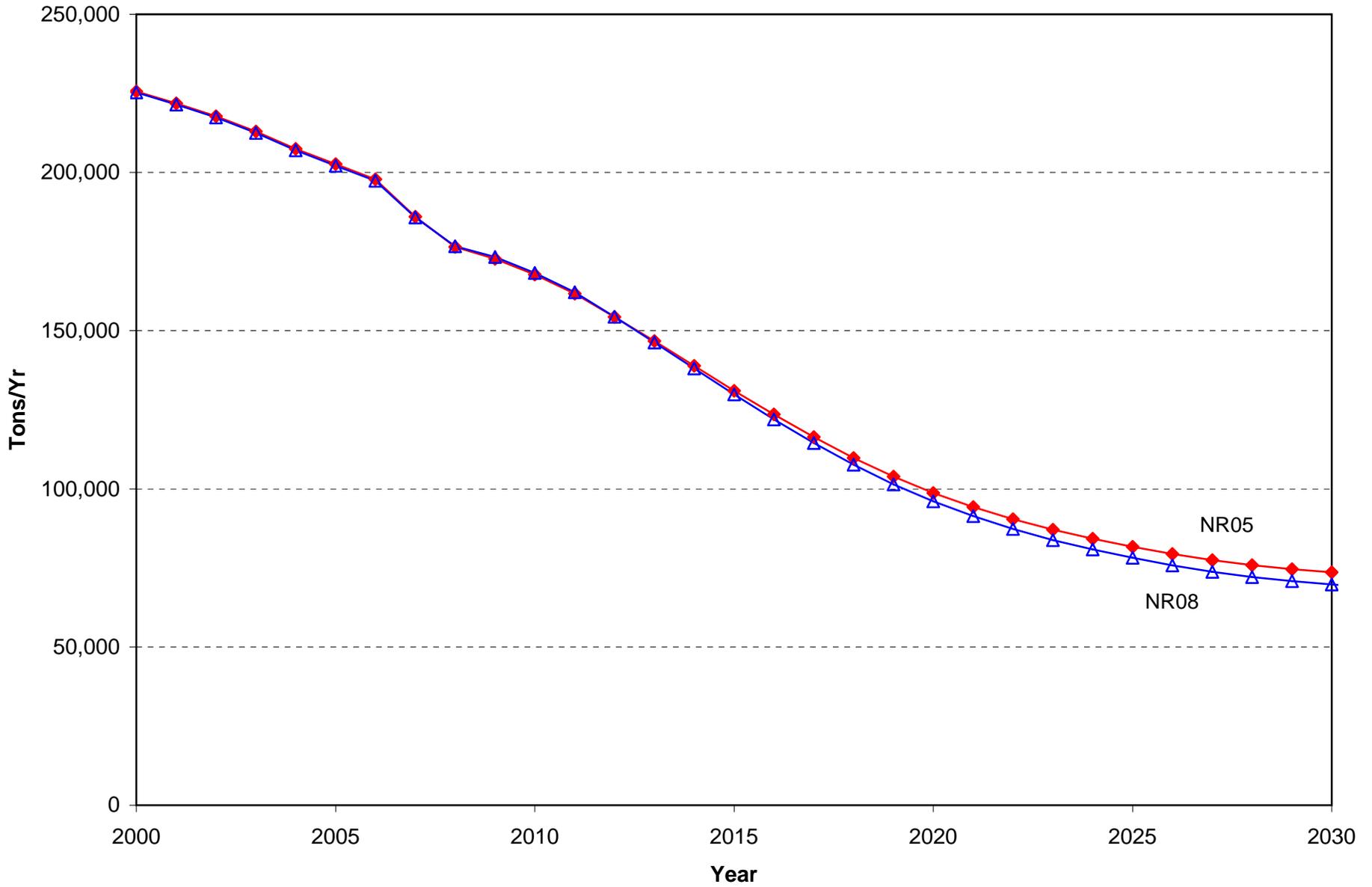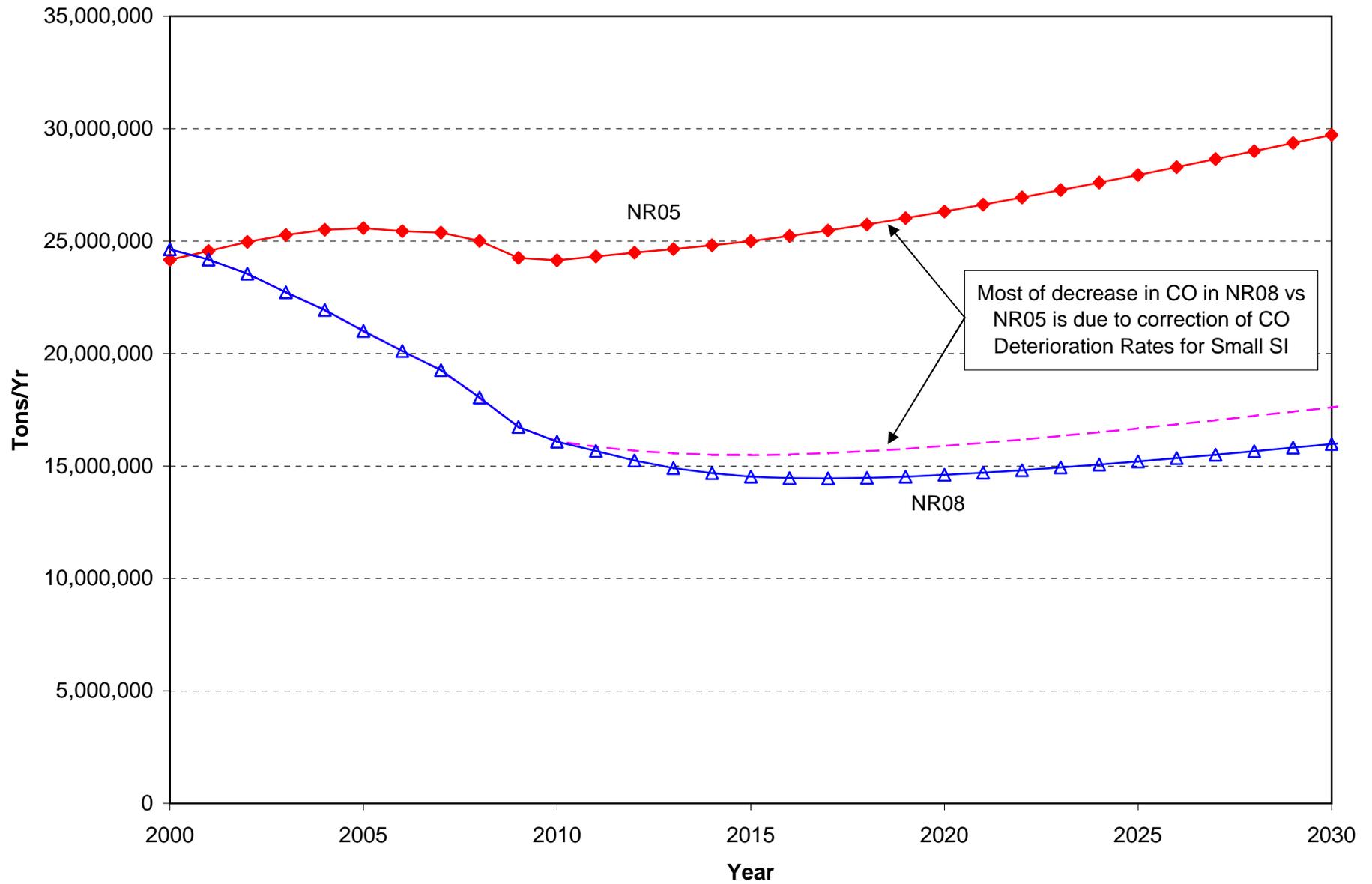
NONROAD2008 VOC (exh+evap)

Chart: Stacked area chart of Tons/Yr (y-axis, 0 to 3,500,000) versus Year (x-axis, 2000 to 2030).

Labels within chart: Diesel Land, Small SI, SI Rec Marine, Large SI, Recreational Vehicles, Diesel Rec Marine (too small to see)

Legend:
- Diesel Rec Marine
- Diesel Land
- Small SI
- SI Rec Marine
- Large SI
- Recreational Vehicles

NONROAD2008 NOx

Tons/Yr (y-axis)

Year (x-axis)

Legend:
- Diesel Rec Marine
- Diesel Land
- Small SI
- SI Rec Marine
- Large SI
- Recreational Vehicles

Chart labels: Diesel Rec Marine, Diesel Land, Small SI, Large SI, SI Rec Marine, Recreational Vehicles

NONROAD2008 PM2.5

Chart showing PM2.5 emissions in Tons/Yr by source category from 2000 to 2030, with a stacked area chart.

Legend:
- Diesel Rec Marine
- Diesel Land
- Small SI
- SI Rec Marine
- Large SI
- Recreational Vehicles

Labeled areas: Diesel Land, Diesel Rec Marine (too small to see), Small SI, SI Rec Marine, Large SI, Recreational Vehicles

Y-axis: Tons/Yr (0 to 250,000)
X-axis: Year (2000 to 2030)

NONROAD2008 Carbon Monoxide

Legend:
- Diesel Rec Marine
- Diesel Land
- Small SI
- SI Rec Marine
- Large SI
- Recreational Vehicles

Diesel Land

Diesel Rec Marine
(too small to see)

Small SI

SI Rec Marine

Large SI

Recreational Vehicles

Y-axis: Tons/Yr (0 to 30,000,000)

X-axis: Year (2000 to 2030)