

Technical Note on the 1990-2009 Inventory Estimates for Natural Gas Systems

- According to the latest inventory, CH₄ emissions from natural gas systems are estimated to be 221.2 MMTCO_{2e} in 2009. Although the primary basis for CH₄ emissions estimates in the Inventory remains a detailed 1996 study by the Gas Research Institute and EPA (1996 GRI/EPA), significant improvements were made to the emissions estimates in the current inventory, based in part on the large body of work carried out in developing subpart W (Petroleum and Natural Gas Systems) under the GHG Reporting Program. [Please see the Technical Support Document for subpart W at http://www.epa.gov/climatechange/emissions/downloads10/Subpart-W_TSD.pdf as well as additional support materials contained in Docket ID No. EPA-HQ-OAR-2009-0923.]
- The net effect of these changes is a 120% increase from the 2008 emissions estimate. Vented, fugitive and flared emissions from petroleum and natural gas systems are now the largest source of CH₄ emissions in the United States, replacing enteric fermentation.
- The large increase in emissions was primarily due to methodological improvements to three existing sources and the addition of two new sources.
- The three existing sources contributing to the large increase in emissions were gas well liquids unloading, condensate storage tanks and centrifugal compressors.
 - The largest increase in emissions was due to the revised emission factor for gas well cleanups (also referred to as gas well liquids unloading). EPA used well production and well property sample data on well depth, shut-in pressure, and production rates in an engineering equation to re-estimate the average unloading emissions by region for this source (HPDI 2009). This improved data and methodological change increased emissions by more than 22 times while decreasing the substantial uncertainty associated with the previous emission factor that was derived from the EPA/GRI 1996 study. Emissions from liquids unloading in 2009 are estimated to be nearly 96 MMTCO_{2e}.
 - For condensate storage tanks, EPA used the same E&P Tank simulation data for hydrocarbon liquids above 45°API flashing emission in tanks as used in previous Inventories to estimate emissions. However, the analysis coupled these flashing emissions simulations with a large sample of condensate production gravities from the HPDI database to improve the factor to account for the average national distribution of condensate gravities. This is different from previous inventories in which a simple average of simulation results for each liquid gravity was used. Additionally, a sample of data from a 2009 Texas Environment Research Consortium (TERC) study was used to account for emissions from separator dump valve malfunctions in the regions represented by the study.
 - For centrifugal compressor seals, EPA separated the centrifugal compressors emission source in the natural gas processing, transmission, and underground storage segments into two sources – centrifugal compressors equipped with wet seals and those with dry seals. EPA used data analysis on centrifugal compressor seal oil degassing vent rates (World Gas Conference 2009) to establish an emission factor for centrifugal compressor wet seal degassing and Natural Gas STAR’s Lessons Learned (EPA 2006) document to develop an emission factor for dry seal

emissions. The seal oil degassing vent (found with compressors using wet seals) was previously unaccounted for in the Inventory.

- In addition, EPA incorporated two new sources not included in previous EPA inventories – unconventional gas well completions and unconventional gas well workovers (re-completions). EPA used publically available data (EPA 2004 and 2007) to estimate new emission factors for hydraulic fracture flowback during completions and re-completions of shale and coal bed formations. Activity data for these activities was collected from multiple state websites. This improvement resulted in an increase in emissions of nearly 28 MMTCO₂e. Tight sand wells were not accounted for in the data sources used by the U.S. Inventory, however new information indicates that incorporating tight sand wells may substantially increase this estimate of unconventional well completions and workovers. EPA is investigating data sources to appropriately account for tight sands formations in the next Inventory cycle. Additionally, data on the Marcellus shale play is not tracked as unconventional in the current U.S. Inventory; in the future EPA will be incorporating data now available through state websites on this source of unconventional gas well completions and workovers.
- During the public review of EPA’s draft inventory, there was greater public interest in the natural gas systems inventory than in years past. Several commenters said that the inventory (1) does not fully capture industry practices to reduce emissions, particularly beyond what is reported to the Natural Gas STAR Program, (2) does not rely on data that are sufficiently representative at the national level, and (3) does not transparently present the methods, assumptions and sources of data in order to fully assess the accuracy of the emissions results.
- While EPA recognizes that further work is needed to improve the methodological approach and transparency of the new data, the inventory estimates provided in the draft were developed using the best available data, consistent with international guidelines. The EPA always welcomes additional data submissions to ensure that the national inventory fully reflects the latest activities in the industry.
- EPA acknowledges these data constraints in the written description of the need for future improvements. For example, there are instances where company application of voluntary control technologies or practices are not reported or accounted for if they are not reported to the EPA’s Gas STAR Program. EPA also recognizes that these reductions are also a source of uncertainty that is not fully analyzed in the Inventory. In the next Inventory cycle, EPA will investigate the potential for other voluntary emissions reductions – in particular from gas well cleanups – to be incorporated and make appropriate revisions to more accurately account for emissions from natural gas systems.
- EPA also recognizes the importance of providing transparency and continually endeavors to improve clarity in the Inventory documentation. The Agency is also making the underlying background documents available to the public to improve the transparency of the emissions calculations.
- EPA is always striving to improve the inventory and would welcome additional comments and data to support these efforts.

References

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