Public Review Comments Received on:

Inventory of U.S. Greenhouse Gas Emissions: 1990-2006

March 2008

This document provides log of all of the comments received during the public review period for the 1990-2006 inventory report, which took place between March 7, 2008 and April 6, 2008.

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Reviewer: Bill Allen

Comment: The science below shows that global warming is not man made.
Water vapor is the main green house gas and the CO_2 produced by all of
Mankind contributes 0.28%. Since China now produces more CO_2 than the US, it would have little effect, if the US could some how reduce emissions to zero!

Global Warming:
A closer look at the numbers

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Water Vapor Rule the Greenhouse System

Just how much of the "Greenhouse Effect" is caused by human activity? It is about 0.28%, if water vapor is taken into account—about 5.53%, if not.

This point is so crucial to the debate over global warming that how water vapor is or isn't factored into an analysis of Earth's greenhouse gases makes the difference between describing a significant human contribution to the greenhouse effect, or a negligible one.

Water vapor constitutes Earth's most significant greenhouse gas, accounting for about 95% of Earth's greenhouse effect (4). Interestingly, many "facts and figures' regarding global warming completely ignore the powerful effects of water vapor in the greenhouse system, carelessly (perhaps, deliberately) overstating human impacts as much as 20-fold.

Water vapor is 99.999% of natural origin. Other atmospheric greenhouse gases, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and miscellaneous other gases (CFC's, etc.), are also mostly of natural origin (except for the latter, which is mostly anthropogenic).

Human activities contribute slightly to greenhouse gas concentrations through farming, manufacturing, power generation, and transportation. However, these emissions are so dwarfed in comparison to emissions from natural sources we can do nothing about, that even the most costly efforts to limit human emissions would have a very small-- perhaps undetectable-- effect on global climate.

For those interested in more details a series of data sets and charts have been assembled below in a 5-step statistical synopsis.

Note that the first two steps ignore water vapor.

1. Greenhouse gas concentrations
2. Converting concentrations to contribution
3. Factoring in water vapor
4. Distinguishing natural vs. man-made greenhouse gases
5. Putting it all together

Note: Calculations are expressed to 3 significant digits to reduce rounding errors, not necessarily to indicate statistical precision of the data. All charts were plotted using Lotus 1-2-3.

Caveat: This analysis is intended to provide a simplified comparison of the various man-made and natural greenhouse gases on an equal basis with each other. It does not take into account all of the complicated interactions between atmosphere, ocean, and terrestrial systems, a feat which can only be accomplished by better computer models than are currently in use.

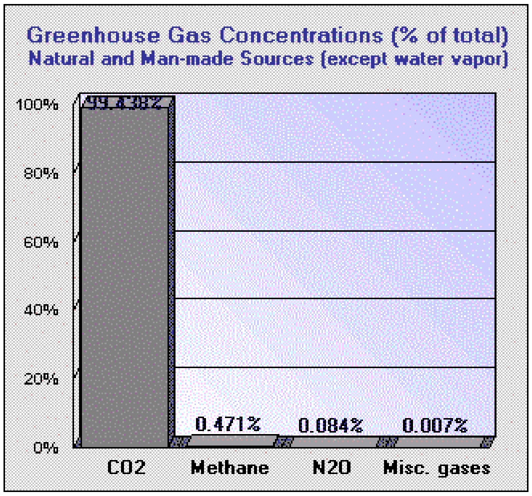
Greenhouse Gas Concentrations:
Natural vs. man-made (anthropogenic)

1. The following table was constructed from data published by the U.S. Department of Energy (1) and other sources, summarizing concentrations of the various atmospheric greenhouse gases. Because some of the concentrations are very small the numbers are stated in parts per billion. DOE chose to NOT show water vapor as a greenhouse gas!

TABLE 1.
The Important Greenhouse Gases (except water vapor)
U.S. Department of Energy, (October, 2000) (1)

(all concentrations expressed in parts per billion)	Pre-industrial baseline	Natural additions	Man-made additions	Total (ppb) Concentration	Percent of Total
Carbon Dioxide (CO_2)	288,000	68,520	11,880	368,400	99.438%
Methane (CH_4)	848	577	320	1,745	0.471%
Nitrous Oxide (N_2O)	285	12	15	312	0.084%
Misc. gases (CFC's, etc.)	25	0	2	27	0.007%
Total	289,158	69,109	12,217	370,484	100.00%

The chart at left summarizes the % of greenhouse gas concentrations in Earth's atmosphere from Table 1. This is not a very meaningful view though because 1) the data has not been corrected for the actual Global Warming Potential (GWP) of each gas, and 2) water vapor is ignored.



But these are the numbers one would use if the goal is to exaggerate human greenhouse contributions:

Man-made and natural carbon dioxide (CO_2) comprises 99.44% of all greenhouse gas concentrations (368,400 / 370,484)--(ignoring water vapor).

Also, from Table 1 (but not shown on graph):

Anthropogenic (man-made) CO_2 additions comprise (11,880 / 370,484) or 3.207% of all greenhouse gas concentrations, (ignoring water vapor).

Total combined anthropogenic greenhouse gases comprise (12,217 /370,484) or 3.298% of all greenhouse gas concentrations, (ignoring water vapor).

The various greenhouse gases are not equal in their heat-retention properties though, so to remain statistically relevant % concentrations must be changed to % contribution relative to CO_2. This is done in Table 2, below, through the use of GWP multipliers for each gas, derived by various researchers.

Converting greenhouse gas concentrations to greenhouse effect contribution (using global warming potential)

2. Using appropriate corrections for the Global Warming Potential of the respective gases provides the following more meaningful comparison of greenhouse gases, based on the conversion:

(concentration) X (the appropriate GWP multiplier (2) (3) of each gas relative to CO_2) = greenhouse contribution:

TABLE 2.
Atmospheric Greenhouse Gases (except water vapor) adjusted for heat retention characteristics, relative to CO_2

This table adjusts values in Table 1 to	Multiplier (GWP)	Pre-industrial baseline(new)	Natural additions (new)	Man-made additions (new)	Tot. Relative Contributio	Percent of Total (new)

compare greenhouse gases equally with respect to CO_2. (#'s are unit-less)					n	
Carbon Dioxide (CO_2)	1	288,000	68,520	11,880	368,400	72.369%
Methane (CH_4)	21 (2)	17,808	12,117	6,720	36,645	7.199%
Nitrous Oxide (N_2O)	310 (2)	88,350	3,599	4,771	96,720	19.000%
CFC's (and other misc. gases)	see data (3)	2,500	0	4,791	7,291	1.432%
Total		396,658	84,236	28,162	509,056	100.000%

NOTE: GWP (Global Warming Potential) is used to contrast different greenhouse gases relative to CO_2.

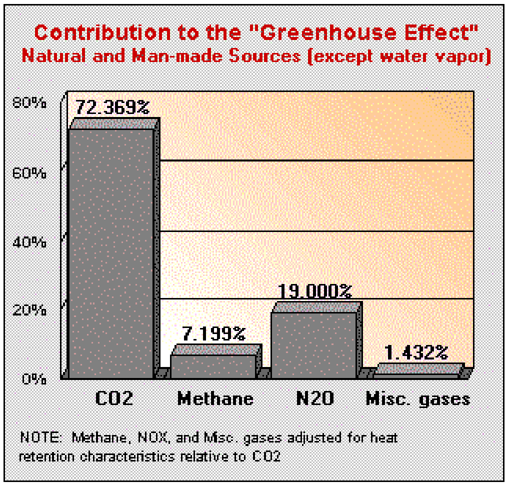
Compared to the concentration statistics in Table 1, the GWP comparison in Table 2 illustrates, among other things:

Total carbon dioxide (CO_2) contributions are reduced to 72.37% of all greenhouse gases (368,400 / 509,056)-- (ignoring water vapor).

Also, from Table 2 (but not shown on graph):

Anthropogenic (man-made) CO_2 contributions drop to (11,880/509,056) or 2.33% of total of all greenhouse gases, (ignoring water vapor).

Total combined anthropogenic greenhouse gases becomes (28,162/509,056) or 5.53% of all greenhouse gas contributions, (ignoring water vapor).



Relative to carbon dioxide the other greenhouse gases together comprise about 27.63% of the greenhouse effect (ignoring water vapor) but only about 0.56% of total greenhouse gas concentrations. Put another way, as a group methane, nitrous oxide (N_2O), and CFC's and other miscellaneous gases are about 50 times more potent than CO_2 as greenhouse gases.

To properly represent the total relative impacts of Earth's greenhouse gases Table 3 (below) factors in the effect of water vapor on the system.

Water vapor overwhelms all other natural and man-made greenhouse contributions.

3. Table 3, shows what happens when the effect of water vapor is factored in, and together with all other greenhouse gases expressed as a relative % of the total greenhouse effect.

TABLE 3.
Role of Atmospheric Greenhouse Gases (man-made and natural) as a % of Relative Contribution to the "Greenhouse Effect"

Based on concentrations (ppb) adjusted for heat retention characteristics	Percent of Total	Percent of Total --adjusted for water vapor
Water vapor	-----	95.000%
Carbon Dioxide (CO_2)	72.369%	3.618%
Methane (CH_4)	7.100%	0.360%
Nitrous oxide (N_2O)	19.000%	0.950%
CFC's (and other misc. gases)	1.432%	0.072%
Total	100.000%	100.000%

As illustrated in this chart of the data in Table 3, the combined greenhouse contributions of CO_2, methane, N_2O and misc. gases are small compared to water vapor!

Total atmospheric carbon dioxide (CO_2) -- both man-made and natural-- is only about 3.62% of the overall greenhouse effect-- a big difference from the 72.37% figure in Table 2, which ignored water!

Water vapor, the most significant greenhouse gas, comes from natural sources and is responsible for roughly 95% of the greenhouse effect (4). Among climatologists this is common knowledge but among special interests, certain governmental groups, and news reporters this fact is under-emphasized or just ignored altogether.

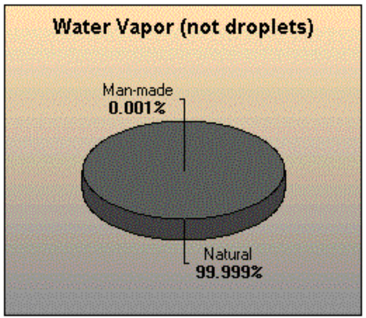
Conceding that it might be "a little misleading" to leave water vapor out, they nonetheless defend the practice by stating that it is "customary" to do so!

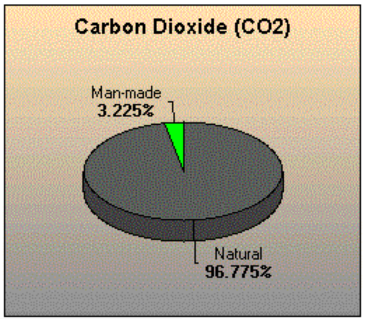
Comparing natural v.s man-made concentrations of greenhouse gases

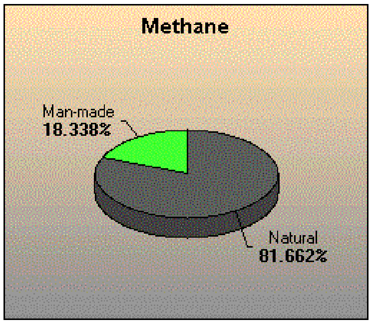
4. Of course, even among the remaining 5% of non-water vapor greenhouse gases, humans contribute only a very small part (and human contributions to water vapor are negligible).

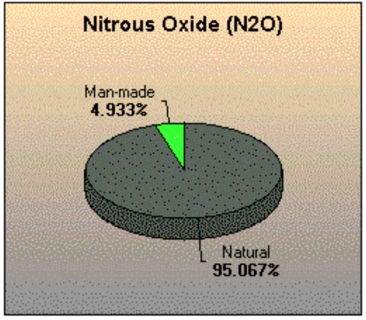
Constructed from data in Table 1, the charts (below) illustrate graphically how much of each greenhouse gas is natural vs how much is man-made. These allocations are used for the next and final step in this analysis-- total man-made contributions to the greenhouse effect. Units are expressed to 3 significant digits in order to reduce rounding errors for those who wish to walk through the calculations, not to imply numerical precision as there is some variation among various researchers.

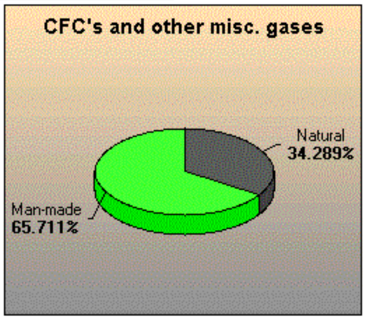
Putting it all together: total human greenhouse gas contributions add up to about 0.28% of the greenhouse effect.











5. To finish with the math, by calculating the product of the adjusted CO_2 contribution to greenhouse gases (3.618%) and % of CO_2 concentration from anthropogenic (man-made) sources (3.225%), we see that only (0.03618 X 0.03225) or 0.117% of the greenhouse effect is due to atmospheric CO_2 from human activity. The other greenhouse gases are similarly calculated and are summarized below.

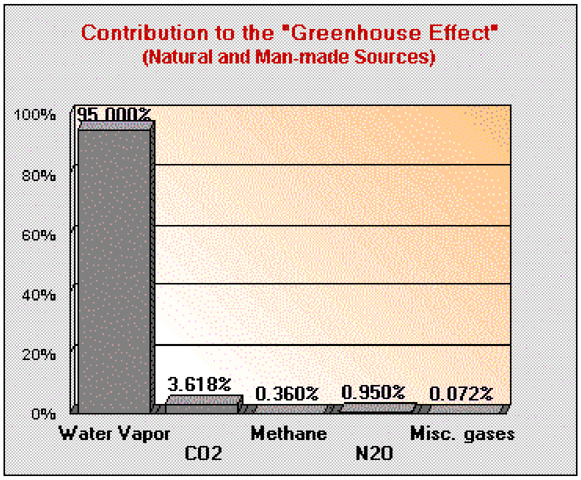
TABLE 4a.
Anthropogenic (man-made) Contribution to the "Greenhouse Effect," expressed as % of Total (water vapor INCLUDED)

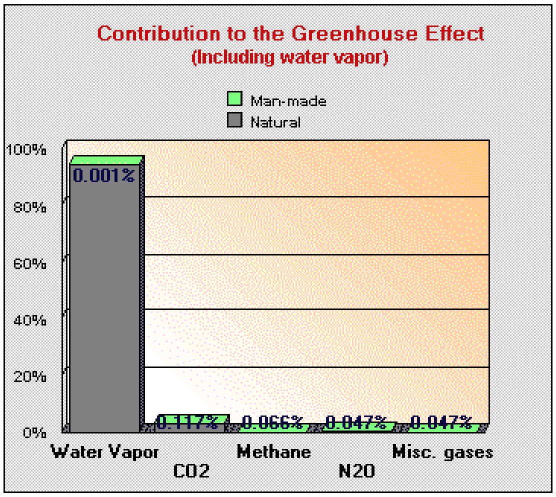
Based on concentrations (ppb) adjusted for heat retention characteristics	% of All Greenhouse Gases	% Natural	% Man-made
Water vapor	95.000%	94.999%	0.001%
Carbon Dioxide (CO_2)	3.618%	3.502%	0.117%

Methane (CH_4)	0.360%	0.294%	0.066%
Nitrous Oxide (N_2O)	0.950%	0.903%	0.047%
Misc. gases (CFC's, etc.)	0.072%	0.025%	0.047%
Total	100.00%	99.72	0.28%

This is the statistically correct way to represent relative human contributions to the greenhouse effect.

From Table 4a, both natural and man-made greenhouse contributions are illustrated in this chart, in gray and green, respectively. For clarity only the man-made (anthropogenic) contributions are labeled on the chart.





Water vapor, responsible for 95% of Earth's greenhouse effect, is 99.999% natural (some argue, 100%). Even if we wanted to we can do nothing to change this.

Anthropogenic (man-made) CO_2 contributions cause only about 0.117% of Earth's greenhouse effect, (factoring in water vapor). This is insignificant!

Adding up all anthropogenic greenhouse sources, the total human contribution to the greenhouse effect is around 0.28% (factoring in water vapor).

The Kyoto Protocol calls for mandatory carbon dioxide reductions of 30% from developed countries like the U.S. Reducing man-made CO_2 emissions this much would have an undetectable effect on climate while having a devastating effect on the U.S. economy. Can you drive your car 30% less, reduce your winter heating 30%? Pay 20-50% more for everything from automobiles to zippers? And that is just a down payment, with more sacrifices to come later.

Such drastic measures, even if imposed equally on all countries around the world, would reduce total human greenhouse contributions from CO_2 by about 0.035%.

This is much less than the natural variability of Earth's climate system!

While the greenhouse reductions would exact a high human price, in terms of sacrifices to our standard of living, they would yield statistically negligible results in terms of measurable impacts to climate change. There is no expectation that any statistically significant global warming reductions would come from the Kyoto Protocol.

"There is no dispute at all about the fact that even if punctiliously observed, (the Kyoto Protocol) would have an imperceptible effect on future temperatures -- one-twentieth of a degree by 2050."

Dr. S. Fred Singer, atmospheric physicist
Professor Emeritus of Environmental Sciences at the University of Virginia, and former director of the US Weather Satellite Service; in a Sept. 10, 2001 Letter to Editor, Wall Street Journal

Research to Watch

Scientists are increasingly recognizing the importance of water vapor in the climate system. Some, like Wallace Broecker, a geochemist at Columbia's Lamont-Doherty Earth Observatory, suggest that it is such an important factor that much of the global warming in the last 10,000 years may be due to the increasing water vapor concentrations in Earth's atmosphere.

His research indicates that air reaching glaciers during the last Ice Age had less than half the water vapor content of today. Such increases in atmospheric moisture during our current interglacial period would have played a far greater role in global warming than carbon dioxide or other minor gases.

"I can only see one element of the climate system capable of generating these fast, global changes, that is, changes in the tropical atmosphere leading to changes in the inventory of the earth's most powerful greenhouse gas-- water vapor. "

Dr. Wallace Broecker, a leading world authority on climate
Lamont-Doherty Earth Observatory, Columbia University, lecture presented at R. A. Daly
Lecture at the American
Geophysical Union's spring meeting in Baltimore, Md., May 1996.

Known causes of global climate change, like cyclical eccentricities in Earth's rotation and orbit, as well as variations in the sun's energy output, are the primary causes of climate cycles measured over the last half million years. However, secondary greenhouse effects stemming from changes in the ability of a warming atmosphere to support greater concentrations of gases like water vapor and carbon dioxide also appear to play a significant role. As demonstrated in the data above, of all Earth's greenhouse gases, water vapor is by far the dominant player.

The ability of humans to influence greenhouse water vapor is negligible. As such, individuals and groups whose agenda it is to require that human beings are the cause of global warming must discount or ignore the effects of water vapor to preserve their arguments, citing numbers similar to those in Table 4b . If political correctness and staying out of trouble aren't high priorities for you, go ahead and ask them how water vapor was handled in their models or statistics. Chances are, it wasn't!

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References:

1) Current Greenhouse Gas Concentrations (updated October, 2000) Carbon Dioxide Information Analysis Center (the primary global-change data and information analysis center of the U.S. Department of Energy) Oak Ridge, Tennessee

Greenhouse Gases and Climate Change (data now available only to "members" IEA Greenhouse Gas R&D Programme, Stoke Orchard, Cheltenham, Gloucestershire, GL52 7RZ, United Kingdom.

2) Greenhouse Gases and Global Warming Potentials (updated April, 2002) U.S. Environmental Protection Agency

3) Warming Potentials of Halocarbons and Greenhouses Gases Chemical formulae and global warming potentials from Intergovernmental Panel on Climate Change, Climate Change 1995: The Science of Climate Change (Cambridge, UK: Cambridge University Press, 1996), pp. 119 and 121. Production and sales of CFC's and other chemicals from International Trade Commission, Synthetic Organic Chemicals: United States Production and Sales, 1994 (Washington, DC, 1995). TRI emissions from U.S. Environmental Protection Agency, 1994 Toxics Release Inventory: Public Data Release, EPA-745-R-94-001 (Washington, DC, June 1996), p. 73. Estimated 1994 U.S. emissions from U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-1994, EPA-230-R-96-006 (Washington, DC, November 1995), pp. 37-40.

4) References to 95% contribution of water vapor:
a. S.M. Freidenreich and V. Ramaswamy, “Solar Radiation Absorption by Carbon Dioxide, Overlap with Water, and a Parameterization for General Circulation Models,” Journal of Geophysical Research 98(1993):7255-7264
b. Global Deception: The Exaggeration of the Global Warming Threat by Dr. Patrick J. Michaels, June 1998 Virginia State Climatologist and Professor of Environmental Sciences, University of Virginia

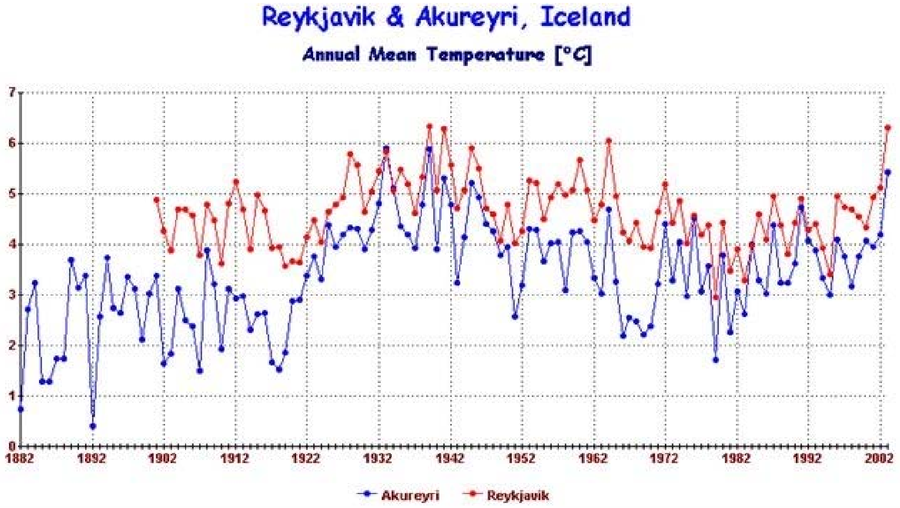
c. Greenhouse Gas Emissions, Appendix D, Greenhouse Gas Spectral Overlaps and Their Significance Energy Information Administration; Official Energy Statistics from the U.S. Government
d. Personal Communication-- Dr. Richard S. Lindzen Alfred P. Slone Professor of Meteorology, MIT
e. The Geologic Record and Climate Change by Dr. Tim Patterson, January 2005 Professor of Geology-- Carleton University Ottawa, Canada
Alternate link:
f. EPA Seeks To Have Water Vapor Classified As A Pollutant by the ecoEnquirer, 2006
Alternate link:
g. Air and Water Issues by Freedom 21.org, 2005
Citation: Bjorn Lomborg, p. 259. Also: Patrick Michaels and Robert Balling, Jr. The Satanic Gases, Clearing the Air About Global Warming (Washington, DC: CATO Institute, 2000), p. 25.
h. Does CO2 Really Drive Global Warming? by Dr. Robert Essenhigh, May 2001
Alternate link:
i. Solar Cycles, Not CO2, Determine Climate by Zbigniew Jaworowski, M.D., Ph.D., D.Sc., 21st Century Science and Technology, Winter 2003-2004, pp. 52-65
Link:
5) Global Climate Change Student Guide Department of Environmental and Geographical Sciences Manchester Metropolitan University Chester Street Manchester M1 5GD United Kingdom
6) Global Budgets for Atmospheric Nitrous Oxide - Anthropogenic Contributions William C. Trogler, Eric Bruner, Glenn Westwood, Barbara Sawrey and Patrick Neill Department of Chemistry and Biochemistry University of California at San Diego, La Jolla, California

7) Methane record and budget Robert Grumbine

Useful conversions:
1 Gt = 1 billion tons = 1 cu. km. H20
1 Gt Carbon(C) = ~3.67 Gt Carbon Dioxide(CO_2)
2.12 Gt C = ~7.8 Gt CO_2 = 1ppmv CO_2

This page by: Monte Hieb
Last revised: January 10, 2003

Comment: The attachment shows the temperature at Akureyri, which indicates no warming in Iceland.



Comment: This is an example of the "urban heat effect" at a station that was moved to the site shown below. Further down is the temp. chart that shows a dramatic increase in temp. after the station was moved to the present site. Prior to the move it was in a proper location and you can see that temps cooled from the 30s until about 1980 while CO_2 was going up. CO_2 is not causing temperatures to rise!

This NOAA USHCN climate station of record #415018 in Lampasas, TX was found to be tucked between a building, and two parking lots, one with nearby vehicles. According to the surveyor, it is right next to the ACE Hardware store on the main street of town. While likely representative of the temperature for downtown Lampasas, one wonders how well it measures the climate of the region.

According to NCDC's MMS database, the Lampasas climate station has been at this location since 10-01-2000.Previous location was an observer residence, which appears to have been a park-like location according to MMS location map. The sensor was apparently converted to the MMTS style seen in the photo in 1986, so the move did not include an equipment change. See the complete survey album here.

But the big surprise of just how bad this location is came from the NASA GISS plot of temperature. It clearly showed the results of the move to this location, causing a jump in temperature almost off the current graph scale. Note that before the move, the temperature trend of Lampasas was nearly flat from 1980-2000.

Click to see the full sized GISS record

Given the entropy of the measurement environment, I have sincere doubts that anyone can create an adjustment that will ascertain an accurate trend from temperature data as badly polluted as this. In my opinion, this station's post 2000 data needs to be removed from the climate record.

UPDATE:

Since there has been some discussion about how well "adjustments" take care of such problems, I thought I'd show you just how well the GISS homogeneity adjustment works with this station.

Here is the GISS plot for Lampasas, TX with the GISS homogeneity applied, I’ve changed the color to red and labeled it to keep them visually separate from the raw data shown in the plot above.

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Now here is the GISS raw data plot with the homogeneity plot overlaid on it:

The effect is quite clear. The recent “spurious” measurement remains unchanged, and the past gets colder.

The result? An artificial warming trend for this station that is created by GISS adjustments.

Comments : 47 Comments »

Categories : climate_change, weather_stations

Where have all the sunspots gone?
13 02 2008

I'm writing this after doing an exhaustive search to see what sort of solar activity has occurred lately, and I find there is little to report. With the exception of the briefly increased solar wind from a coronal hole, there is almost no significant solar activity.

The sun has gone quiet. Really quiet.

It is normal for our sun to have quiet periods between solar cycles, but we've seen months and months of next to nothing, and the start of solar cycle 24 seems to have materialized (as first reported here) then abruptly disappeared. The reverse polarity sunspot that signaled the start of cycle 24 on January 4th, dissolved within two days after that.

Of course we've known that the sunspot cycle has gone low, which is also to be expected for this period of the cycle. Note that NOAA still has two undecided scenarios for cycle 24 Lower that normal, or higher than normal, as indicated on the graph below:

But the real news is just how quiet the suns magnetic field has been in the past couple of years. From the data provided by NOAA's Space Weather Prediction Center (SWPC) you can see just how little magnetic field activity there has been. I've graphed it below:

What is most interesting about the Geomagnetic Average Planetary Index graph above is what happened around October 2005. Notice the sharp drop in the magnetic index and the continuance at low levels.

This looks much like a "step function" that I see on GISS surface temperature graphs when a station has been relocated to a cooler measurement environment. In the case of the sun, it appears this indicates that something abruptly "switched off" in the inner workings of the solar dynamo. Note that in the prior months, the magnetic index was ramping up a bit with more activity, then it simply dropped and stayed mostly flat.

We saw a single reversed polarity high latitude sunspot on January 4th, 2008, which would signal the start of a new cycle 24, which was originally predicted to have started last March and expected to peak in 2012. So far the sun doesn't seem to have restarted its normal upwards climb.

If you have ever studied how the magnetic dynamo of the sun is so incredibly full of entropy, yet has cycles, you'll understand how it can change states. The sun's magnetic field is a like a series of twisted and looped rubber bands, mostly because the sun is a fluid gas, which rotates at different rates between the poles and the equator. Since the suns magnetic field is pulled along with the gas, all these twists, bumps, and burps occur in the process as the magnetic field lines get twisted like taffy. You can see more about it in the Babcock model.

I've alway's likened a sunspot to what happens with a rubber band on a toy balsa wood plane. You keep twisting the propeller beyond the normal tightness to get that extra second of thrust and you see the rubber band start to pop out knots. Those knots are like sunspots bursting out of twisted magnetic field lines.

The Babcock model says that the differential rotation of the Sun winds up the magnetic fields of it's layers during a solar cycle. The magnetic fields will then eventually tangle up to such a

degree that they will eventually cause a magnetic break down and the fields will have to struggle to reorganize themselves by bursting up from the surface layers of the Sun. This will cause magnetic North-South pair boundaries (spots) in the photosphere trapping gaseous material that will cool slightly.
Thus, when we see sunspots, we are seeing these areas of magnetic field breakdown.

Sunspots are cross connected eruptions of the magnetic field lines, shown in red above. Sometimes they break, spewing tremendous amounts of gas and particles into space. Solar flares and coronal mass ejections
(CME's) are some examples of this process. Sometimes they snap back like rubber bands. The number of sunspots at solar max is a direct indicator of the activity level of the solar dynamo.

Given the current quietness of the sun and it's magnetic field, combined with the late start to cycle 24 with even possibly a false start, it appears that the sun has slowed it's internal dynamo to a similar level such as was seen during the Dalton Minimum. One of the things about the Dalton Minimum was that it started with a skipped solar cycle, which also coincided with a very long solar cycle 4 from 1784-1799. The longer our current cycle 23 lasts before we see a true ramp up of cycle 24, the greater chance it seems then that cycle 24 will be a low one.

No wonder there is so much talk recently about global cooling. I certainly hope that's wrong, because a Dalton type solar minimum would be very bad for our world economy and agriculture. NASA GISS published a release back in 2003 that agrees with the commonly accepted idea that long period trends in solar activity do affect our climate by changing the Total Solar Irradiance (TSI).

Some say it is no coincidence that 2008 has seen a drop in global temperature as indicated by several respected temperature indexes compared to 2007, and that our sun is also quiet and still not kick starting its internal magentic dynamo.

GISS Land-Ocean Index dives in Jan08, exceeding drops for UAH and RSS satellite data
11 02 2008

Goddard Institute for Space Studies (GISS) Land-Ocean Global temperature index data was released yesterday for the month of January, 2008. Like we've reported before for other datasets, including the RSS and UAH satellite temperature anomalies, GISS also had a sharp drop in January.

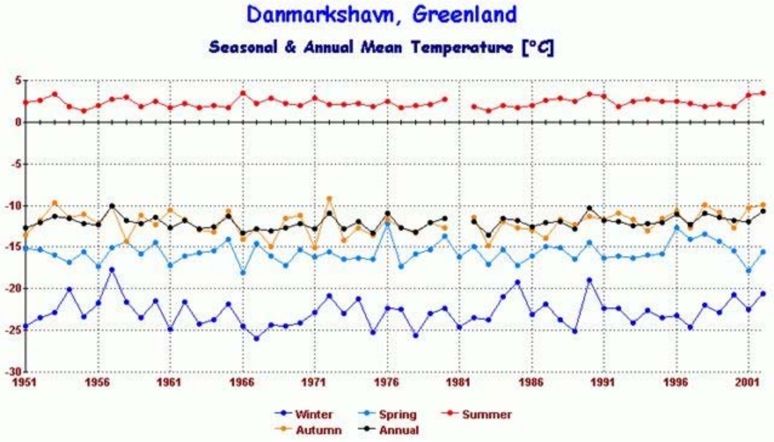
The GISS ΔT was -.75°C, which is larger than the satellite data from UAH ΔT of -.588°C and the RSS RSS ΔT of -.629°C

The ΔT of -.75°C from January 2007 to January 2008 appears to be the largest single year to year January drop for the entire GISS data set.

This is yet one more indication of the intensity of planet-wide cooler temperatures seen in January 2008, particularly in the Northern Hemisphere, which has seen record amounts of snow coverage extent as well as new record low surface temperatures in many places.

Comment: This is the surface measuring station at Danmarkshavn, Greenland and as you can see there is no warming trend. The highest winter temperature is in 1957.

The only source of higher temperatures is the urban sites that are affected by the "urban heat effect".



Reviewer: Patrick H. Wicks, PE, CHMM

Comment: I haven't been able to read the draft report yet, but review of the table of contents gives no indication of inclusion of natural GHG sources in this report. The contribution of GHG from natural sources must be included for such an inventory to have any real meaning.

Reviewer: Brien Quirk

Comment: I am submitting a public comment about the Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks:
1990-2006. A major source of greenhouse gases in the US, and in particular in the State of Oregon, is from field grass burning which occurs every year as a non-essential means of controlling pests and weed seeds in the grass seed industry of the Willamette Valley. Not only does it pose probable particulate matter EPA health violations with frequent incursions into local major populations centers such as Eugene, Oregon during the summer months, but the unnecessary release of carbon dioxide, oxides of nitrogen from nitrogen fertilizer enriched grasses, as well as from particulate matter contribute an additional heavy burden of greenhouse gases and substances. In the US 1.2 million metric tons of carbon dioxide equivalents and 0.6 million metric tons of nitrous oxide greenhouse gases were generated by crop burning in 2006. (source: DOE http://ftp.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/ggrpt/057306.pdf)

That alternative methods to field grass burning have been shown to be effective, this enormous source of grass-generated biomass being burned could theoretically be used instead as organic matter for improving soil quality, which is a vital resource for future generations, and is a potential feedstock for cellulosic ethanol production. Since field grass burning is only for a limited economic interest of a few at the expense of the entire earth's ecosystem and world-wide economic wellbeing, EPA should consider banning this practice, as a major source of greenhouse gases without delay.

Reviewer: Jeff Quick, Utah Geological Survey

Comment: Carbon emission factors for coal that are used in the EPA greenhouse gas inventory are based, in part, on the COALQUAL assay data that was published by the United States Geological Survey (USGS). Using published data is commendable, and demonstrates EPA's commitment to a transparent and verifiable greenhouse gas inventory. Moreover, using published data encourages public scrutiny, which should improve the inventory quality.
Coal rank designations listed in COALQUAL are used by EPA to calculate emissions factors for USA coal aggregated by rank and state-of-origin (Annex 2, table A-34); these results are subsequently used to derive state-specific emission factors, and ultimately, the sector-specific factors used in the inventory. Examination of table A-34 shows incorrect results. For example, Utah bituminous coal is shown to have nearly the same emission factor as Louisiana lignite, and bituminous coal from New Mexico is shown to have a higher emission factor than subbituminous coal from New Mexico. Several factors contribute to the erroneous emission factors listed in table A-34.

1. Coal rank designations listed in COALQUAL are not reliable. This is what USGS says about the rank designations listed with their data: "the USGS makes no claims as to the accuracy of coal rank calculated from parameters of proximate and ultimate analyses" (Bragg et al., 1998, p.8 and p.13). Note that they say this twice, using bold, all-capital letters for emphasis. EPA should believe the USGS coal experts, and not use these inaccurate rank designations. Moreover, there is no need to use them. Instead, the state-specific factors EPA currently uses (to calculate the sector-specific emission factors) can be more accurately calculated by aggregating the data by county-of-origin. Unlike coal rank, the county-of-origin is accurately reported COALQUAL, and is likewise reported in Table 2, "Coal Production and Number of Mines by State, County, and Mine Type" of the EIA Annual Coal Report.

Of course, it is still possible to report national-level emission factors by rank for comparison with the IPCC default values (for example, rank and production reported on EIA Form-7a may be aggregated by county, assigned an emission factor from COALQUAL, and tabulated). But for this purpose, the rank-specific emission factors should probably be adjusted to comply with IPCC protocol (net energy basis, United Nations rank classification). Regardless, given that these national-level emission factors are not used to calculate USA emissions, and that the IPCC default values are based on unpublished data for coal of unknown origin, this comparison may not be meaningful or worthwhile.

2. COALQUAL samples collected from natural outcrops or roadcuts, as well as those designated as weathered, should not be used to calculate emission factors for commercial coal. Almost 10% of the coal samples listed in COALQUAL were collected from surface outcrops. During the years, decades, and centuries that these coals were exposed to the atmosphere, they were inevitably oxidized and weathered. Weathered coal typically has decreased heating and hydrogen values, increased oxygen and moisture values, and an anomalously high carbon emission factor. Consequently, weathered coal is not representative of coal that is burned in power stations, industrial boilers, or domestic furnaces.

3. COALQUAL data underestimate carbon emissions for washed coal products and some commercially mined coal. Commercial coal is often selectively mined or physically cleaned (washed) to meet consumer quality requirements. Consequently, commercial coal usually contains less sulfur than indicated by the COALQUAL data. During combustion, sulfur in coal contributes about 4050 Btu/lb, but does not produce any CO_2. Consequently, a high-sulfur coal reported in COALQUAL produces less CO_2 than the equivalent low-sulfur, washed or produced coal product. To avoid systematically underestimating carbon emissions, the emission factors calculated from COALQUAL might be adjusted to comport with the sulfur content of commercially produced coal. Commercial coal quality data collected on forms FERC 423 and EIA 423, as well as the new EIA Form-923, can be used for this purpose.
Finally, EPA should reconsider the current practice where emission factors expressed on a mass/unit energy basis are weighted by coal tonnage (rather than energy) to obtain the sector-specific emission factor. This practice introduces a systematic bias by increasing the significance of emission factors of coal with relatively low heating values. One solution is to use the commercial coal quality data (mentioned above) with the produced tonnage values to derive appropriate weighting factors.

Reference: Bragg, L.J., Oman, J.K., Tewalt, S.J., Oman, C.L., Rega, N.H., Washington, P.M., Finkelman, R.B., 1998, Coal quality (COALQUAL) database – version 2.0: U.S. Geological Survey, Open-File Report 97-134, CD-ROM.

Reviewer: B. Sachau

Comment: I have looked over the material prepared in draft form which requires a comment before April 6, 2008.

I do believe some of the reference bibliography is unbelievably old. Why would anyone need l910 material to be reviewed for this collection of information. There seems to be waste in that area.

I think information more than ten years old - 1998 - should be dismissed. it is clear we need up to date information, not 80 year old information for a clear understanding of what is going on in America.

Reviewer: Marie Fisher

Comment: This report supports public opinion that greenhouse gas emissions via human activity need to be brought under control as an environmental priority. Given that a warmer winter and cooler summer contributed to a 1.5% reduction in 2005-2006, it would seem that alternative energy options for heating/cooling should continue to be explored as a viable solution to reducing greenhouse gas emissions.

Reviewer: Tom McClellan

Trends

Comment: There is an apparent typo in: http://www.epa.gov/climatechange/emissions/downloads/08_Trends.pdf On page 29, the bar for 2003 has a data label of "7,716", and judging by the bar height and the trend of the data, it looks like a value of 7,116 is more likely. I suspect a typo. I thought you would like to know.

Reviewer: Karen Ritter, American Petroleum Institute

Energy

Comment: (Section 3.7 Natural Gas Systems, Tables, p. 3-45 and 3-46) Performing the emission summation for CH_4 for 2006 by hand, it reveals that CH_4 emissions from Field Production total 1,346 Gg (vs. 1,317 Gg as shown in Table 3-35), and CH_4 emissions from Processing total 579 Gg (vs. 568 Gg as shown in Table 3-35). (The rest of the stage emission totals match what is listed in Table 3-35; performing the CO_2 emission summation by hand for 2006 resulted in the values listed in Table 3-37.) The difference appears to be larger than just due to rounding. Please double check the CH_4 summation calculation. (This applies to all other years identified in the tables as well.)

Comment: (Section 3.7 Natural Gas Systems, Recalculations Discussion, p. 3-47, line 39) In the discussion on oil platform counts, it is noted that a miscalculation in the year 2003 was re-estimated, which caused the entire time series prior to year 2003 (except 1992) to change. It was assumed that the miscalculation was in the number of oil platforms, which meant that the number of oil platforms (as shown in Annex 3.4, Table A-109) would be different from the number of oil platforms shown in the 2005 Inventory. However, the oil platform numbers are the same as the values shown in Table A-120 of the 2005 Inventory. This statement should be clarified, or the values should be adjusted as appropriate. (Note that this discussion is also in Section 3.8 Petroleum Systems, however it is not possible to determine if the number of wells differs between the 2005 and 2006 Inventories Annex 3.5 (Petroleum Systems), as activity factors for years other than 2006 (or 2005) are not provided.)

Comment: (Section 3.7 Natural Gas Systems) Perhaps the update of the reciprocating compressor emission factors should be mentioned in Planned Improvements, in addition to in the QA/QC portion of this section.

Comment: (Sections 3.5 and 3.8 Petroleum Systems) Emission and activity factors are only provided for 2006, yet emissions are shown for multiple years. Recommend adding emission and activity factors for all years for which emissions are being estimated, for full disclosure. (In addition, it is discussed in Step 2 that activity factors vary by year.) This is consistent with Annex 3.4.

Comment: (Section 3.8 Petroleum Systems) Emissions in Tables 3-39 through 3-42 are provided in Tg/Gg, however, it is never mentioned how the emissions are converted from the Bcf shown in the tables in Annex 3.5. An explanation of this conversion should be added.

Comment: (Section 3.8 Petroleum Systems) Production Field Operations emission activities in Tables 3-39 through 3-42 do not correlate to main subheadings in Annex 3.5 Table A-120. Recommend using the same divisions as in Annex 3.5.

Comment: (Section 3.8 Petroleum Systems) Are there any Planned Improvements for this section? Perhaps the discussion on Carbon Dioxide Transport, Injection and Geological Storage should be a part of Planned Improvements.

Comment: (Section 3.8 Petroleum Systems, p. 3-53, Tables 3-44 and 3-45) The tables' captions: "Emissions of CO_2 from EOR Operations and Pipelines" are inconsistent with the text describing the tables. The tables imply that these are emissions, however p. 3-52 indicates that naturally occurring CO_2 used in EOR is assumed to be fully sequestered. Also, acid gas removal plants, naturally occurring CO_2 and ammonia production plants are not EOR operations, but rather other sources of CO_2 that could be used for EOR or CCS.

Comment: (Section 3.8 Petroleum Systems, p. 3-52, Line 37) Perhaps the statement "Additionally, all anthropogenic CO_2 emitted from natural gas processing […] is assumed to be emitted to the atmosphere, regardless of whether the CO_2 is captured or not" should be added to Section 3.7 and/or Annex 3.4.

Annex 3.4

Comment: (Annex 3.4 Natural Gas Systems, p. A-131, line 1) The title of the section is "Methodology for Estimating CH_4 Emissions from Natural Gas Systems" however methodology is presented for estimating both CH_4 and CO_2 emissions. Perhaps the title should be revised to something along the lines of "Methodology for Estimating CH_4 and CO_2 Emissions from Natural Gas Systems". This would be consistent with the title of Annex 3.5.

Comment: (Annex 3.4 Natural Gas Systems) All emission factors and activity factors used to determine emissions should be clearly identified and provided in tables in Annex 3.4. Currently there are no emission or activity factors identified for the Natural Gas Production Stage, Natural Gas Processing Plants, Natural Gas Transmission and Storage, and the Natural Gas Distribution Stage (for years other than 1992), yet emissions are provided in Tables A-111 through A-114, respectively. Text should also be added to Annex 3.4/Section 3.7 if not already present, defining the sources of the activity and emission factor data.

Comment: (Annex 3.4 Natural Gas Systems) Emissions for the year 2000 are missing from all tables in this annex; however, they are shown in Section 3.7 (Tables 3-34 through 3-37). Emissions (and all data used to derive emissions) for the year 2000 should be added to Annex 3.4.

Comment: (Annex 3.4 Natural Gas Systems, p. A-131, Step 3) In comparing the text of the 2005 Inventory (Annex 3.4, Step 3) to the 2006 Inventory (Annex 3.4, Step 3), it was observed that the 2005 Inventory statement "The reductions are also adjusted to remove the sunsetting time period, which removes reductions from the accounting system after a set time period. In future inventories, the sunsetting may be replaced with a technological lifetime" can no longer be found. There is also no mention of sunsetting or technological lifetimes in the body of the 2006 Inventory. If reductions are no longer adjusted for sunsetting, or if reductions are adjusted for technological lifetimes, this should be noted (for example, in the Recalculations Discussion of Section 3.7). It should also be clarified for which years the sunsetting/technological lifetime adjustments apply.

Comment: (Annex 3.4 Natural Gas Systems, p. A-132, para. 1) Emission reductions from NESHAP regulations are mentioned as being estimated (p. A-132, line 7) in addition to emission reductions from the Natural Gas STAR program (provided in Table A-110). If emission reductions from NESHAP regulations are being used (in addition to Natural Gas STAR program emission reductions) to determine emissions from Natural Gas Systems, they should be clearly identified, and provided in a table in Annex 3.4. If emission reductions from NESHAP regulations are not being used to determine emissions from Natural Gas Systems, the discussion on NESHAP emission reductions should be revised/removed.

Comment: (Annex 3.4 Natural Gas Systems, p. A-138, line 28) A Table B-1 is referred to as providing CO_2 production concentrations; however there is no Table B-1. It is believed the proper table reference should be Table A-115.

Comment: (Annex 3.4 Natural Gas Systems) It is recommended that total rows be added to all emission estimate tables in this section. This is consistent with table presentation in Annex 3.5 (Methodology for Estimating CH_4 and CO_2 Emissions from Petroleum Systems) and makes it easier to correlate the emissions tables in Annex 3.4 to the emission tables in Section 3.7.

Comment: (Annex 3.4 Natural Gas Systems, p. A-135, Table A-109) Comparing values for the variable “Transmission Pipelines Length” in the 2006 Inventory to values for the variable “Transmission Pipelines Length” in the 2005 Inventory reveals that all values for years 2001 through 2006 are off by one year in the 2006 Inventory. For example, the 2006 Inventory Transmission Pipelines Length value for the year 2001 is 298,957, which is the 2005 Inventory Transmission Pipelines Length value for the year 2000. Continuing down the row, the 2006 Inventory Transmission Pipelines Length value for the year 2006 is 290,680, which is the 2005 Inventory Transmission Pipelines Length value for the year 2005. All values in the 2006 Inventory should be adjusted appropriately, or the reason for the discrepancy should be noted in the Recalculations Discussion portion of Section 3.7.

Comment: (Annex 3.4 Natural Gas Systems, p. A-139, Table A-116) There is a border above the Activity Flaring Emissions – Offshore row which should be removed.

Annex 3.5

Comment: (Annex 3.5 Petroleum Systems, p. A-142, Step 1) It is noted that CO_2 emission factors are estimated by multiplying CH_4 emission factors with a ratio of CO_2 content to CH_4 content. However, CH_4 and CO_2 contents are not provided in the annex (either by number or by reference). Both CH_4 and CO_2 contents should be provided and sources should be referenced. (They are mentioned briefly in Section 3.8, but should be mentioned in the Annex as well.)

Comment: (Annex 3.5 Petroleum Systems, p. A-143, line 8) It appears that end of the line (1 Emissions are not actually…) is supposed to be a footnote, which was misplaced.

Comment: (Annex 3.5 Petroleum Systems, p. A-144, Table A-121) There should be a space between "scf" and "CH_4/mile/yr." in the Emission Factor Units of Fugitive Emissions: Pump Stations.

Comment: (Annex 3.5 Petroleum Systems, p. A-151, Table A-136) The Emission Factor Units should be for emissions of CO_2, not CH_4. (The emission factors have already been adjusted from the CH_4 emission factors shown in Table A-132.)

Comment: (Annex 3.5 Petroleum Systems, p. A-145, Table A-124) The Combustion Emissions Activities need to be added to the Table A-136, to be consistent with the activities listed in Table A-120. A footnote could be added denoting that "Energy use CO_2 emissions not estimated to avoid double counting", like is done for the CO_2 emission tables in Annex 3.4.

Reviewer: Curt B. Beck, P.E.

Comment: Nowhere in the subject report is any discussion of the belief that anthropogenic greenhouse gas emissions have little or no measurable effect on global climate change.
This is a serious omission of pertinent information. There might be no need for any proposed Draconic carbon dioxide emission reduction.

Reviewer: Randy Dutton

Comment: I want to make this comment on CO_2 official. As per the attached document, CO_2 is an essential gas necessary for growing trees and crops. As a tree farmer with 124 acres on the Washington Olympic Peninsula, I need the CO_2 to survive. CO_2 increases tree growth at a linear rate and is an economic boon to the US economy. Any manmade attempt to reduce CO_2 could cause the initiation of lawsuits for economic loss. The right to natural CO_2, which can't be separated from manmade CO_2, is as important as the right to oxygen. Another study shows that CO_2 global warming effect is NOT linear but its effect incrementally and dramatically decreases after 20ppm.

The solutions thus implemented by the US government actually harm the environment. The increase of CH_4 (a global warming gas 23 times more potent than CO_2; and NH_4 (from fertilizer for corn), which is 296 times more potent than CO_2 far offsets any reduction in CO_2 levels.

CO_2 isn't the problem, nor is climate change. But what is a very big problem, particularly for states closest to China is the massive pollution we are getting. This article was just released that shows 10 billion pounds (2003 figures) of real pollutants annually reaching the US from Asia. You probably know that heavy metals and organomolecules are part of the pollutants and they affect our health and environment, and are reported to have contaminated Olympic National Park lakes. The corrosive gases and carbon soot further affect our equipment and infrastructure (an area of expertise for me). This will continue to get worse until business and environmental regulations make it more advantageous to produce in the US, which has much better corrosion prevention technologies, rather than Asia. Lower taxes, tort reform, strong port of entry import inspection with importer paying all inspection and DHS costs, lower energy costs (ethanol drives it up), excellent education, and other factors contribute to a solid US manufacturing base.

NASA has quantified the amount of pollution that moves from East Asia to North America.

http://www.technologyreview.com/Infotech/20465/?nlid=963&a=f
By Brittany Sauser

A hazy day: The MODIS instrument captured a thick swath of smog or dust (or both) over the Sea of Japan on March 11. The image shows the plume blowing off the coasts of China, North Korea, and South Korea, and heading toward Japan. The plume is a translucent dingy gray contrasting with the bright white clouds to the east.
Credit: NASA

Multimedia
- See video of the transport of pollution across the North Pacific.

Atmospheric scientists have long known that air pollution travels vast distances and is a global phenomenon. Now researchers at NASA Goddard Space Flight Center have conducted the first-ever satellite-based measurements of pollution aerosols transported from East Asia to North America.

The researchers looked at four years of satellite data and found the amount of pollution arriving in North America to be equivalent to 15 percent of local emissions of the United States and Canada. It is "a significant number," says Hongbin Yu, an associate research scientist at the University of Maryland, in Baltimore, who is working at NASA Goddard and led the study.

"This means that any reduction in our emissions may be offset by the pollution aerosols coming from East Asia and other regions," says Yu.
The new study will be published in April in the American Geophysical Union's Journal of Geophysical Research.

The study was conducted from 2002 to 2005, using measurements from a satellite instrument called the moderate-resolution imaging spectroradiometer (MODIS) onboard NASA's Terra satellite. The instrument measures the reflective solar radiation and emitted thermal radiation from the earth's surface and atmosphere.

The satellite-based instrument can look at 36 different wavelengths of the solar-terrestrial spectrum, and it does so with better spatial resolution than previous satellite instruments, says Lorraine Remer, a physical scientist and a member of the MODIS science team at Goddard.

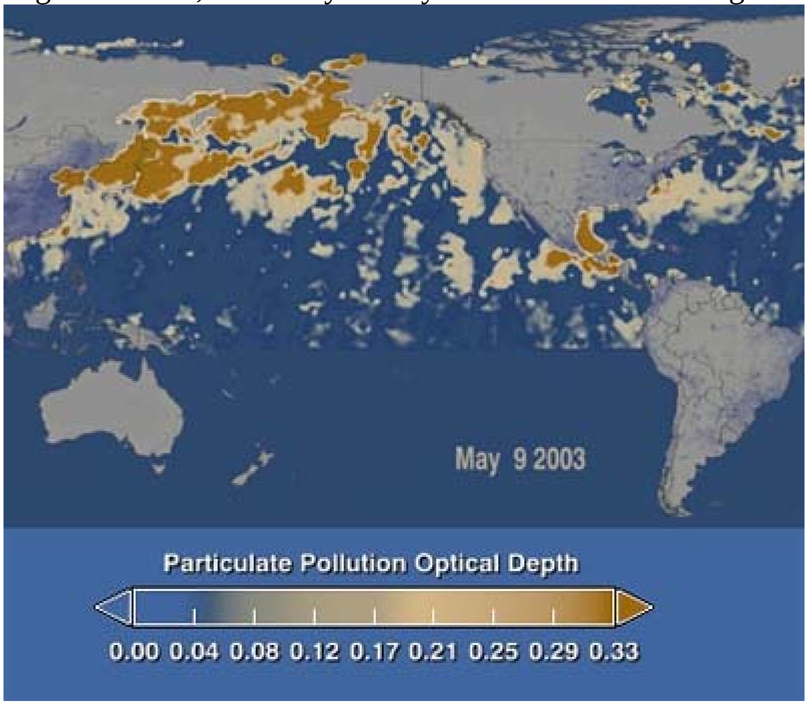
For the study, the researchers measured the reflected solar radiation at seven different wavelengths. Being able to see different colors of the spectrum allows the researchers to differentiate the types of particles more accurately than the older sensors, says Remer.

"Some particulates are absorbing things like black carbon that come out of diesel exhaust, making it a black color," says Ronald Prinn, a professor of atmospheric sciences and the director of the Center for Global Change Science at MIT. "Particles that are produced from sulfur that comes from the burning of coal are very bright white. You can look at the multiple colors ... and get information about composition and density as well."

The instrument is able to distinguish between man-made pollution and naturally occurring particles based on size. Naturally occurring dust and sea salt are typically larger than aerosol particles emitted from combustion sources, forest fires, automobiles, and industry, says Remer.

The MODIS instrument works by scanning a broad swath of the earth--about 2,300 kilometers--and counting the number of photons it is receiving by turning them into electrical signals. The instrument can measure the entire earth in one day.

MODIS does a better job than aircraft instrumentation does because it can observe the earth all the time, capturing events that only happen occasionally and accumulating them over the whole year, says Richard Honrath, a professor in the department of civil and environmental engineering at Michigan Technological University, in Houghton. "We can only do continuous measurements at ground level, but then you only see events that hit the ground," he says.



The instrument also gets "spatial and time detail that one would never get from ground-based measurements, and it captures the entire pollution plumes rather than just having a few observing stations looking up," says Prinn.

NASA researchers drew two virtual lines at 20 degrees north to 60 degrees north, and they measured the optical effect of the particles as they crossed those lines, says Yu. Using software that he made, the researchers culled this data and mapped it to see globally where the pollution is located.

The researchers found that 18 teragrams--almost 40 billion pounds--of pollution is exported from Asia, and that 4.5 teragrams--10 billion pounds, or about 25 percent--reaches North America annually, says Mian Chin, an atmospheric scientist at NASA and a coauthor of the study. But the instrument measures the total atmosphere column and does not have the vertical structure, so it is unknown how many of the pollutants are at surface level, and how many are aloft in the atmosphere, says Chin.

Despite that uncertainty, the scientists say that it is the higher-altitude pollution that is probably most worrisome. "We think the pollution being imported to North America will impact the weather and climate; we don't expect any big impact on the air quality because particles from East Asia are exported at high altitude," says Yu.

"It is very difficult to lower pollution levels of man-made pollutants to extremely low levels because pollutants come in the air from other countries that the U.S. Environmental Protection Agency, for example, cannot control," says Prinn. Agrees Honrath: "You have to consider the future industrial growth of Asia if you develop long-range plans for meeting air-quality goals in the United States."

The Congress is focused on MMGW and ethanol as a solution. Here's why it's wrong – and somebody should tell them. Apparently the UK now understands the biofuel mistake http://news.bbc.co.uk/2/hi/science/nature/7309099.stm;

Ethanol is corrosive. As a solvent it eats rubber, aluminum, paints, and fiberglass. It quite literally dissolves rubber fuel lines in some appliance as it did to one of my HomeLite tools, leaving gasoline dripping out of the gas tank. The HomeLite technical expert said it was because of the ethanol in our fuel and they didn't have a "fix". Now multiply that millions of times in garages across Washington State; I reported it to the CPSC. Ethanol additive percentage above 5.8% requires decreasing the percentage of cheaper fuel additives such as pentanes because of volatility problems per the EIA of DOT, yet some states have created policy pushing ethanol concentrations higher: Ethanol separates from petroleum gasoline, which makes it unstable generally in less than 90 days. This can leave motorists and boaters stranded. It can make industrial and emergency equipment such as generators unusable; Ethanol, after separating from water, actually increases the total container volume required because it expands; Ethanol absorbs water. This is part of the reason it is so corrosive; Ethanol can't be shipped through pipelines, thus dramatically increases hazardous tanker truck shipment on our highways and increases the rail terminal infrastructure necessary to handle ethanol rail shipment; Ethanol, as a solvent, causes sediment to separate from the bottom of a fuel tank and be run through the fuel system, which can clog fuel nozzles; Ethanol increases microbial action; Ethanol production from food is driving up the cost of food and reducing export income; Ethanol production targets have signaled to oil companies (and OPEC) that their additional investment in refineries and extraction may not pay out, thus we are left with more severe shortages; Ethanol increases several air pollution gases and is predicted to raise respiratory deaths by a few hundred people per year; Ethanol fires have been found to be much harder and more expensive to fight. Ethanol fires burn through the foam generally used to fight petroleum fires and which costs about 30% more. Most fire departments neither have this different but necessary foam, nor the training to use it; Ethanol increases the frequency of gas station fill-ups, and the number of gas stations because it has only 70% the energy of petroleum; Ethanol subsidies are helping to bankrupt the US economy; Ethanol production is now criticized by many environmental groups. And far from showing the world how advanced we are, the US is being criticized for damaging the global food supply and forcing the destruction of rain forests.

- The U.S. Energy Information Administration believes that the practical limit for domestic ethanol production is about 13.8 billion gallons by 2030, or about 7 percent of the transportation fuels market. (Annual Energy Outlook 2007)
- Even if all the corn produced in America last year were dedicated to ethanol, it would reduce U.S. consumption of gasoline by only 12 percent. ("Corn Can't Solve Our Problem", Washington Post, March 25, 2007) A 12 percent reduction in our gasoline demand would reduce our oil demand by only 5 percent – less than third of what is imported from the Persian Gulf alone.
- According to University of Minnesota economists C. Ford and Benjamin Senauer, filling the gas tank of an SUV with pure ethanol would require more than 450 pounds of corn—roughly enough calories to feed one person for a year. ("How Biofuels Could Starve the Poor", Foreign Affairs) Two different approaches, the Lifecycle Emission Model, a bottom-up approach developed by Delucchi and co-workers at the Institute of Transportation Studies at University of California, Davis;2 and the inverse approach used by Crutzen, et al. (2007),3 indicate that for U.S. corn cultivation, at least 3% of the nitrogen in fertilizer is converted to nitrous oxide (N_2O). Because a pound of N_2O has 296 times the greenhouse gas impacts of a pound of carbon dioxide (CO_2), N_2O emissions from corn cultivation are sufficient to eliminate the greenhouse gas benefit of using corn-derived ethanol as a transportation fuel.
- Since America provides two-thirds of all global corn exports, the increasing use of corn for motor fuel production – and the resulting rise in grain prices – will be felt worldwide. According to Runge and Senauer, rising food prices caused by the demand for ethanol and other bio-fuels could cause as many as 600 million more people to go hungry worldwide by 2025.
- One gallon of ethanol requires 4 to 5 gallons of water to produce at the distillery. Irrigated corn requires 880 gallons of water to produce1 gallon of ethanol, but only about 15 percent of the corn grown in the U.S. is irrigated. Averaging across both irrigated and non-irrigated corn, 1 gallon of ethanol requires 132 gallons of water. Production of ethanol has already threatened water supplies in many areas. Increasing ethanol production will exasperate this problem. (For water needed by irrigated corn and ethanol, see: Sandia National Laboratory, "Energy Demands On Water Resources," December 2006. For percentage of corn under irrigation, see Patzek and Pimentel. For concern about water supplies, see Wichita Eagle, "Time to get serious about Ogallala Aquifer, April 8, 2007.)
- According to a group of academics from the University of California at Berkeley, only 5 to 26 percent of the energy content of ethanol is "renewable." The rest of ethanol's energy comes from other fossil fuels (coal and natural gas) necessary to produce corn and process it into ethanol. (Science 311, January 27, 2006) Transportation energy demand is essentially transferred from one fossil fuel (petroleum) to another (natural gas and/or coal). (Brent D. Yacobucci, "Fuel Ethanol: Background and Public Policy Issues," Congressional Research Service, October 19, 2006, 22. Available: http://www.ncseonline.org/NLE/CRSreports).

- Ethanol contains 34 percent less energy content than gasoline. Less energy efficiency will require motorists to refuel more frequently.
- Ethanol plants are heavily subsidized. The federal government provides a $0.51 per-gallon tax credit that is paid out of the government's general fund. (Kansas Fuel Retailers' Ethanol Guide.)
- The Energy Information Administration reports that the capital costs associated with cellulosic ethanol production are 5 times greater than those associated with conventional corn-based production. (Assumptions to the Annual Energy Outlook 2007). A gallon of cellulosic ethanol then would cost about $7.50 per gallon before even considering the price of the feedstock. (Jerry Taylor, Heartland Institute's Energy Summit).
- Current cellulosic ethanol plants are either pilot or demonstration projects that are not producing commercially viable (that is, economic) quantities of ethanol.
- Dr. Howard Gruenspecht, Deputy Administrator, Energy Information Administration, U.S. Department of Energy, said in a recent hearing before the House Agriculture Committee that domestic corn is expected to continue to be the primary source of alternative fuels through 2030 – belying the common contention that switchgrass or sugarcane will soon take over the market.
- A final point worth considering, particularly given the severe drought now affecting the southeastern U.S.: Should the American public be gambling on the vagaries of the weather for its fuel supply? A severe, years-long drought in Iowa or Illinois or other key corn-producing states could devastate America's ethanol industry and the U.S. would have no choice but to make up for any shortfall in ethanol production by importing more oil. Further, it's reasonable to assume – given the ethanol industry's decades-long addiction to subsidies – that federal taxpayers will be called upon to prop up the ethanol producers in the event of such a drought.

And it has been found that overall global warming gases increase dramatically when growing corn for fuel. Not only is methane(CH_4) 23 times more effective as a global warming gas than CO_2, but the (NH_4) nitrous oxides released by fertilizers used to grow corn are 296 times more effective than CO_2. The net effect is that the US is subsidizing the destruction of our economy while polluting the air with chemicals that are much more damaging than CO_2.

And from the National Renewable Energy Council http://www.e85fuel.com/pdf/ethanol_guidebook.pdf comes a list of materials incompatible with ethanol. Now consider that nearly every home tool, boat, generator, RV, etc has these components in their fuel system, and plastic gas cans also present a problem.

Materials Recommendations

As with all liquid fuels, it is vitally important that proper fuel handling techniques be practiced to prevent fuel contamination. Certain materials commonly used with gasoline are totally incompatible with alcohols. When these materials (such as aluminum) come in contact with ethanol, they may dissolve in the fuel, which may damage engine parts and may result in poor vehicle driveability. Even if parts do not fail, running an ethanol-fueled vehicle with contaminated fuel may cause deposits that could eventually harm the engine. The materials and parts presented in this guidebook perform well with E85.

The following sections describe parts and equipment that are compatible with fuel ethanol. They should be available from your usual petroleum equipment supplier. You can find a list of alcohol-compatible equipment at ***http://www.e85fuel.com/information/manufacturers.htm***.

The NEVC and the Petroleum Equipment Institute have worked together to gather the most comprehensive summary of alcohol-compatible equipment possible; however, other approved parts may be available.

Some materials become degraded by contact with fuel ethanol blends having high alcohol concentrations. Zinc, brass, lead, and aluminum are sensitive metals. Terne (lead-tin-alloy)-plated steel, which is commonly used for gasoline fuel tanks, and lead-based solder are also incompatible with E85. Avoid using these metals because of the possibility of fuel contamination and potential difficulties with vehicle driveability. Unplated steel, stainless steel, black iron, and bronze have shown acceptable resistance to ethanol corrosion.

Nonmetallic materials that degrade when in contact with fuel ethanol include natural rubber, polyurethane, cork gasket material, leather, polyvinyl chloride (PVC), polyamides, methyl-methacrylate plastics, and certain thermo and thermoset plastics. Nonmetallic materials that have been successfully used for transferring and storing fuel ethanol include nonmetallic thermoset reinforced fiberglass, thermo plastic piping, and thermoset reinforced fiberglass tanks as listed by Underwriters Laboratories, Inc. Buna-N, Neoprene rubber, polypropylene, nitrile, Viton, and Teflon materials may also be used with E85.

And I might add that ethanol stored in old underground storage tanks are likely to leak into ground water.

https://www.fleet.ford.com/showroom/environmental_vehicles/BiodieselTechnology.asp

From Ford Motor Company website:

"The World-Wide Fuel Charter, a compilation of fuel quality requirements endorsed by the Alliance of Automobile Manufacturers, the European Automobile Manufacturers Association (ACEA), the Engine Manufacturers Association, the Japanese Automobile Manufacturers Association and a number of other automobile manufacturer trade associations around the world, does not endorse fuels that contain more than 5% biodiesel for fuels sold in WWFC defined category 1-3 areas (most of the world). International Truck and Engine Company has stated that the use of biodiesel in their engines - some of which are in Ford products - at greater than 5%

concentration, is solely at the discretion and risk of the customer. (read that as "warranty does not cover…")
Use of Biodiesel in Ford Vehicles:
Fuels containing no more than 5% biodiesel may be used in Ford diesel powered vehicles. Consistent with WWFC (World-Wide Fuel Charter) category 1-3, "Fatty Acid Methyl Esters (FAME) used in commercial fuel must meet both the EN 14214 and ASTM D 6751 specifications".
There are still some unresolved technical concerns with the use of biodiesel at concentration greater than 5%. Some of the concerns are:
Requires special care at low temperatures to avoid excessive rise in viscosity and loss of fluidity
Storage is a problem due to higher then normal risk of microbial contamination due to water absorption as well as a higher rate of oxidation stability which creates insoluble gums and sediment deposits
Being hygroscopic, the fuel tends to have increased water content, which increases the risk of corrosion
Biodiesel tends to cause higher engine deposit formations
The methyl esters in biodiesel fuel may attack the seals and composite materials used in vehicle fuel systems
It may attack certain metals such as zinc, copper based alloys, cast iron, tin, lead, cobalt, and manganese

It is an effective solvent, and can act as a paint stripper, whilst it will tend to loosen deposits in the bottom of fuel tanks of vehicle previously run on mineral diesel
Ford believes that it is unlikely that the emission benefits of biodiesel will be sufficient to achieve Tier 2 emission standards with out catalysts and particulate filters. Ford is working aggressively on technologies, including engine improvements, new catalysts and particulate filters that will remove HC, CO, NO_x and soot from diesel exhaust. Renewable fuels or blends containing renewable components can help reduce the total lifecycle CO_2 impact and may be used when available, but they are not the key step to achieving Tier 2 emission standards. "

The ethanol policy is based upon fear – fear of running out of fuel – fear of global warming – fear of destroying the Earth. All are wrong.
The US has 800 billion barrels of recoverable oil in the Rockies but Legislators are trying to block its exploitation because they have placed their hopes on biofuel.

Manmade Global Warming is sham issue but too many politicians have entrenched themselves in it to climb out of the hole. Here's some real
info:

The JPL Argo Project, which has 3000+ diving robots in the world's oceans report that the oceans are getting slightly cooler. Read the NPR article and remember that NPR is hardly a bastion of conservative writers.
Environment
The Mystery of Global Warming's Missing Heat by Richard Harris Listen Now [3 min 57 sec] add to playlist

Waipi'o Valley Lookout and Hamakua Coast in Hawaii

Stuart Westmorland Oceans hold much more heat than the atmosphere can.

Corbis Morning Edition, March 19, 2008 · Some 3,000 scientific robots that are plying the ocean have sent home a puzzling message. These diving instruments suggest that the oceans have not warmed up at all over the past four or five years. That could mean global warming has taken a breather. Or it could mean scientists aren't quite understanding what their robots are telling them. This is puzzling in part because here on the surface of the Earth, the years since 2003 have been some of the hottest on record. But Josh Willis at NASA's Jet Propulsion Laboratory says the oceans are what really matter when it comes to global warming.

In fact, 80 percent to 90 percent of global warming involves heating up ocean waters. They hold much more heat than the atmosphere can. So Willis has been studying the ocean with a fleet of robotic instruments called the Argo system. The buoys can dive 3,000 feet down and measure ocean temperature. Since the system was fully deployed in 2003, it has recorded no warming of the global oceans.

"There has been a very slight cooling, but not anything really significant," Willis says. So the buildup of heat on Earth may be on a brief hiatus. "Global warming doesn't mean every year will be warmer than the last. And it may be that we are in a period of less rapid warming."

In recent years, heat has actually been flowing out of the ocean and into the air. This is a feature of the weather phenomenon known as El Nino. So it is indeed possible the air has warmed but the ocean has not.

But it's also possible that something more mysterious is going on.

That becomes clear when you consider what's happening to global sea level. Sea level rises when the oceans get warm because warmer water expands. This accounts for about half of global sea level rise. So with the oceans not warming, you would expect to see less sea level rise.

Instead, sea level has risen about half an inch in the past four years.

That's a lot.

Willis says some of this water is apparently coming from a recent increase in the melting rate of glaciers in Greenland and Antarctica.

"But in fact there's a little bit of a mystery. We can't account for all of the sea level increase we've seen over the last three or four years,"

he says.

One possibility is that the sea has, in fact, warmed and expanded — and scientists are somehow misinterpreting the data from the diving buoys.

But if the aquatic robots are actually telling the right story, that raises a new question: Where is the extra heat all going?

Kevin Trenberth at the National Center for Atmospheric Research says it's probably going back out into space. The Earth has a number of natural thermostats, including clouds, which can either trap heat and turn up the temperature, or reflect sunlight and help cool the planet.

That can't be directly measured at the moment, however.
"Unfortunately, we don't have adequate tracking of clouds to determine exactly what role they've been playing during this period," Trenberth says.
It's also possible that some of the heat has gone even deeper into the ocean, he says. Or it's possible that scientists need to correct for some other feature of the planet they don't know about.
It's an exciting time, though, with all this new data about global sea temperature, sea level and other features of climate.
"I suspect that we'll able to put this together with a little bit more perspective and further analysis," Trenberth says. "But what this does is highlight some of the issues and send people back to the drawing board."
Trenberth and Willis agree that a few mild years have no effect on the long-term trend of global warming. But they say there are still things to learn about how our planet copes with the heat.

January 2008 - 4 sources say “globally cooler” in the past 12 months
19 02 2008

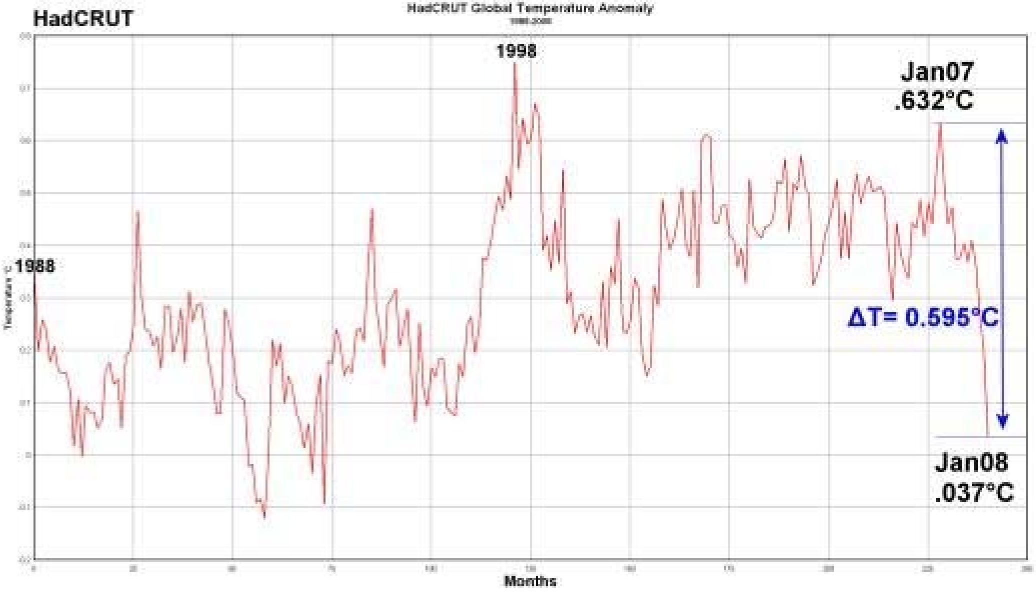
http://wattsupwiththat.wordpress.com/2008/02/19/january-2008-4-sources-say-globally-cooler-in-the-past-12-months/

January 2008 was an exceptional month for our planet, with a significant cooling, especially since January 2007 started out well above normal.

January 2008 capped a 12 month period of global temperature drops on all of the major well respected indicators. I have reported in the past two weeks that HadCRUT, RSS, UAH, and GISS global temperature sets all show sharp drops in the last year.

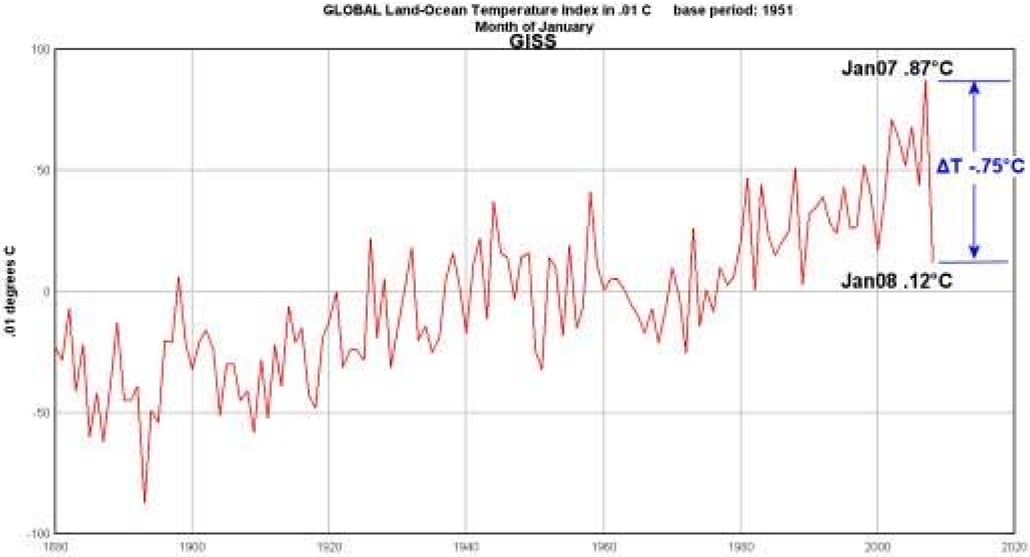
Also see the recent post on what the last 10 years looks like with the same four metrics - 3 of four show a flat trendline.

Here are the 4 major temperature metrics compared top to bottom, with the most recently released at the top:
UK’s Hadley Climate Research Unit Temperature anomaly (HadCRUT) Dr. Phil Jones:



hadcrut-jan08

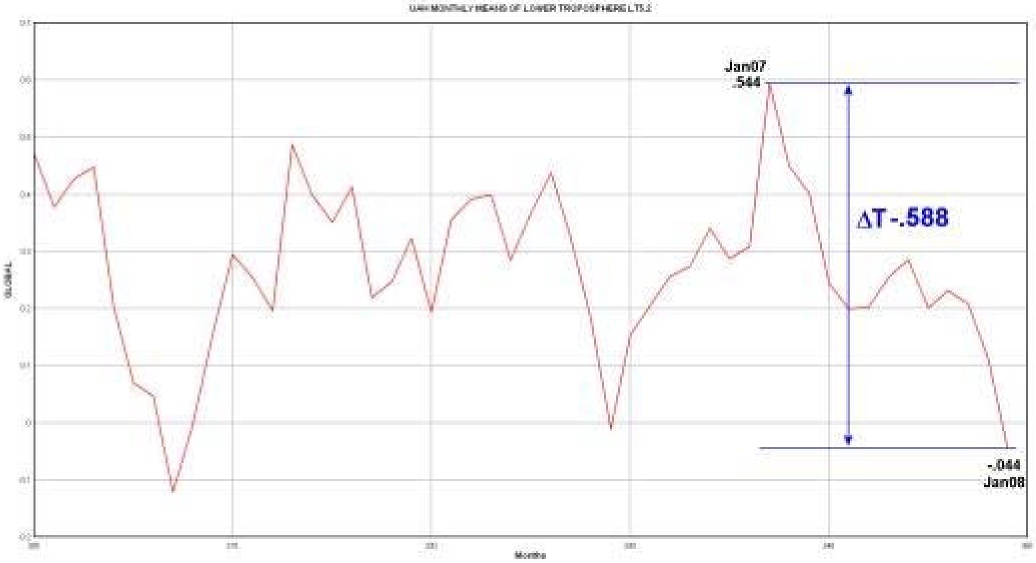
Reference: above data is HadCRUT3 column 2 which can be found here description of the HadCRUT3 data file columns is here NASA Goddard Institute for Space Studies (GISS) Dr. James Hansen:



GISS January Land-Sea Anomaly

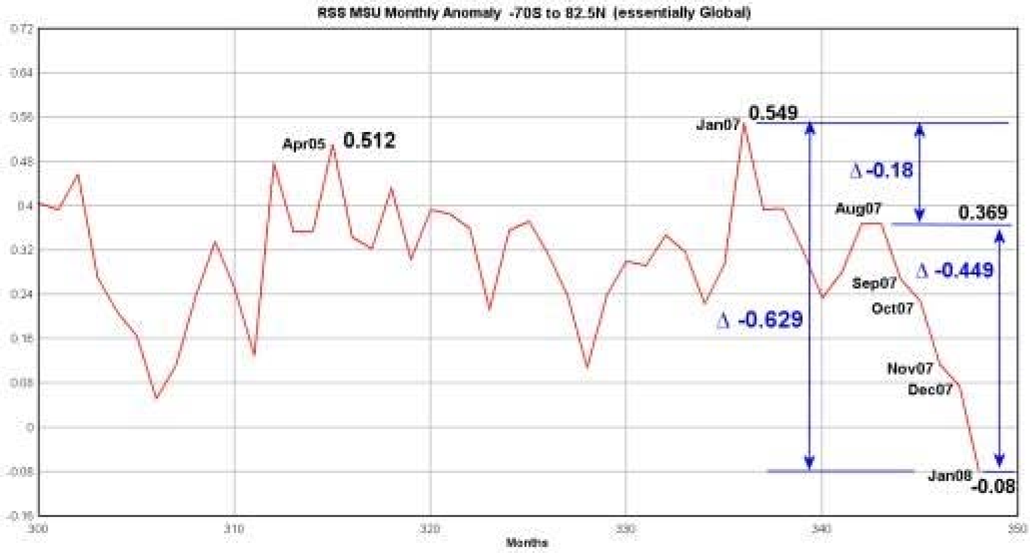
Reference: GISS dataset temperature index data University of Alabama, Huntsville (UAH) Dr. John Christy

UAH-monthly-anomaly-zoomed



Reference: UAH lower troposphere data

Remote Sensing Systems of Santa Rosa, CA (RSS):



Reference: RSS data here (RSS Data Version 3.1)

Th prpseofths umar i t mkeiteay orevryne to compare the last 4 postings I've made on this subject.

I realize that not all the graphs are of the same scale, so my next task will be to run a combined graphic of all the data-sets on identical amplitude and time scales to show the agreements or differences such a graph would illustrate.

UPDATE: that comparison has been done here

Here is a quick comparison and average of ΔT for all metrics shown above:

Source:	Global ΔT °C
HadCRUT	- 0.595
GISS	- 0.750
UAH	- 0.588
RSS	- 0.629
Average:	- 0.6405°C

For all four metrics the global average ΔT for January 2007 to January 2008 is: - 0.6405°C

This represents an average between the two lower troposphere satellite metrics (RSS and UAH) and the two land-ocean metrics (GISS and HadCRUT).
While some may argue that they are not compatible data-sets, since they are derived by different methods (Satellite -Microwave Sounder Unit and direct surface temperature measurements) I would argue that the average of these four metrics is a measure of temperature, nearest where we live, the surface and near surface atmosphere.

UPDATE AND CAVEAT:

The website DailyTech has an article citing this blog entry as a reference, and their story got picked up by the Drudge report, resulting in a wide distribution. In the DailyTech article there is a paragraph:

“Anthony Watts compiled the results of all the sources. The total amount of cooling ranges from 0.65C up to 0.75C — a value large enough to erase nearly all the global warming recorded over the past 100 years. All in one year time. For all sources, it’s the single fastest temperature change ever recorded, either up or down.”

I wish to state for the record, that this statement is not mine: “–a value large enough to erase nearly all the global warming recorded over the past 100 years”

There has been no “erasure”. This is an anomaly with a large magnitude, and it coincides with other anecdotal weather evidence. It is curious, it is unusual, it is large, it is unexpected, but it does not “erase”
anything. I suggested a correction to DailyTech and they have graciously complied.

UPDATE #2 see this post from Dr. John R. Christy on the issue.

UPDATE #3 see the post on what the last 10 years looks like with the same four metrics - 3 of four show a flat trendline.

« Another Global Temp Index Dives in Jan08, this time HadCRUT NOAA:
Hurricane frequency and global warming NOT the cause of increased destruction

Comment: Sorry,The emissions from the fertilizer to make ethanol is N_2O, not NOx. See attached: Greenhouse gas emissions from biofuel.

Reviewer: Gail Sandlin, WA State Dept. of Ecology

Executive Summary

Comment:

Page	Line #	Comments
ES-3	12	Add. One teragram is equal to 10^{12} grams or one million metric tons. (although national inventories use the teragram unit it would be useful for readers to understand the unit relationship since in most voluntary programs emissions are reported as MMT CO2eq.

Industrial Processes

Comment:

Page	Line #	Comments
4-36	22	‘Primary lead production, in the form of direct smelting….though to a lesser extent in Idaho, Montana and Washington. Remove ‘Washington’. No lead smelting occurs in Washington State. Lead mining at Pend Oreille, WA; transported to smelting facility in Trail, B.C. (USGS 2006 Minerals Yearbook)

Reviewer: Nicholas Themelis, Columbia University

Energy, MSW Combustion

Comment: In response to your request for comments to the Report Draft, I would like to bring to your attention that according to our studies and calculations the CO_2 emissions from municipal solid wastes (MSW) in Table 3-46 (2004: 20.1 Tg; 2005: 20.7 Tg; 2006: 20.9 Tg) are somehow overestimated by a factor of 2. Our reasoning is based on the following information. The Report Draft (p.3.54, line 1) states that “Over 31 million metric tons of MSW were combusted in the U.S. in 2006”. This is higher than the 26.4 million metric tons reported in the SOG national survey for 2004 (29 million short tons) but there may have been an increase in the intervening two years and the 2006 number may also include tires and other solid wastes co-combusted in cement kilns and power plants. Further discussion will be based on the 31 million metric tons estimate of the Report Draft.

Our detailed studies and publications, and also published data by other researchers in the U.S. (e.g. G. Tchobanoglous et al, Integrated Waste Management Handbook), have shown that the total carbon content in U.S. MSW, as received at waste-to-energy (WTE) plants and at landfills, ranges from 29% to 30%.

Multiplying the high end 30% by the 31 million metric tons, yields a total carbon content in the U.S. MSW combusted of 9.3 million metric tons. Since the carbon molecular weight is 12 and of CO_2 44, multiplying the 9.3 million tons of carbon by the ratio 44/12 yields the total CO_2 emitted from the complete combustion of the 31 million tons of MSW to be 31*44/12= 34.1 million metric tons of CO_2.

As per the assumption of the Report Draft, that also follows the methodology of the Intergovernmental Panel on Climate Change (IPCC), only the fossil-based (i.e. the petrochemical origin) fraction of the MSW should be considered in Table 3-46. We have developed, and published our results, on two ways for arriving at the “split” of carbon in MSW between biogenic and fossil-based carbon.

In the first and indirect method, we have used the typical composition of MSW (paper, cardboard, plastics, food wastes, etc.) as reported by EPA, and we have arrived at the result that the MSW, as received at WTEs and landfills, contains at most 15% petrochemicals. Therefore, at the known average carbon concentration of petrochemicals in MSW of about 64% C (the

Tchobanoglous et al Handbook shows elemental composition of all MSW components), the fossil-based carbon in MSW should be 15%*64% = 9.75%C. i.e. about one third of the 30% total carbon in MSW.

In the second and direct method of fossil-based carbon in MSW, in 2006-2007, we collaborated with Beta Labs in Florida in testing an ASTM-approved instrumental analysis technique (ratio of Carbon 14 to Carbon 12) that can differentiate between fossil-based and biogenic CO_2 in stack gas samples from WTE facilities. We reported on this test at the NAWTEC 15 meeting (May 2007) and we will be glad to send you copies of this evaluation. It consisted of our mixing two wastes, in quantities from 0% to 100%, one representing fossil-based (polyethylene) and the other biogenic (paper) materials, combusting them in a bomb calorimeter and then sending "blind" gas samples to Beta Labs for analysis of C^{14} to C^{12}. The results showed near perfect correlation between the prepared ratios and the actual results of the Beta Labs analysis.

We communicated the results of this test to the U.S. WTE industry and recommended collecting and analyzing representative stack gas samples. At least two major companies, Wheelabrator Technologies and Covanta Energy, in 2007 sent over fifty stack gas samples to Beta Labs for analysis. These samples were obtained in most regions of the continental U.S. that operate WTEs. All the results were astonishingly close to the analytical ratio we had projected earlier: About one third of the carbon in the stack gases is fossil-based and two thirds (64-67%) is biogenic. Returning now to the total of 34.1% million metric tons of CO_2 emitted from "MSW combustion" of 31 million metric tons of "MSW", and considering that only one third of this amount is fossil based, leads to the inescapable conclusion that the maximum CO_2 emissions from "MSW" combustion is 34.1/3 = 11.4 million metric tons = 11.4 Tg instead of the 20.9 Tg shown in Table 3-46.

We are at this time completing the BioCycle/Columbia SOG survey of 2006 data. Not all states have submitted full data as yet but on the basis of what we have as of now we project that the MSW combusted in the existing WTE facilities in 2006 will amount to less than 30 million short tons, i.e. less than 27.2 million metric tons. If this projection is supported by the final data of the BioCycle/Columbia SOG survey for 2006, the corresponding CO_2 fossil-based emissions by the 88 U.S. WTE facilities, alone, will be 10.0 million metric tons, i.e. 10.0 Tg.

In closing, I would like to congratulate and thank the authors of the Report Draft for using in their GHG emissions analysis (both in the Energy and the Waste Sections) the national waste management data provided by the BioCycle/Columbia survey, rather than those usually reported by EPA, based on Franklin Associates projections. The latter grossly underestimate the amount of MSW generated and landfilled in the U.S., as we have discussed at a recent meeting with the EPA Office of Solid Wastes at EPA Headquarters.

Reviewer: Ted Michaels, Integrated Waste Services Association

(please see "080405 inventory comments.pdf" for details of attachments)

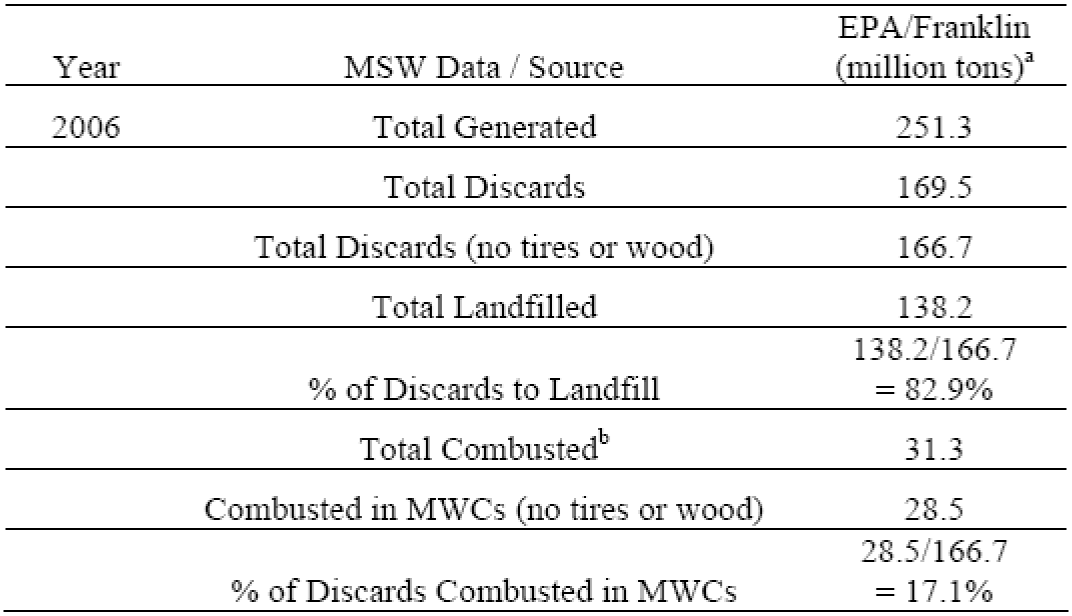
Energy, MSW Combustion

Comment: Using an indirect methodology and flawed data, EPA overstates actual CO_2 emissions from municipal waste combustors (MWCs) by a factor of two. EPA should abandon its current methodology and instead use a more accurate direct testing method to quantify MWC

CO_2 emissions. ASTM-D6866 is the direct test method that has been proven to accurately determine biogenic and non-biogenic CO_2 emissions in MWC stack gas. ASTM D6866 results combined with MSW higher heating value and total annual tons of MSW combusted provides a direct calculation of non-biogenic CO_2 emissions. Using this approach, a non-biogenic CO_2 emission factor of 323 kg/short ton MSW is derived. This direct calculation method is insensitive to the inherent errors associated with determining solid waste composition. The direct method was adopted in the California Greenhouse Gas Reporting Protocol. EPA and ASTM are also pursuing adoption of new method for collecting stack gas samples for ASTM D6866 analysis with the anticipation the method would be used with ASTM D6866 in EPA's GHG reporting protocol. Detailed comments on EPA's methodology and the proposed alternative direct method are presented in the attached January 9, 2008 submittal by Andrew Szurgot of Stratosphere, LLC. IWSA endorses these comments and urges EPA to embrace this available and demonstrated alternative method to accurately estimate CO_2 emissions.

Comment: 1) EPA incorrectly calculated the relative proportion of 2006 discards sent to landfills and combustion:

Table A-125 reports discards as a % of generation and then apportions the discards into 80.2% landfill and 19.8% combustion, based on data from its "Municipal Solid Waste in the United States" report series (also known as the EPA/Franklin reports). However, the EPA/Franklin report for 2006, adjusted to remove 2.8 million tons of tires and wood that are not combusted in WTE facilities, indicates that the proportions should be 82.9% landfill and 17.1% combustion (please see tabulation below). So, even if one were to accept the EPA/Franklin MSW quantities as accurate, EPA overstates the % of plastics sent to MWCs and therefore the resulting CO_2 emissions by the ratio 19.8/17.1, or 16%. This same mistake also affects EPA's calculations for CO_2 from synthetic rubber and synthetic fibers by the same ratio.



Year	MSW Data / Source	EPA/Franklin (million tons)[a]
2006	Total Generated	251.3
	Total Discards	169.5
	Total Discards (no tires or wood)	166.7
	Total Landfilled	138.2
	% of Discards to Landfill	138.2/166.7 = 82.9%
	Total Combusted[b]	31.3
	Combusted in MWCs (no tires or wood)	28.5
	% of Discards Combusted in MWCs	28.5/166.7 = 17.1%

[a] U.S. Environmental Protection Agency, "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2006," page 9, Table 3. Accessed at http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw06.pdf

[b]EPA/Franklin "Total Combusted" figures include tires and other separated wastes not combusted in MWCs, e.g., 2.8 million tons in 2005. See U.S. Environmental Protection Agency, “Municipal Solid Waste in the United States: 2005 Facts and Figures”, EPA-530-R-06-011, October 2006, page 138. Accessed at http://www.epa.gov/msw/pubs/mswchar05.pdf

Comment: 2) EPA incorrectly calculates CO_2 emissions from synthetic fibers.
On page A-149, EPA cites the equation it used to calculate CO_2 emissions from synthetic fiber combustion. For the year 2006, and accepting EPA’s Table A-130 total combustion value of 984 Gg, that equation would be:

$$984 \text{ Gg} \times 55\% \times 70\% \times 44/12 = 1391 \text{ Gg } CO_2 \text{ Eq., i.e., } 1.4 \text{ Tg } CO_2 \text{ Eq.}$$

However, EPA’s stated value for 2006 synthetic fiber CO_2 emissions in Table 3-46 on page 3-54 is 2.5 Tg CO_2 Eq., that is it overstates these emissions by 1.1 Tg CO_2 Eq.

Comment: EPA should re-examine MSW combustion N_2O emissions based on recent test data, as it had indicated it would do in last year’s report under “Planned Improvements”. By doing so, we believe that EPA will conclude that modern MWC facilities are not significant sources of N_2O emissions.

In the draft report, EPA continues to identify N_2O as a characteristic emission of MSW combustion based on data from older, foreign sources. We are re-submitting a stack test report by The Avogadro Group, LLC containing 2007 N_2O emission testing data from a California waste-to-energy facility. This facility is equipped with MACT-compliant spray dryer, fabric filter, carbon injection, and selective non-catalytic reduction air pollution control systems, typical of the large majority of MWCs operating in the U.S. since the year 2000 MACT compliance deadline for MWCs. The data show that N_2O was not detected at a method detection threshold of 1 ppmdv and an average stack oxygen concentration of 11.4% dry, or 1.46 ppmdv @ 7% O_2. For MSW with an F-factor of 14,389 scf @ 7% O_2/MMBTU (EPA Method 19) and a MSW higher heating value of 5000 BTU/lb this detection limit is equivalent to an N_2O emission factor of:

$$1.46 \text{ E-6} \times 14{,}389 \text{ scf/MMBTU} \times 44 \text{ lb/mole} / 385 \text{ scf/mole} \times 10 \text{ MMBTU/short ton MSW}$$
$$= 0.024 \text{ lb/short ton MSW, or } 12 \text{ g/metric ton MSW}$$

This revised emission factor is much smaller than the 44 g/metric ton used in EPA’s calculations. Using the emission factor of 12g/metric ton MSW, the 2006 annual N_2O emissions from MSW combustion are:

$$12 \text{ g/metric ton} \times 26{,}027{,}823 \text{ metric tons} \times 310 \text{ GWP} \times 1 \text{ E-12 Tg/g} = 0.097 \text{ Tg } CO_2 \text{ Eq.}$$

These revisions reduce EPA’s 2006 estimated N_2O emissions from 0.5 Tg CO_2 Eq. to less than 0.1 Tg CO_2 Eq. Unless convincingly contradicted by EPA’s own data representative of MACT-compliant U.S. MWC facilities, EPA should accept the Avogadro data and accordingly revise Tables 3-46 and 3-47 for all reporting years since 2000.

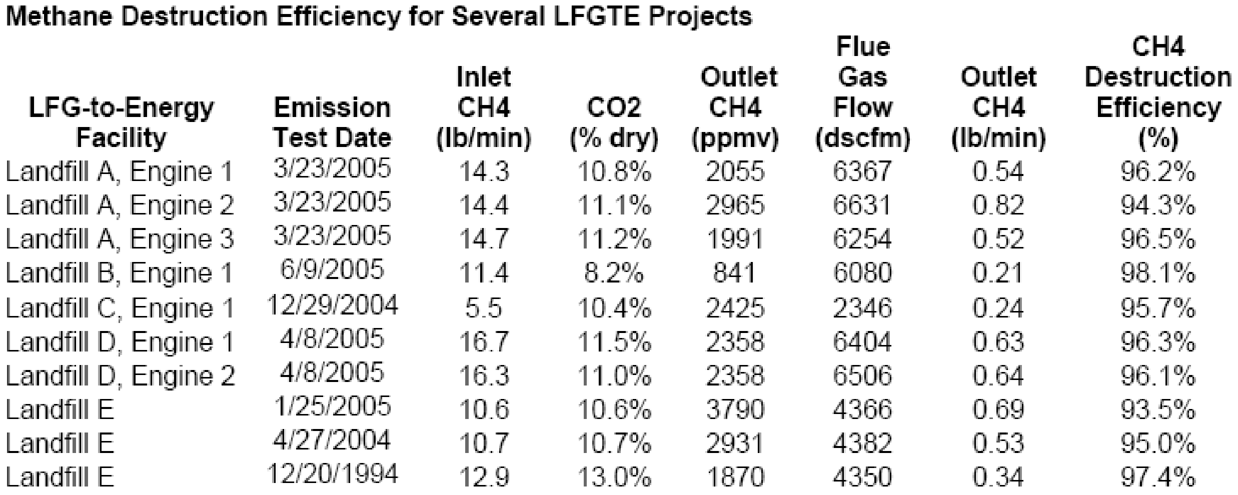
Waste, Landfills

Comment: Based on data presented below, EPA should lower its flare and landfill gas-to-energy (LFGTE) project methane destruction removal efficiency. EPA justifies the 99% methane destruction efficiency, which is apparently used for both flares and LFGTE projects, based on a flare efficiency range of 98-100% given in AP-42. First, we are unaware of any such citation in AP-42. There is a flare control efficiency range of 98.0- 99.7% given is not for methane, but for other classes of organic compounds listed in Table 2.4-3.[1] In addition, the same table cites an organics control efficiency range of 86.1-97.2% for internal combustion engines (ICE), the predominant equipment used in LFGTE projects. If, extrapolating from the Table 2.4-3, flare methane control is indeed 99%, then the table would also suggest that ICE control is much lower, the midpoint of the range being 92%. It is important to note that the confidence ratings for Table 4.2-3 are low, “B/C” for flares and “E” for ICEs.

The 99% value used in the draft report may be appropriate for well-maintained and operated flares, but performance cannot be assumed as typical or average for flares unless there is some form of compliance monitoring and enforcement that demonstrates this level of control.

As for ICE’s, they should not be lumped in with flares, their destruction efficiency should be lower. The table below presents data from a number of California LFGTE facilities that met air permit compliance, but did not achieve 99% destruction efficiency. These data confirm the suspected lower methane destruction efficiencies for ICEs that are implied by Table 4.2-3.

EPA should review these and other methane destruction data and revise its default methane destruction efficiencies accordingly.



Methane Destruction Efficiency for Several LFGTE Projects

LFG-to-Energy Facility	Emission Test Date	Inlet CH4 (lb/min)	CO2 (% dry)	Outlet CH4 (ppmv)	Flue Gas Flow (dscfm)	Outlet CH4 (lb/min)	CH4 Destruction Efficiency (%)
Landfill A, Engine 1	3/23/2005	14.3	10.8%	2055	6367	0.54	96.2%
Landfill A, Engine 2	3/23/2005	14.4	11.1%	2965	6631	0.82	94.3%
Landfill A, Engine 3	3/23/2005	14.7	11.2%	1991	6254	0.52	96.5%
Landfill B, Engine 1	6/9/2005	11.4	8.2%	841	6080	0.21	98.1%
Landfill C, Engine 1	12/29/2004	5.5	10.4%	2425	2346	0.24	95.7%
Landfill D, Engine 1	4/8/2005	16.7	11.5%	2358	6404	0.63	96.3%
Landfill D, Engine 2	4/8/2005	16.3	11.0%	2358	6506	0.64	96.1%
Landfill E	1/25/2005	10.6	10.6%	3790	4366	0.69	93.5%
Landfill E	4/27/2004	10.7	10.7%	2931	4382	0.53	95.0%
Landfill E	12/20/1994	12.9	13.0%	1870	4350	0.34	97.4%

Comment: Landfill methane emission estimates are highly uncertain for all the reasons stated in EPA’s draft report. Given this uncertainty, EPA should use a more conservative approach. The consequence of a less conservative approach could be an inventory with methane emissions that under-represent actual conditions. When field verification programs are implemented to document actual emissions, the actual inventory could end up being larger than the baseline,

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[1] USEPA (1998), Compilation of Air Pollutant Emission Factors, Volume I – Stationary Point and Area Sources, AP-42, Fifth Edition, Municipal Solid Waste Landfills, Supplement E, November 1998, Table 2.4-3. Accessed at http://www.epa.gov/ttn/chief/ap42/ch02/index.html

making it more difficult for the country to achieve any forthcoming mandated greenhouse gas reduction requirements.

For example, IPCC offers a far different view of landfill gas collection efficiency than is indicated by EPA’s inventory results. Using a more conservative approach, the methane collection efficiency over all phases of landfill operation (the integrated collection efficiency) default value is as low as 20-35%, which is the range suggested by IPCC, due to the many uncertainties associated with the estimating methodology.[2]

Reviewer: Reid Miner, National Council for Air and Stream Improvement

Executive Summary

Comment: Page ES-14, line 1: It would be helpful to insert a parenthetical after “stocks in harvested wood pools” to clarify that both in-use and in-landfill stocks are included. We suggest adding, “(products in use and discarded products in landfills).”

Introduction

Comment: Page 1-8, line 2: Since the Fourth Assessment Report is now available and the GWPs have changed from the Third Assessment Report, it would seem appropriate to have a discussion of the 4thAR GWPs in addition to, or instead of, the discussion of the GWPs in the 3rdAR.

Trends

Comment: Page 2-14, line 8: It would be helpful to insert a parenthetical after “net accumulation of carbon stocks in harvested wood pools” to clarify that both in-use and in-landfill stocks are included. We suggest adding, “(products in use and discarded products in landfills).”

Energy

Comment: Page 3-29, line 6: Most of the biomass used for energy in the US is used in the forest products industry. Therefore, as a “Planned Improvement,” we would encourage EPA to undertake a review of information characterizing methane and nitrous oxide emissions from these operations. A summary of past data is available in the WRI/WBCSD GHG Protocol Calculation Tool report for pulp and paper mills available at www.ghgprotocol.org. Additional studies are now underway at NCASI and elsewhere and we are hopeful that the new data will be available in time for EPA's next inventory.

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[2] Intergovernmental Panel on Climate Change, “Guidelines for National Greenhouse Gas Inventories”, Volume 5: Waste, Chapter 3: Solid Waste Disposal, page 3.19.

Industrial Processes

Comment: Page 4-13, line 11: In the event EPA would like to cite a peer reviewed paper on this topic, we are including with our comments a copy of Miner and Upton, 2002, "Methods for estimating greenhouse gas emissions from lime kilns at kraft pulp mills," published in the journal "Energy" Vol. 27 (2002) 729-738.

Comment: Page 4-25, line 17: A refinement EPA may want to consider for future years is including estimates of the CO_2 sequestered in precipitated calcium carbonate used as filler in paper products. The manufacturing process for this material, performed at facilities adjacent to pulp and paper mills, involves the combination of CO_2 in stack gas from the mill with lime to produce a precipitated $CaCO_3$ product that is used to improve the optical properties of certain types of papers. The CO_2 released in producing the lime used by these operations is already included in EPA's inventory calculations, but EPA's calculations do not account for the consumption of stack-derived CO_2 in making the precipitated calcium carbonate. The CO_2 in the precipitated $CaCO_3$ remains sequestered in the paper, with very little of it returning to the atmosphere, even through the remaining parts of the lifecycle. The amounts are not large enough to impact national emissions estimates but could be addressed for purposes of completeness.

Land Use, Land Use Change, and Forestry

Comment: Page 7-12, line 2: It is not clear why "CO_2" is in bold font.

Comment: Page 7-12, line 5: Add the words "or is burned" after the phrase, "or even centuries before the lumber decays…"

Comment: Page 7-15, line 17: An explanation is needed somewhere explaining why it is appropriate to include CO_2 releases from fires in what is essentially unmanaged land in large parts of Alaska when these same lands are not included in the forest carbon stock change estimates. One would think that unmanaged land would not be included in either stock change estimates or fire loss calculations (based on my interpretation of IPCC guidelines). In any event, given the potential for confusion over this issue, an explanation would be helpful.

Comment: Page 7-20, line 33: The use of survey data from EPA, US Census Bureau and USDA to calibrate the HWP model represents an important improvement which should be noted here.

Comment: Page 7-21, line 14: Since IPCC reporting applies only to managed forest lands, and since much of Alaska is unmanaged and not included in the carbon stock change calculations, it is not clear why would it be included in estimates of fire-related emissions. It would be helpful to the reader if an explanation of this was included.

Waste

Comment: Page 8-2, lines 24 and 25: It would be helpful here to show how the various biomass-derived components of the waste stream are changing over time. It is of particular interest given that recovery rates for paper products have increased over this time, suggesting that the paper-related component of the waste stream may be not be contributing to the growth in landfilled organic material. Additional data would eliminate the need to speculate on this point.

Comment: Page 8-10, line 28: NCASI has recently completed field and laboratory studies to improve the estimates of methane emissions from pulp and paper mill wastewater treatment systems. The data are still being analyzed but several findings have emerged that may be useful to EPA at this point. First, it is clear that methane emissions from mechanical clarifiers and well mixed, high rate aerobic treatment systems are essentially zero. Second, the field data indicate that the emissions from non-aerated or partially-aerated basins are highly variable for reasons that are not yet clear. It appears that a one important factor is the extent to which solids have been allowed to accumulate in anaerobic zones, but accounting for this effect in an emissions estimate is not yet possible. We will provide the analyzed data to EPA when it becomes available. For the time being, we are providing comments on the draft inventory report and its Annexes that may be useful to EPA (see below).

Comment: Page 8-11, line 11: Portions of primary settling ponds could experience anaerobic conditions and NCASI's field data indicate that they are capable of generating methane. For now, EPA might consider categorizing these as "not well-managed" basins for purposes of the calculations (i.e. MCF of 0.3). Please note, however, that it is not yet possible to test this approach against the new field data generated by NCASI.

Comment: Page 8-11, line 15: Field data just developed by NCASI show that some aerated stabilization basins emit methane but the data have not been analyzed to a point where we can suggest a way to use the data to improve EPA's estimates. We are hopeful that we will be able provide the analyzed data to EPA in time for use in next year's inventory.

Comment: Page 8-11, lines 15 to 17: EPA's calculations assume that 25% of the treatment plants in the industry are non-aerated and are used as alternatives to aerated basins. This is incorrect. Almost all of these "non-aerated stabilization basins" are used for additional treatment of wastewater that has already passed through biological treatment systems, usually aerated stabilization basins. These post aeration basins, often called polishing ponds, are used for a number of purposes including (a) ensuring removal of slowly settling solids formed in aerated stabilization basins, and (b) allowing controlled release of treated wastewater in places where this is needed to protect water quality. Because these basins follow biological treatment, the waste strength coming to them is very low and this should be reflected in EPA's calculations. One option, using EPA’s existing numbers, would be to assume that these 25% of systems are all polishing ponds following aerated treatment systems. This would mean (assuming that EPA’s statistics are correct) that one out of three aerobic treatment systems is followed by a polishing pond. A 90% BOD removal across the aerated system could be assumed to calculate the BOD flowing into these polishing ponds. This would then be used to estimate methane releases from these ponds. We would add that, at this time, it is not possible to use NCASI’s new data to examine the accuracy of estimates derived in this manner.

Comment: Page 8-11, line 33: In AF&PA's 2004 Environmental Health and Safety Report, (a copy of which accompanies these comments) the industry average wastewater discharge rate for 2004 is shown as 11,654 gallons per short ton of production (approximately 48.5 cubic meters per metric ton), a significantly lower value than used by EPA (85 m3/ton). We suggest using the value reported by AF&PA.

Comment: Page 8-11, line 34: Using AF&PA data for final effluent flow (11654 gallons/short ton) and final effluent BOD load (2.8 pounds BOD/short ton), and assuming BOD removal efficiencies of 90 to 95%, the untreated wastewater BOD concentration assumed by EPA (0.4 gram BOD/liter) does not appear unreasonable.

Annex

Comment: Page A-98, Table A-70: Since most of the biomass burned for energy in the US is burned by the forest products industry, we would encourage EPA to use emission factors that have been derived from forest product industry combustion sources. The existing data are summarized in the WRI/WBCSD GHG Protocol Calculation Tools for Pulp and Paper Mills available at www.ghgprotocol.org. Additional data are being developed that will allow these factors to be refined. We are hopeful that the new data will be available in time to assist EPA with next year’s inventory.

Comment: Page A-245, line 14 and Table A-200: As we understand the calculations, these half lives are for the fiber (as it exits the forest) rather than the products themselves. Half lives for fiber used in paper are longer than the product half lives due to the high recovery and recycling rates for paper products. If our understanding of the calculations is correct, it would be helpful to add some text or perhaps a footnote explaining this nuance. This would help ensure that the values published here are not misapplied in other situations where people are trying to model the fate of carbon in individual products.

Comment: Page A-245, line 19: The calibration process described is an important improvement in the modeling. It should be mentioned in the "improvements" section in the main report.

Comment: Page A-245, line 22: If the assumptions regarding the use of dumps vs. landfills are the same here as in the "methane from MSW landfills" calculations, this should be noted. If the HWP calculations use a different set of assumptions, this should be noted and explained.

Comment: Page A-270, line3, Table A-217: It would be helpful if the table also showed the relative contributions of different solid waste components contributing to methane generation (e.g. paper and paperboard, food wastes, lawn clippings, wood, etc.). This information is helpful in trying to understand the links between the methane estimates and the HWP estimates developed elsewhere in the report.

Comment: Page A-271, line 4: To help understand the connection between these calculations and those for HWP in landfills, it would be helpful to have a short discussion of how this value for Lo compares with those used in the HWP landfill calculations.

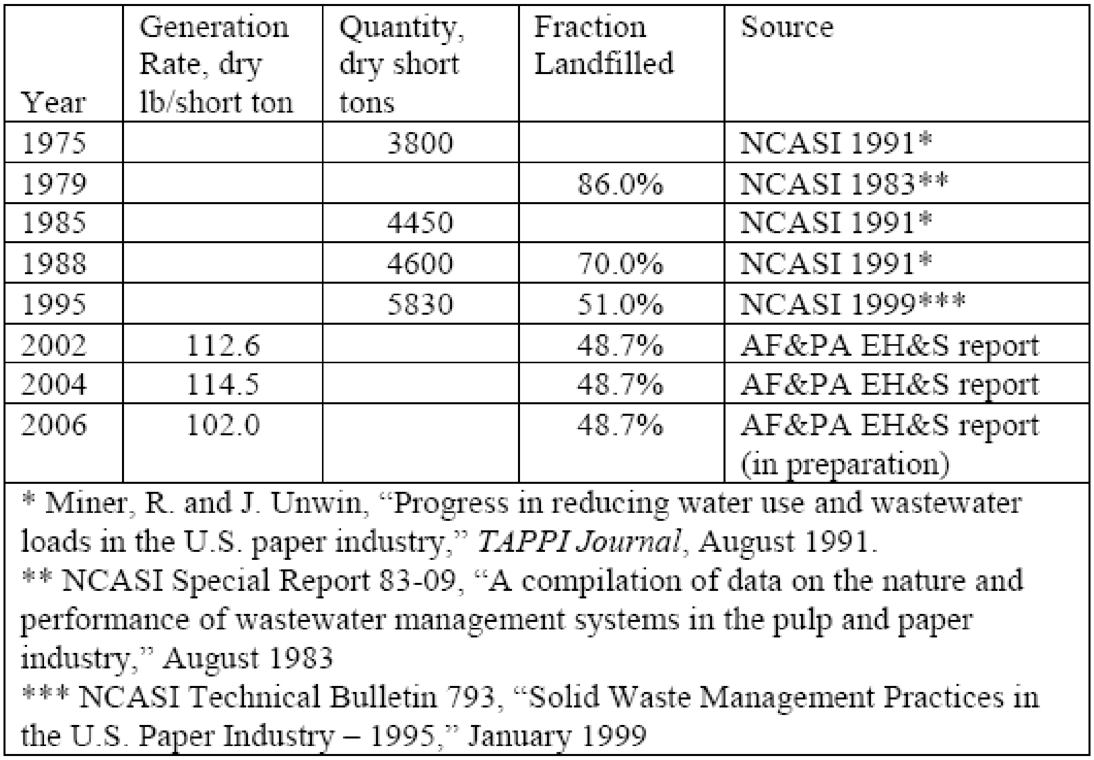
Comment: Page A-271, line 13: To help understand the connection between these calculations and those for HWP in landfills, it would be helpful to have a short discussion of how these values for k compare with those used in the HWP landfill calculations.

Comment: Page A-272, lines 11 to 13: Below we provide an alternative source of information on pulp and paper mill solid waste generation for EPA’s analysis. It is appropriate to limit the analysis to wastewater treatment plant (WWTP) residuals (sludges) since these represent the vast majority of degradable material entering pulp and paper mill landfills. With regards to deciding on the appropriate time series, it is important to consider that NCASI and others have documented that treatment residuals collected in primary treatment alone degrade in landfills very slowly or not at all, probably because of a lack of essential nutrients, particularly phosphorus and nitrogen, to support anaerobic biological activity. Only after 1970, with the widespread adoption of biological treatment and the practice of combining biological solids with primary solids, did landfilled wastewater treatment residuals have much potential to produce methane. Therefore, when estimating methane emissions from pulp and paper mill landfills, it is reasonable to include only wastewater treatment residuals landfilled since 1970.

Survey data relevant to landfilling of WWTP residuals are available as far back as 1979. Table 1, below, summarizes the available information.

Where data are available in the table, the quantity landfilled can be calculated as the product of the quantity of WWTP residuals generated and the landfilling rate. Where the quantity generated is not known, it can be estimated from the product of the generation rate and the total paper, paperboard, and market pulp production for the year (information that can be obtained from AF&PA, FAO or NCASI). For years in which the quantity generated was unknown or could not be estimated from the generation rate, the quantity can be estimated by interpolation between the most recent values before and after that year. Quantities before 1970 can be extrapolated from values in 1985 and 1975. Where the landfilling rate is unknown, it can also be estimated by interpolation. The landfilling rate in 1970 can be assumed to be 95%.

Table 1. Available information relevant to landfilling pulp and paper mill WWTP residuals



Year	Generation Rate, dry lb/short ton	Quantity, dry short tons	Fraction Landfilled	Source
1975		3800		NCASI 1991*
1979			86.0%	NCASI 1983**
1985		4450		NCASI 1991*
1988		4600	70.0%	NCASI 1991*
1995		5830	51.0%	NCASI 1999***
2002	112.6		48.7%	AF&PA EH&S report
2004	114.5		48.7%	AF&PA EH&S report
2006	102.0		48.7%	AF&PA EH&S report (in preparation)

* Miner, R. and J. Unwin, "Progress in reducing water use and wastewater loads in the U.S. paper industry," *TAPPI Journal*, August 1991.
** NCASI Special Report 83-09, "A compilation of data on the nature and performance of wastewater management systems in the pulp and paper industry," August 1983
*** NCASI Technical Bulletin 793, "Solid Waste Management Practices in the U.S. Paper Industry – 1995," January 1999

Comment: Page A-272, lines 17: NCASI has just completed field and laboratory studies intended to provide estimates for Lo and k that are better suited to pulp and paper mill landfills. The data are still being analyzed, but our initial examination of the data indicates that while EPA's values (Lo=99 m_3/Mg and k=0.06 yr-1) are within the range seen in NCASI's data, they are at the upper end of the range. The average Lo seen in NCASI studies is approximately 80 m_3/Mg while the average k is approximately 0.03 yr-1. We would suggest using these values. A report documenting the methods and data analysis is being prepared.

Comment: Page A-272, line 23: As noted above, there is little reason to extend the calculations for pulp and paper mill landfills to before 1970. In addition, due to their moisture content, most mill waste landfills are saturated from the time of placement. This was especially true in the years before modern dewatering devices were available. As a result of being saturated with water, oxygen is unlikely to be available, even in landfills (or dumps) operated many years ago. Therefore, we recommend using and MCF of 1.0 for the entire time series.

Comment: Page A-272, line 26: Due to confusion about "avoided emissions", we suggesting changing the "avoided emissions" terminology used here and in several places in the Annex to "methane destroyed in flaring systems and landfill gas-to-energy projects"

Comment: Page A-272, line 32: There are very few systems on pulp and paper landfills in the U.S. to collect and burn methane.

Comment: Page A-294, Table A-231: Since many of the GWPs in the Fourth Assessment Report are different, it would be good to include a discussion of the GWPs in the Fourth Assessment Report.

Reviewer: Hobie Perry, USDA Forest Service: Northern Research Station

Land Use, Land Use Change, and Forestry

Comment: The approach outlined on p. 7-5, line 24-30 relies quite heavily on NLCD. I am not a remote sensing scientist, but I work quite closely with them, and I am concerned about this reliance on NLCD, particularly for documenting land-use change. The product is not updated very frequently, and the definitions changed "confound[ing] any direct comparison between NLCD 2001 and the 1992" product" (source: MRLC website). I know the MRLC created a retrofit change product to address this need, but I have serious concerns about the timeliness of this product, particularly for use in an annual inventory. I would strongly urge the authors to consider other remote sensing alternatives for documenting land-use change.

Comment: There is a more accessible reference to that cited on 7-12, line 38. Perry, C.H., C. W. Woodall, G. C. Liknes and M. M. Schoeneberger. 2008. Filling the gap: improving estimates of working tree resources in agricultural landscapes. Agroforestry Systems. doi:10.1007/s10457-008-9125-6. At this point, the publication is in the journal's early release system. A volume and page number should be available shortly.

Reviewer: Bruce Parker, National Solid Wastes Management Association and John Skinner, Solid Waste Association of North America

Waste

Comment: Landfill Carbon Sequestration

We were pleased to note that the footnote on page 8-1 explains that landfills also store carbon because of the “incomplete degradation of organic materials such as wood products and yard trimmings as described in the Land Use, Land-Use Change, and Forestry chapter.” The effect of this process on overall U.S. GHG emissions is quite significant. In comparison to other sources and sinks in the draft U.S. GHG inventory, the annual increase in storage of carbon in landfills in 2005 offset 51 percent of landfill methane emissions and exceeded, in absolute magnitude, the emissions from 47 of the 54 source categories (U.S. EPA, 2007). To make more transparent to the public the actual emissions and sinks associated with landfills, we recommend that all of the listed values on carbon sequestration in landfills be incorporated into Chapter 8.1 Landfills so that a complete mass balance for landfills can be shown in Tables 8-3 and 8-4. Therefore these tables would contain the activities of MSW Landfills, Industrial Landfills, Recovered (with the sub-categories of Gas-to-Energy and Flares), Oxidized, and Carbon Sequestered. This follows the principles recommended by the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) protocol for GHG reporting that whoever has operational control of the facility or activity (in this case waste management) should account for the emissions and sinks of that activity. We also recommend that EPA review the attached papers by SCS Engineers[3] and ICF[4,5] (Attachments 1, 2, and 3) that examines carbon sequestration rates in 1) harvested wood products and 2) yard trimmings and food scraps, and the importance of sequestration in inventorying GHG emissions from landfills.

Additionally, having a complete characterization of GHG emissions and sinks for landfills is important because GHG inventories are organized according to a set of principles that groups emissions and sinks by physical process rather than economic sectors. As a result, one must compile data from various components or chapters of the draft inventory to develop a straightforward and comprehensive analysis of GHG for landfills or any other waste management sector. Emissions from the waste management sector are scattered throughout various chapters in the draft inventory. Given that both voluntary and regulatory efforts to address climate change are likely to focus on specific sectors, inventories provide an important foundation for developing mitigation strategies. Inventory compliers who adhere to the IPCC reporting guidelines, the structure of the draft inventory, cannot fix this organizational problem. Therefore, we recommend that to provide a complete picture of all human-related emissions and sinks within the waste management sector, landfill carbon storage calculations should be reported along with the emissions of methane. This is the same conclusion made by ICF in a recent white paper for Waste Management, Inc. (Attachment 3)

Comment: Number of Municipal Solid Waste Landfills

The document states that there were approximately 1,800 operational landfills existing in the U.S. based on a survey published by Biocycle magazine (page 8-2 line 6). NSWMA has surveyed states in the past and found that from year to year the number of landfills can change dramatically. In some cases, the number of landfills has varied by more than 200 (Attachment 4). Performing these surveys is very time consuming and costly, which is why Biocycle now performs their data collection every two years. Because this information along with landfill characteristics is very suspect, the actual number may be larger or smaller. EPA should attempt to collect its own data rather than relying on magazine data for the next update of the document. EPA's Office of Research and Development has prepared a list of landfills for its "Disaster Debris Management & Disposal Support Tool" that could be used as a starting point.

Comment: Landfill Gas Recovery Data

The landfill recovery data is based on data collected from vendors of flaring equipment, a database of landfill gas-to-energy projects complied by EPA's Landfill Methane Outreach Program (LMOP), and a database maintained by the Energy Information Administration for voluntary reporting of GHGs (page 8-4 lines 6 and 8). Based on a review of these databases, many of our members' operational and closed facilities that have gas collection and destruction

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[3] *Current MSW Industry Position and State-of-the-Practice on LFG Collection, Efficiency, Methane Oxidation, and Carbon Sequestration in Landfills*, SCS Engineers, 2007

[4] *Addressing Carbon Storage in Landfills in Greenhouse Gas Inventories*, ICF International, 2007

[5] *Landfill Carbon Storage and Greenhouse Gas Inventories*, ICF International, 2007

devices are not included. Therefore, the values presented underestimate the total gas collected and destroyed. We suggest that for this year's report, EPA include the following footnote: "Values presented underestimate the number of facilities that have collection and destruction equipment." For the next inventory, we suggest that EPA collect better data because relying on LMOP and vendor data does not provide an accurate or complete picture.

Comment: Landfill Data Uncertainty

Under this section, the report states that there is uncertainty about landfill gas collection efficiency, amount of oxidation in soil covers, and methane destruction equipment efficiency. Recent reports by SCS Engineers (Attachments 1 and 5) that reviewed existing literature from national and international sources found the following values:

- Gas Collection Efficiency:

    1. 50-85 percent (average 68%) for a landfill or portion of a landfill that is under daily cover with an active landfill gas collection system installed but does not have a RCRA Subtitle D equivalent liner;
    2. 85-99 percent (average 92%) for a landfill or portion of a landfill that contains intermediate or an engineered final soil cover with an active landfill gas collection system but does not have a RCRA Subtitle D equivalent liner; and
    3. 95-99 percent (average 97%) for landfills that have a RCRA Subtitle D equivalent liner with an active LFG collection system (i.e. typically constructed after 1991).

- Methane Oxidation:

    1. Daily Cover – 22.70 percent;
    2. Intermediate Cover – 32.80 percent;
    3. Final Cover – 35.63 percent, and
    4. Biocovers – 55.33 percent.

- Methane Destruction Efficiency:

    1. Flares – 99.96 percent;
    2. Engines – 98.34 percent; and
    3. Turbines – 99.97 percent.

We suggest that EPA review the new data and make the necessary changes to the GHG inventory report. Also, ongoing research by academicians and private companies should be incorporated into subsequent inventories such that more accurate and recent data are presented.

Reviewer: Cynthia Finley, National Association of Clean Water Agencies

Wastewater Treatment

Comment: Our analysis indicates that the total nitrogen load to wastewater treatment plants is systematically overestimated in the Draft Inventory, resulting in an overestimation of N_2O emissions from wastewater treatment. The Draft Inventory estimates nitrogen discharges to wastewater based on reported annual protein consumption, which is the methodology used in the Intergovernmental Panel on Climate Change (IPCC) protocol document[6] (IPCC Guidelines). Expressed as nitrogen (N), the estimate for domestic sources is developed as follows:

42.1 kg protein/person/year x 0.16 kg N/kg protein x 1.4 Factor for Non-Consumption
= 9.43 kg N/person/year

This is further increased by a factor of 1.25 to account for industrial discharges, resulting in a total value of 1.25 x 9.43 or 11.79 kg N/person/year.

This value differs significantly from per capita wastewater discharge rates presented in standard references such as Metcalf & Eddy[7]. Metcalf & Eddy report per capita nitrogen discharge rates to wastewater of 0.015 kg N/person/day. Converting this to a yearly value gives:

0.015 kg N/person/day x 365 days/year = 5.48 kg N/person/year

This is less than half the value used in the Draft Inventory calculation. The values presented in standard industry references such as Metcalf & Eddy are supported by a wealth of data and have been widely confirmed in U.S. practice. We recommend that the IPCC protocol be replaced by a nitrogen discharge rate based on data collected from wastewater treatment plants in the U.S. This type of data, which was used in Metcalf & Eddy, would represent all domestic sources of nitrogen, including meal production and consumption, the use of other nitrogen containing compounds, and both residential and commercial sources.

To support this request to change the nitrogen discharge rate used in the Inventory, NACWA collected data from wastewater utilities that have measured per-capita nitrogen loadings for their communities. The data were found in plant records or in reports prepared by consultants. As shown in Table 1, the data represent 48 wastewater treatment facilities throughout the U.S., with a total service population of over 17 million people. The smallest service population for a wastewater treatment facility included in the data set is 2,000 people, and the largest population is over 2 million people. The collected data therefore provide a reasonable representation of the wastewater treatment nitrogen loading for different sizes of communities and treatment facilities in the U.S. The period of data collection varies, but in many cases the per capita nitrogen loading is based on many years worth of influent loading data. The names, cities, and other information about the treatment facilities are not included in this table, but this information can be provided by NACWA if needed.

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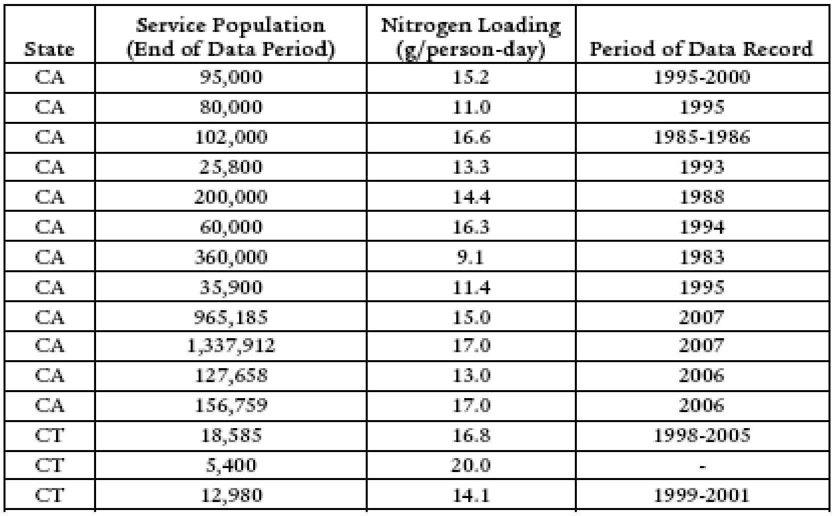
[6] IPCC, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Prepared by the National 18 Greenhouse Gas Inventories Programme,Eggleston H.S., Buenida L., Miwa K., Ngara T., and Tanabe K. (eds.) 19 Published: IGES, Japan, 2006.

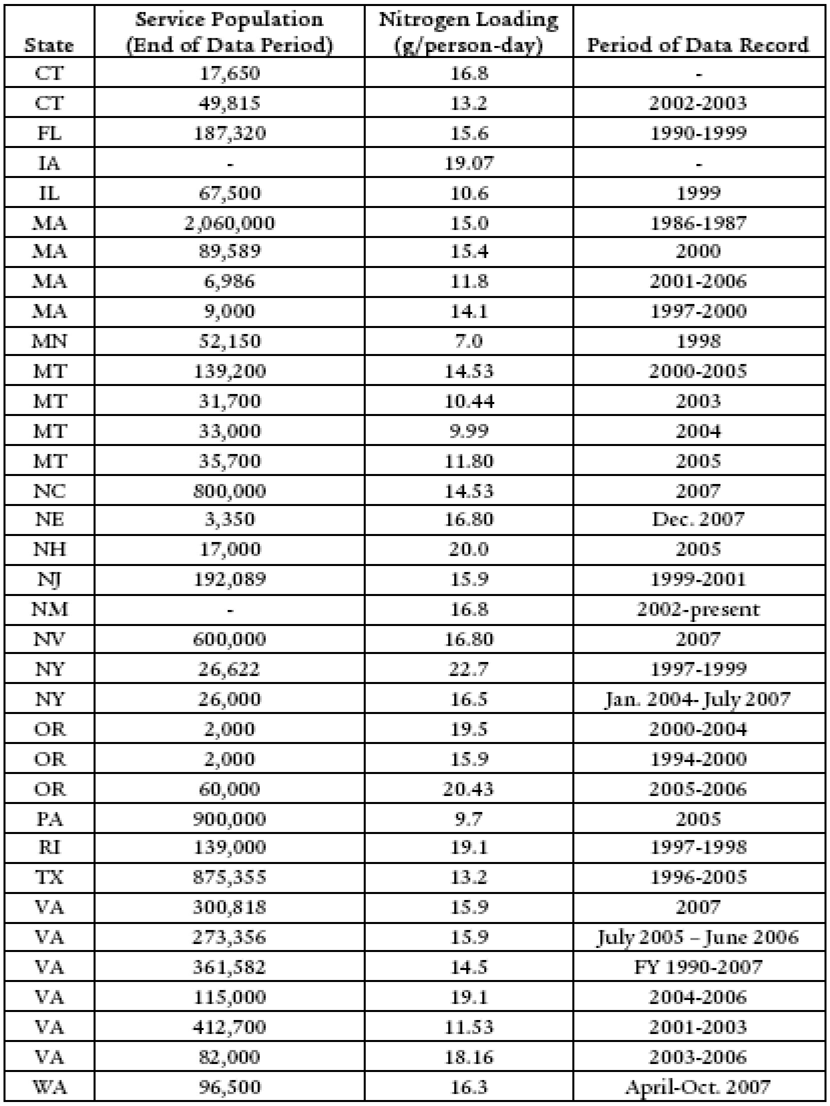
[7] Tchobanoglous, G., F.L. Burton, and H.D. Stensel, *Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy, Inc.* 4th Edition, McGraw-Hill, New York, 2003.

The results documented an average per-capita nitrogen loading of 15.09 g/person/day, or 5.51 kg N/person/year, which is consistent with the 5.48 kg N/person/year reported by Metcalf & Eddy. These data include all domestic and commercial sources for these service communities. These data further substantiate NACWA's assertion that industry standard influent total nitrogen data should be used in the Inventory, rather than a calculation procedure that does not compare accurately to known and well-documented values. The uncertainty analysis could then consider the possibility of industrial discharges not incorporated into the standard per capita values, multiplying by the 1.25 factor currently used in the Draft Inventory.

Table 1. Nitrogen loading data from wastewater treatment facilities in the U.S.



State	Service Population (End of Data Period)	Nitrogen Loading (g/person-day)	Period of Data Record
CA	95,000	15.2	1995-2000
CA	80,000	11.0	1995
CA	102,000	16.6	1985-1986
CA	25,800	13.3	1993
CA	200,000	14.4	1988
CA	60,000	16.3	1994
CA	360,000	9.1	1983
CA	35,900	11.4	1995
CA	965,185	15.0	2007
CA	1,337,912	17.0	2007
CA	127,658	13.0	2006
CA	156,759	17.0	2006
CT	18,585	16.8	1998-2005
CT	5,400	20.0	-
CT	12,980	14.1	1999-2001



State	Service Population (End of Data Period)	Nitrogen Loading (g/person-day)	Period of Data Record
CT	17,650	16.8	-
CT	49,815	13.2	2002-2003
FL	187,320	15.6	1990-1999
IA	-	19.07	-
IL	67,500	10.6	1999
MA	2,060,000	15.0	1986-1987
MA	89,589	15.4	2000
MA	6,986	11.8	2001-2006
MA	9,000	14.1	1997-2000
MN	52,150	7.0	1998
MT	139,200	14.53	2000-2005
MT	31,700	10.44	2003
MT	33,000	9.99	2004
MT	35,700	11.80	2005
NC	800,000	14.53	2007
NE	3,350	16.80	Dec. 2007
NH	17,000	20.0	2005
NJ	192,089	15.9	1999-2001
NM	-	16.8	2002-present
NV	600,000	16.80	2007
NY	26,622	22.7	1997-1999
NY	26,000	16.5	Jan. 2004- July 2007
OR	2,000	19.5	2000-2004
OR	2,000	15.9	1994-2000
OR	60,000	20.43	2005-2006
PA	900,000	9.7	2005
RI	139,000	19.1	1997-1998
TX	875,355	13.2	1996-2005
VA	300,818	15.9	2007
VA	273,356	15.9	July 2005 – June 2006
VA	361,582	14.5	FY 1990-2007
VA	115,000	19.1	2004-2006
VA	412,700	11.53	2001-2003
VA	82,000	18.16	2003-2006
WA	96,500	16.3	April-Oct. 2007

Comment: The Draft Inventory utilizes default IPCC emission factors to calculate N_2O emission rates from wastewater treatment, such as the value of 0.005 kg N_2O N/kg sewage N produced. These emission factors are very uncertain, though, as explained in the IPCC Guidelines. More work is needed to refine the emission factors and determine a more accurate N_2O emission estimate for wastewater treatment.

Comment: We are pleased to see that the procedure for calculating CH_4 emissions from centrally treated wastewater has been modified to account for the BOD removed during primary treatment. However, the maximum CH_4 producing capacity for domestic wastewater, termed the Bo value, of 0.6 kg CH_4/kg BOD still assumes that all organic matter in wastewater treated anaerobically is converted to CH_4, whether it is biodegradable or not. This Bo value is then multiplied by a methane correction factor (MCF) which quantifies how much of the influent organic matter is actually converted to CH_4. The MCF is 0.5 for septic systems and 0.8 for anaerobic systems. We believe that the maximum MCF should be 2/3 or 0.67, since several well-recognized and commonly accepted references (e.g. Metcalf & Eddy and Grady, Daigger, and

Lim[8]) indicate that no more than about two-thirds of the organic matter in domestic wastewater is biodegradable. The MCF accounts for the portion of the organic matter that is stabilized anaerobically (versus aerobically) and also for the portion that is incorporated into sludge. The fact that all wastewater treatment facilities produce sludge reinforces the fact that an MCF of 0.8 is overly conservative. Thus, it appears that the maximum CH_4 producing potential was coupled with the maximum potential conversion to CH_4, resulting not in a “mid-range” estimate but rather a “worst case” estimate. This methodology therefore appears to result in an overestimation of CH_4 emissions from domestic wastewater treatment.

Comment: The Draft Inventory separates central wastewater treatment systems into two categories: aerobic and anaerobic. No direct CH_4 emissions are assumed for the aerobic systems, but an MCF of 0.8 is assumed for the anaerobic systems. As explained in Comment 3 above, we suggest that the MCF should be no more than 0.67 if the system is fully anaerobic. However, exclusive anaerobic treatment of domestic wastewater is not practiced in the U.S. Instead, the general practice is to use facultative lagoons which incorporate a combination of aerobic and anaerobic processes or natural treatment systems such as wetlands that use largely aerobic treatment mechanisms (see Metcalf & Eddy). Given the fact that these systems incorporate both aerobic and anaerobic treatment mechanisms, we suggest that a MCF of less than 0.67 (our recommended maximum value for anaerobic systems from Comment 3) is appropriate for these systems. In the Planned Improvements Discussion section of the Draft Inventory, EPA indicates their intention to investigate this further and potentially “differentiate between anaerobic systems to allow for the use of different MCFs for different types of anaerobic treatment systems.” We support this planned improvement.

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[8] Grady, C. P. L., Jr., G. T. Daigger, and H. C. Lim, *Biological Wastewater Treatment*, 2nd Edition, Marcel Dekker, NY, 1999.