

Report on carbon tetrachloride budget discrepancies Decision XXVII/7

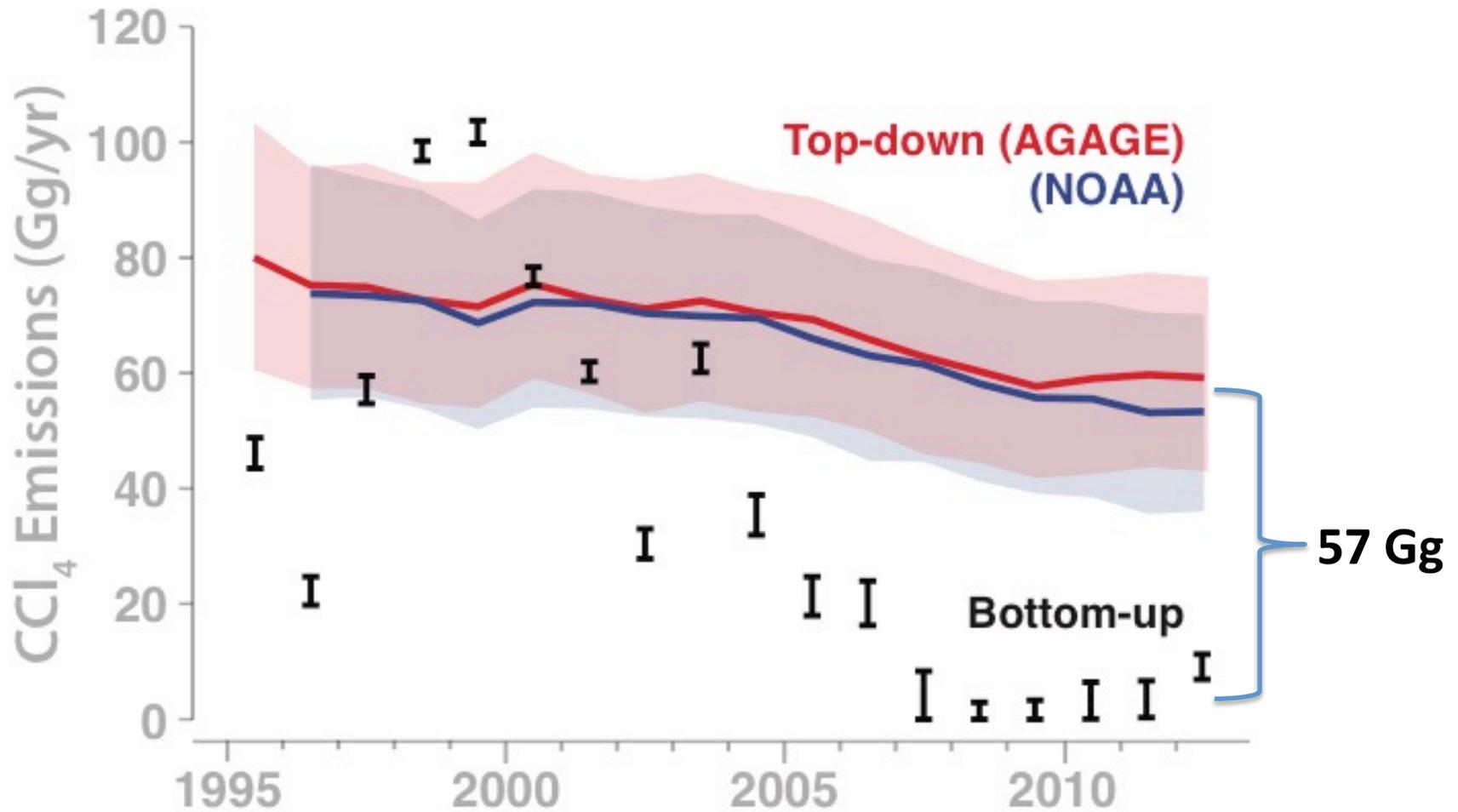
Paul A. Newman, SAP co-chair

Helen Tope, MCTOC co-chair

SAP and TEAP co-chairs



WMO/UNEP assessments have exposed a significant discrepancy between bottom-up and top down emissions of 57 Gg yr⁻¹



SPARC/WCRP has published a report on the Carbon Tetrachloride discrepancy

SPARC Report on the Mystery of Carbon Tetrachloride

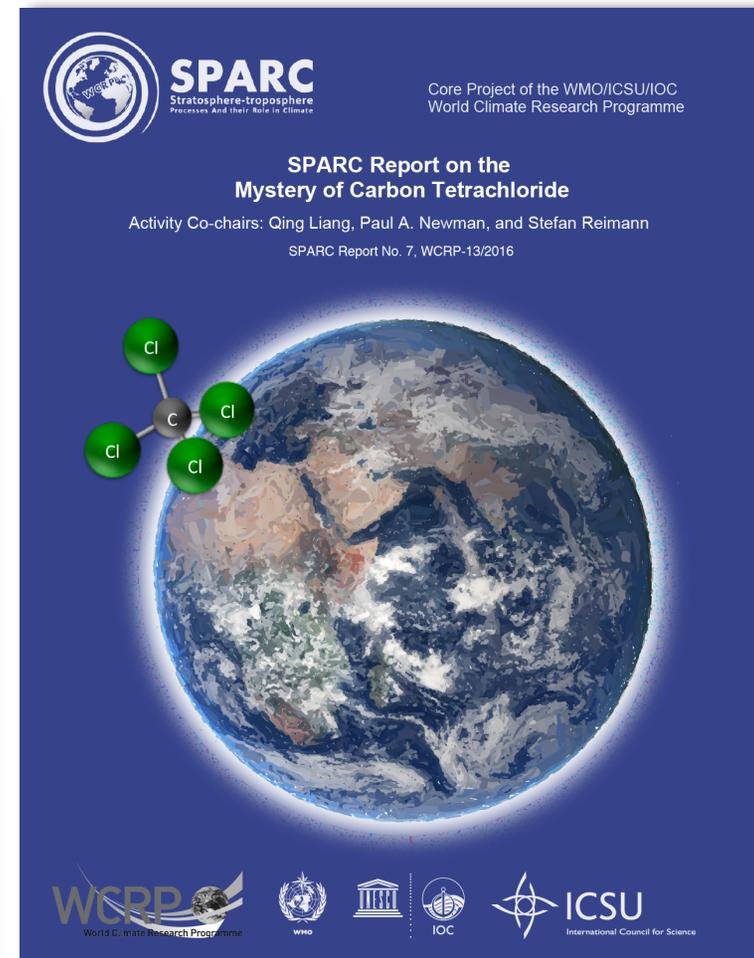
Activity Co-chairs: Qing Liang, Stefan Reimann, and Paul A. Newman

40+ scientists and industrial experts world-wide

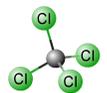
This document describes the key findings of the “Solving the Mystery of Carbon Tetrachloride” workshop that was held in Dübendorf, Switzerland, from 4-6 October 2015.

Participants from 16 different countries. Reviewed by 9 independent referees.

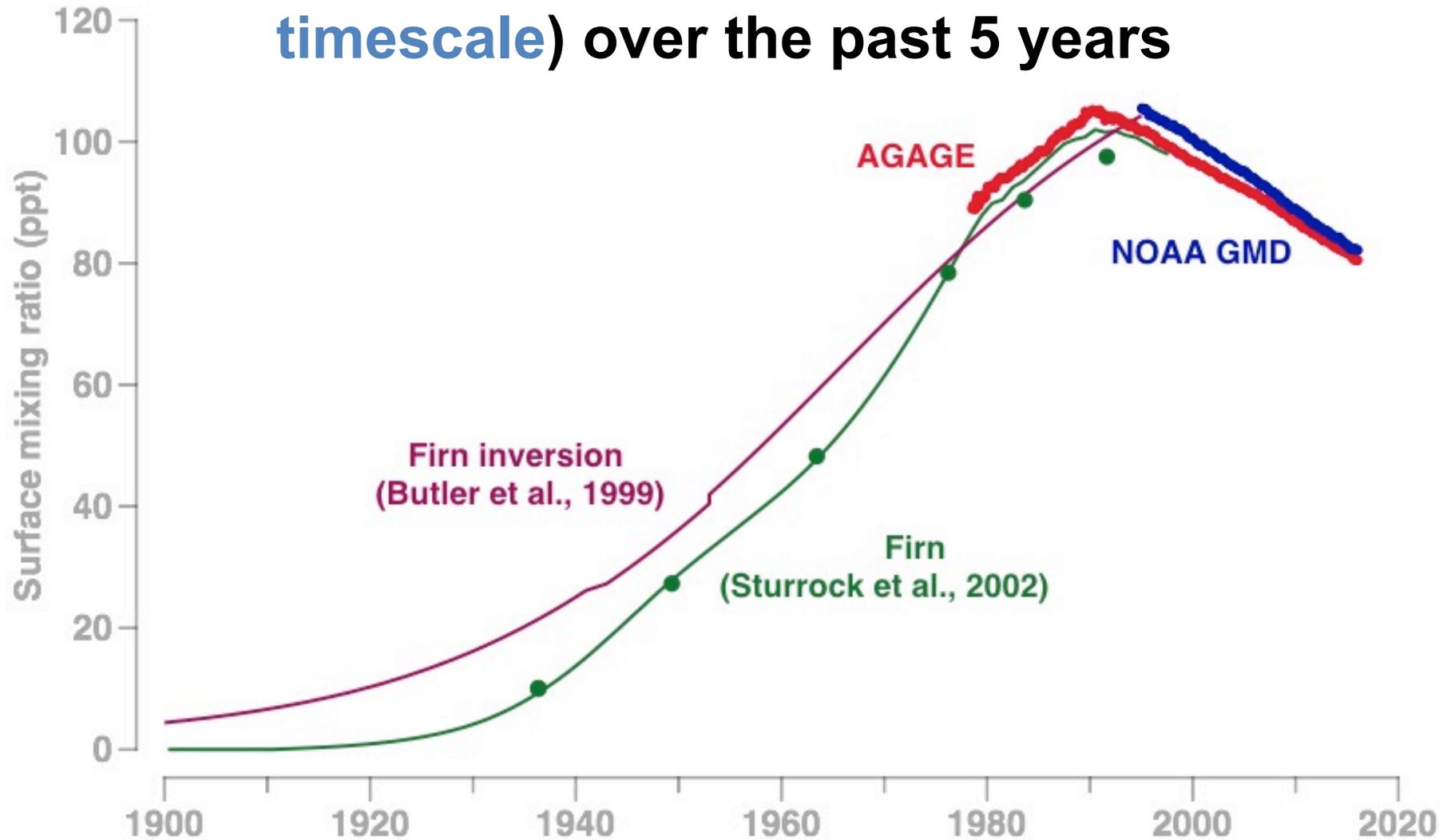
<http://www.sparc-climate.org/publications/sparc-reports/sparc-report-no7/>



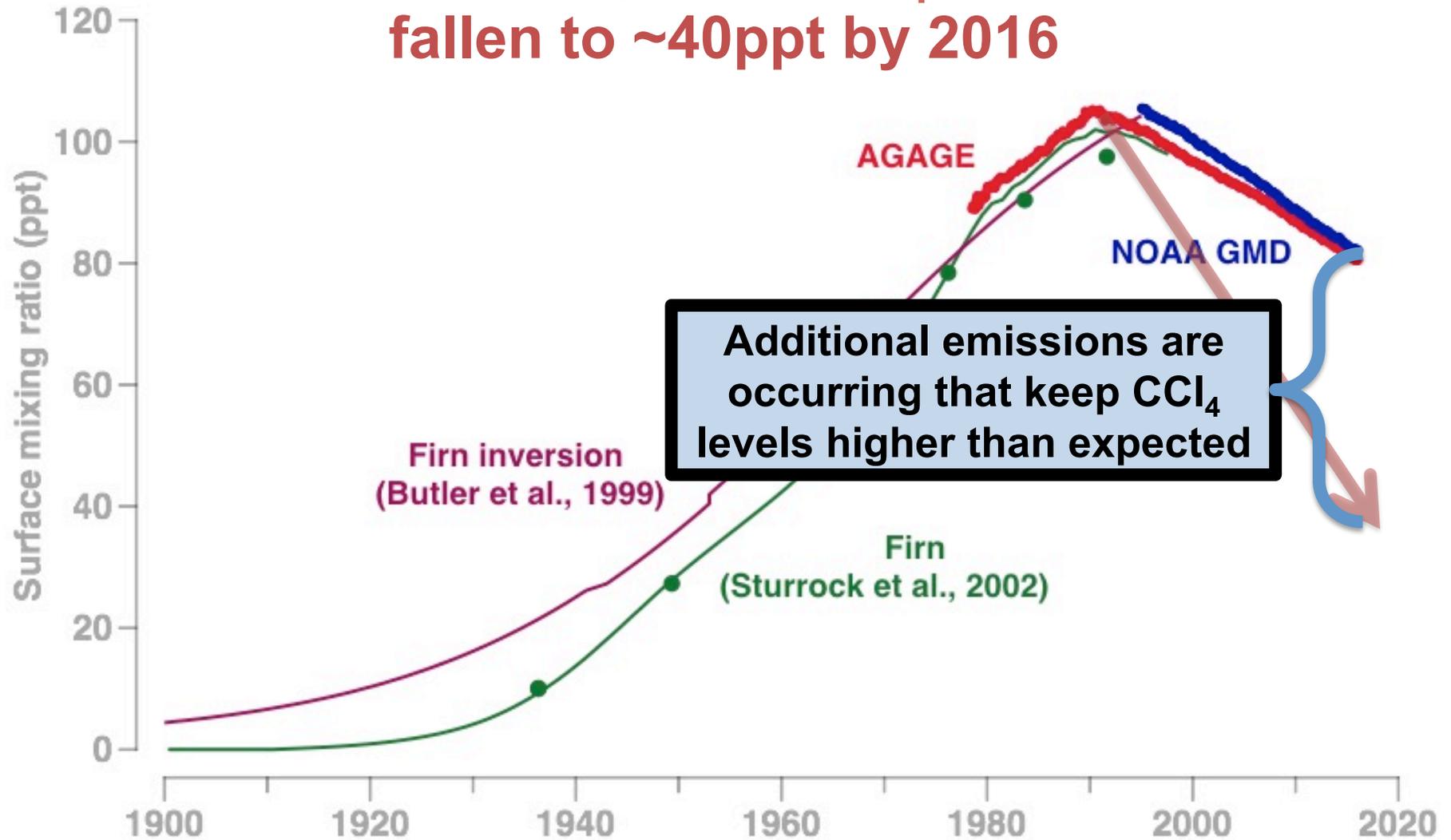
Stratosphere-Troposphere Processes And their Role in Climate (SPARC) project. SPARC is a core project of the World Climate Research Programme (WCRP).



CCl₄ levels peaked in the early 1990s and have declined at a 1.2-1.3% yr⁻¹ (~80 year timescale) over the past 5 years



If emissions had ceased in 1990, and the lifetime was 26 years, CCl_4 would have fallen to ~40ppt by 2016



Where are the CCl₄ emissions coming from? D. Legacy Emissions

D. Legacy

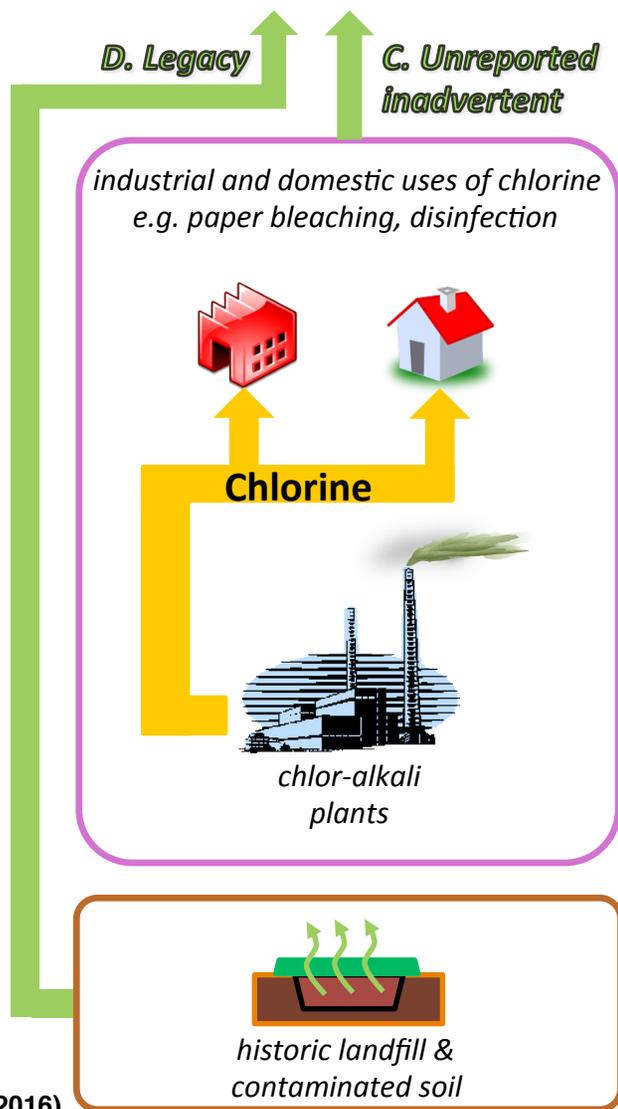
CTC was originally used as a fire extinguishing agent and as dry cleaning solvent



historic landfill & contaminated soil

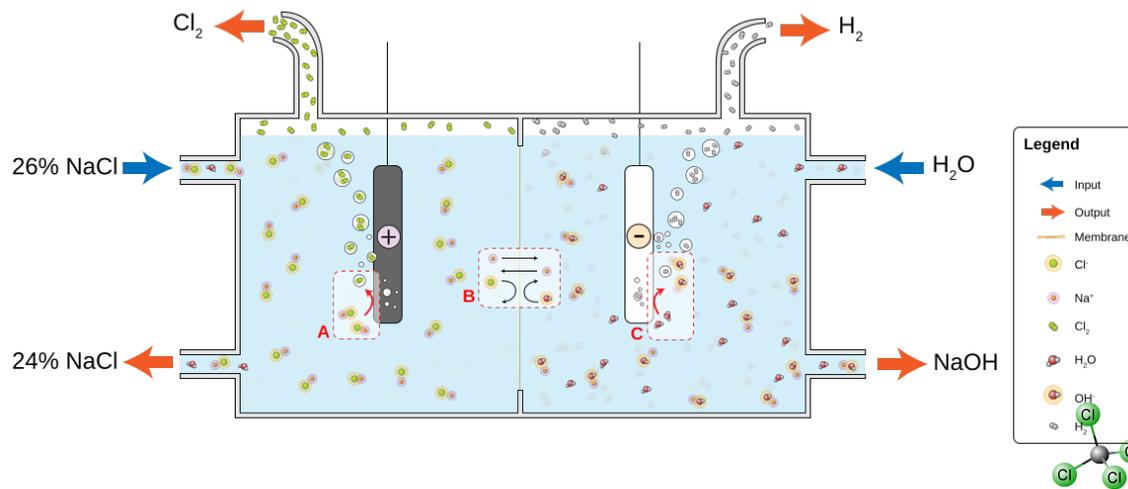


Where are the CCl₄ emissions coming from? C. Unreported inadvertent

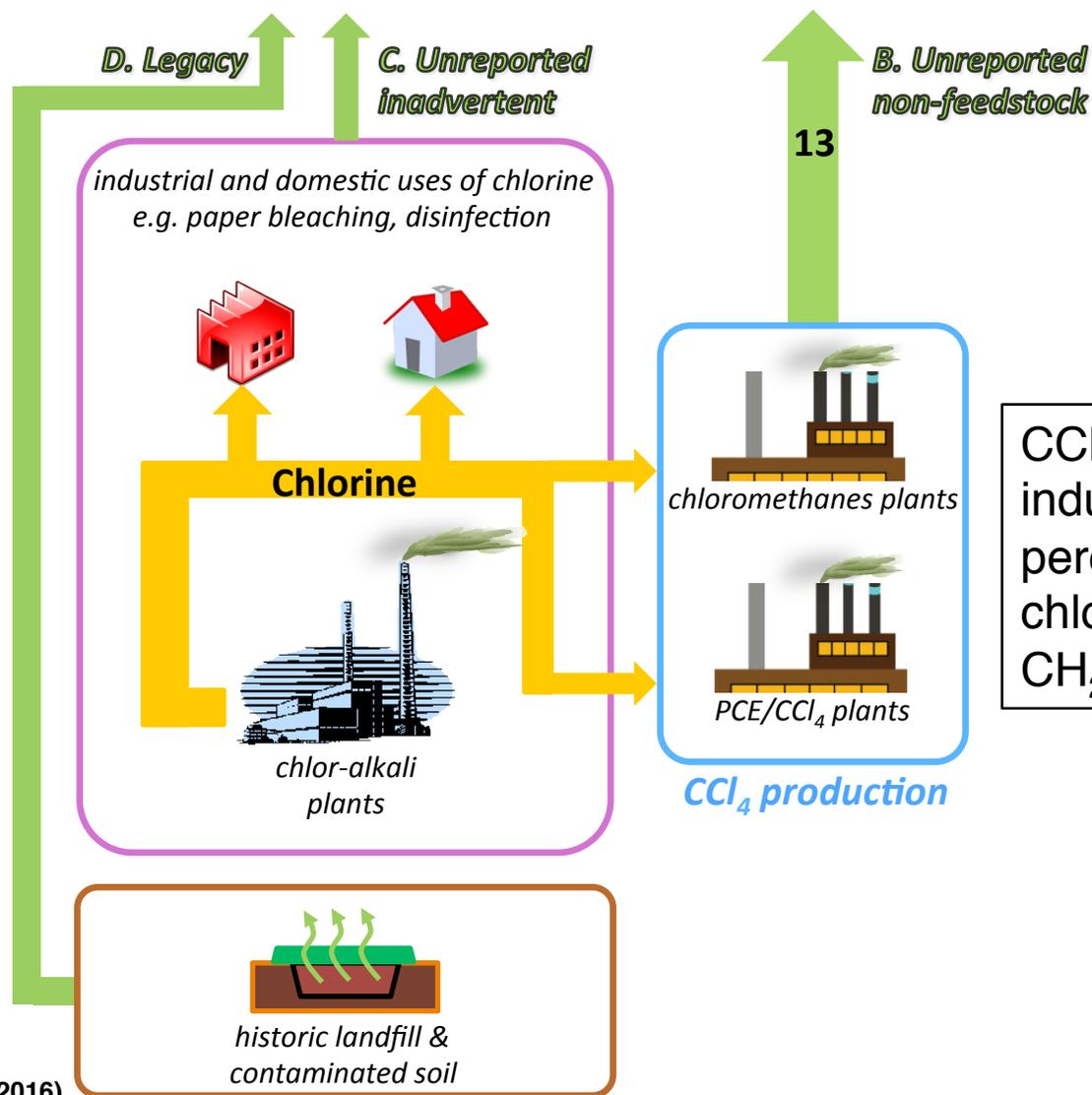


Unreported inadvertent emissions of CCl₄ into the atmosphere can also occur during the production of Cl₂ in chlor-alkali plants, and industrial and domestic use of chlorine (e.g. paper bleaching, disinfection)

Mixing Cl₂ with organics leads to some CCl₄ production



Where are the CCl_4 emissions coming from? B. Unreported non-feedstock

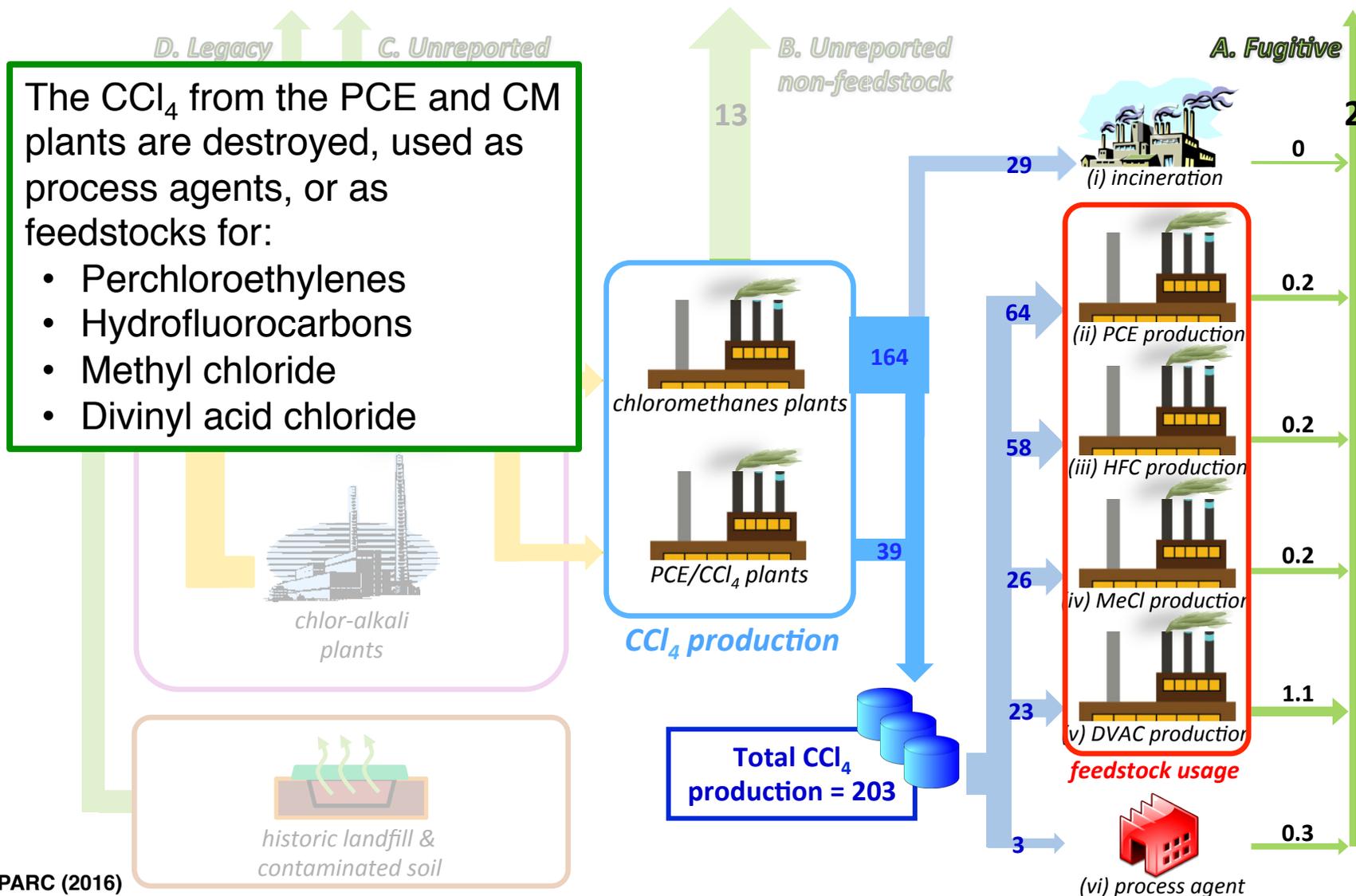


CCl_4 is a co-product of the industrial production of perchloroethylene (PCE) and chloromethanes, including CH_2Cl_2 and CHCl_3 .

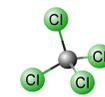
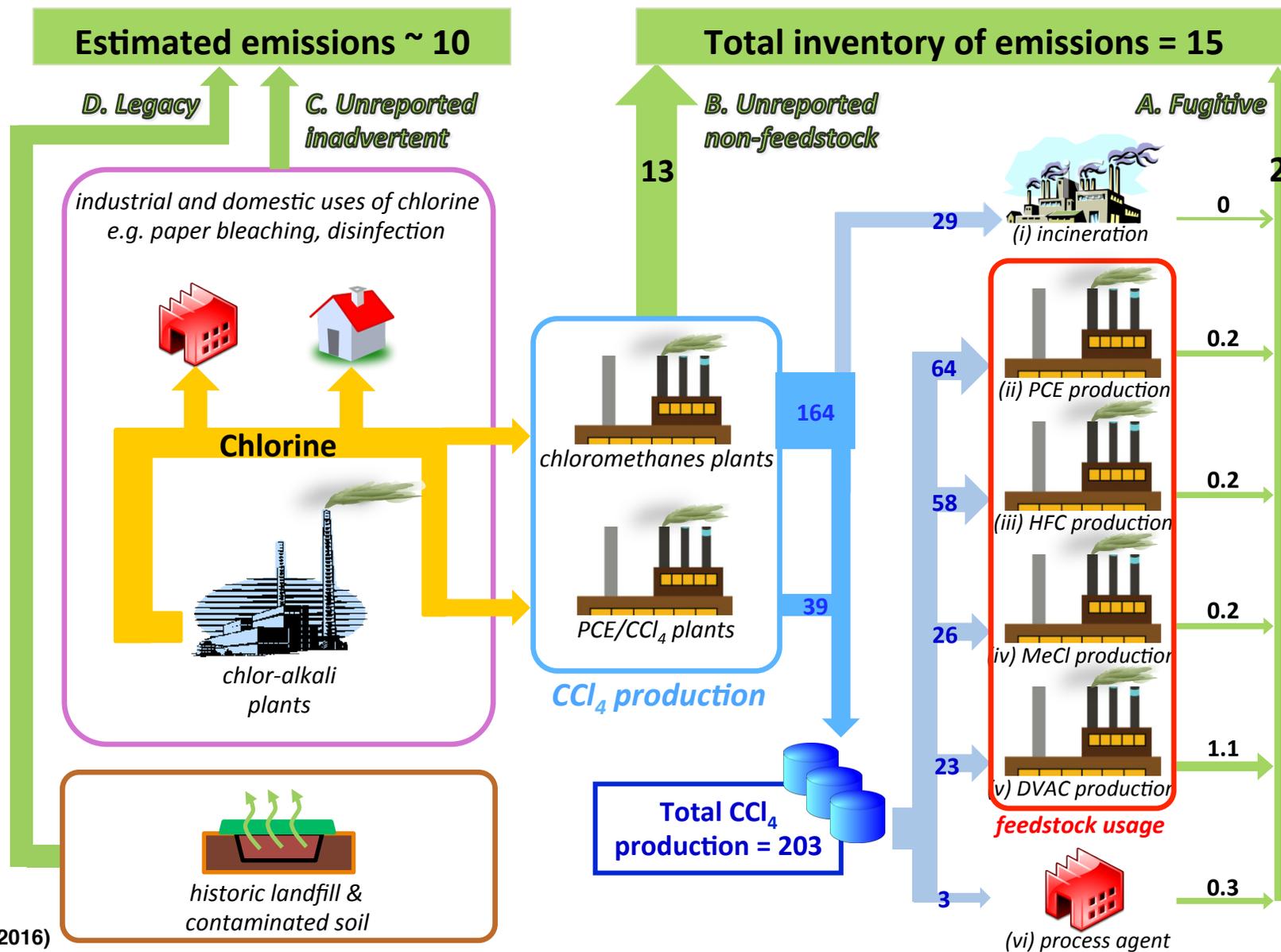


Where are the CCl₄ emissions coming from?

A. Fugitive (accounted for under Article 7)



Four emissions pathways have been identified



Four emissions pathways have been identified

Estimated emissions ~ 10

Total inventory of emissions = 15

D. Legacy

C. Unreported inadvertent

B. Unreported non-feedstock

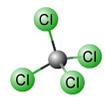
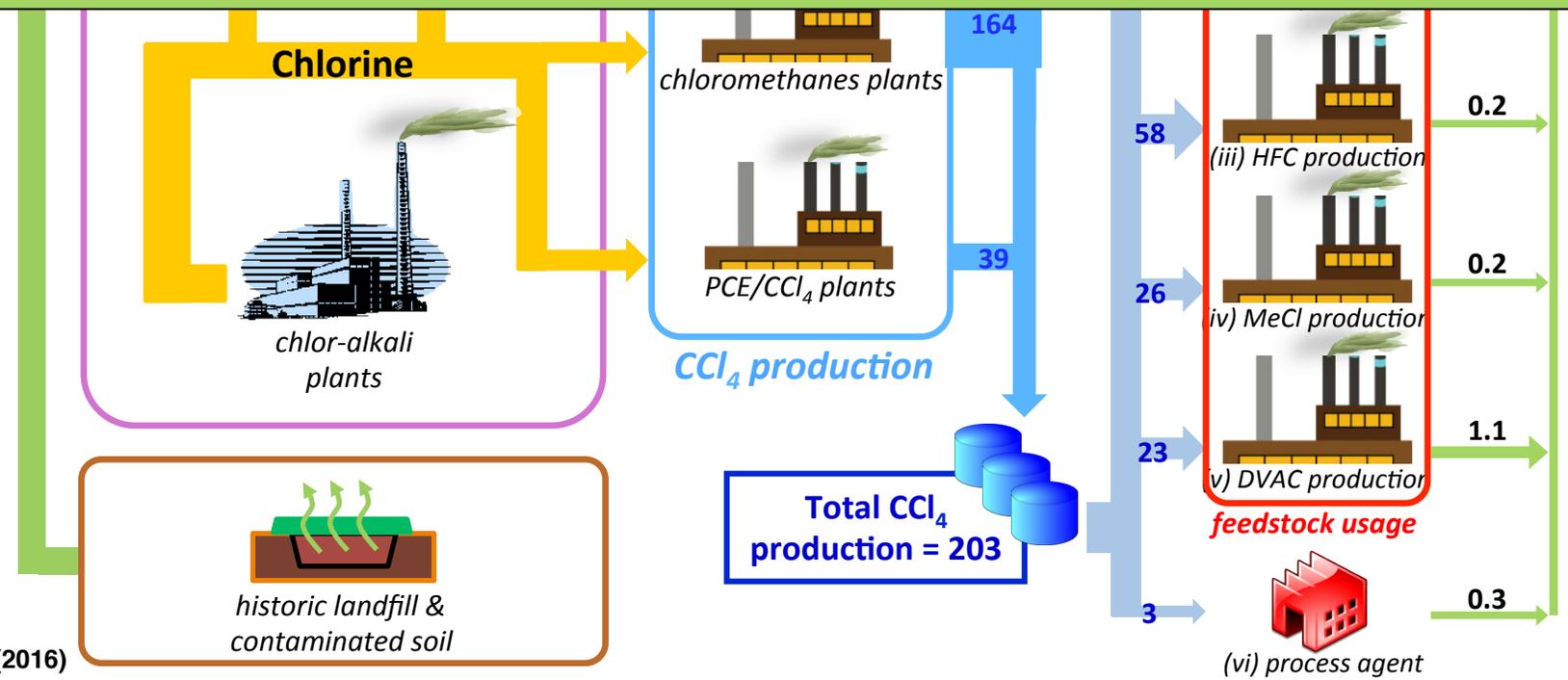
A. Fugitive

industrial and domestic uses of chlorine

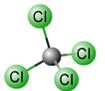
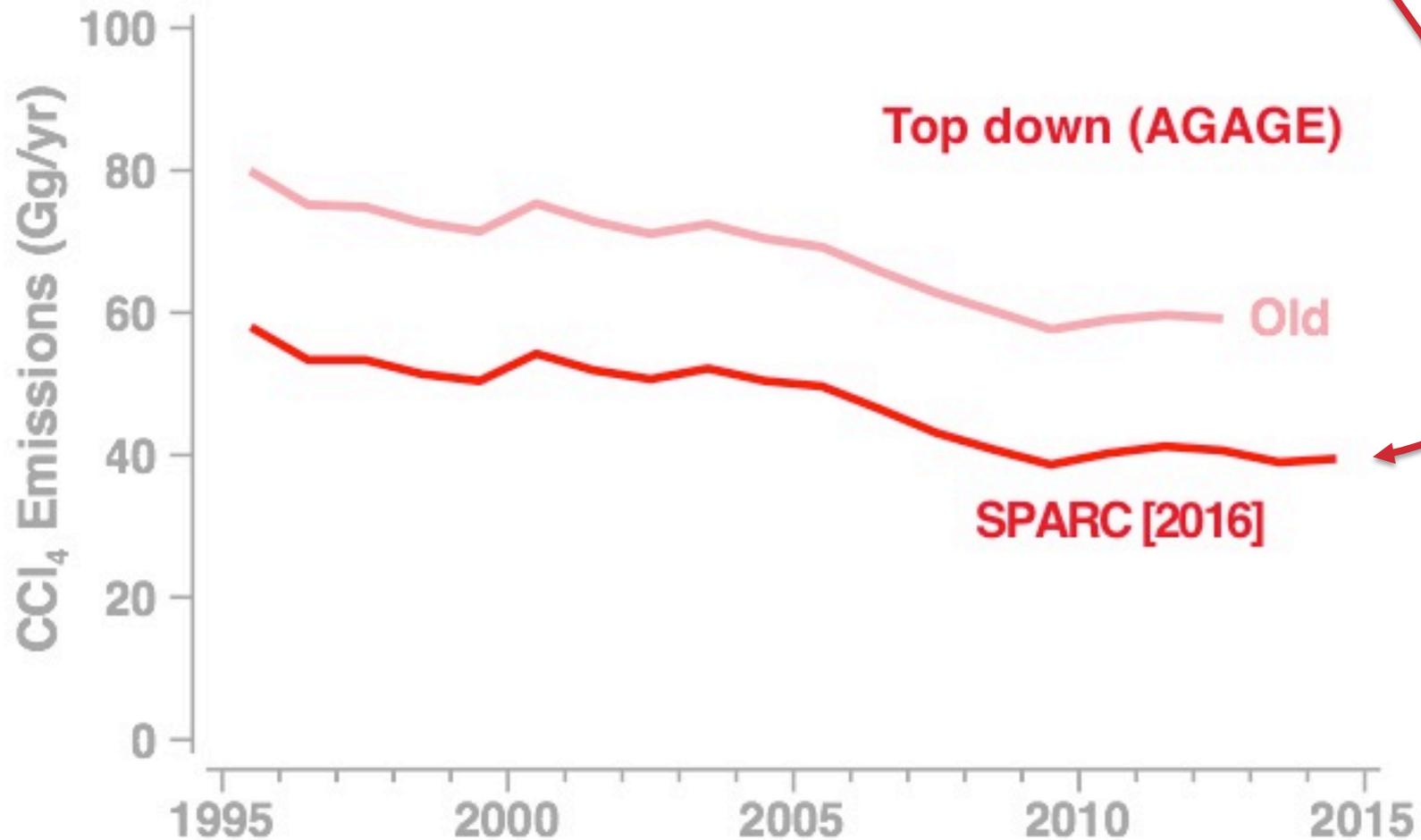
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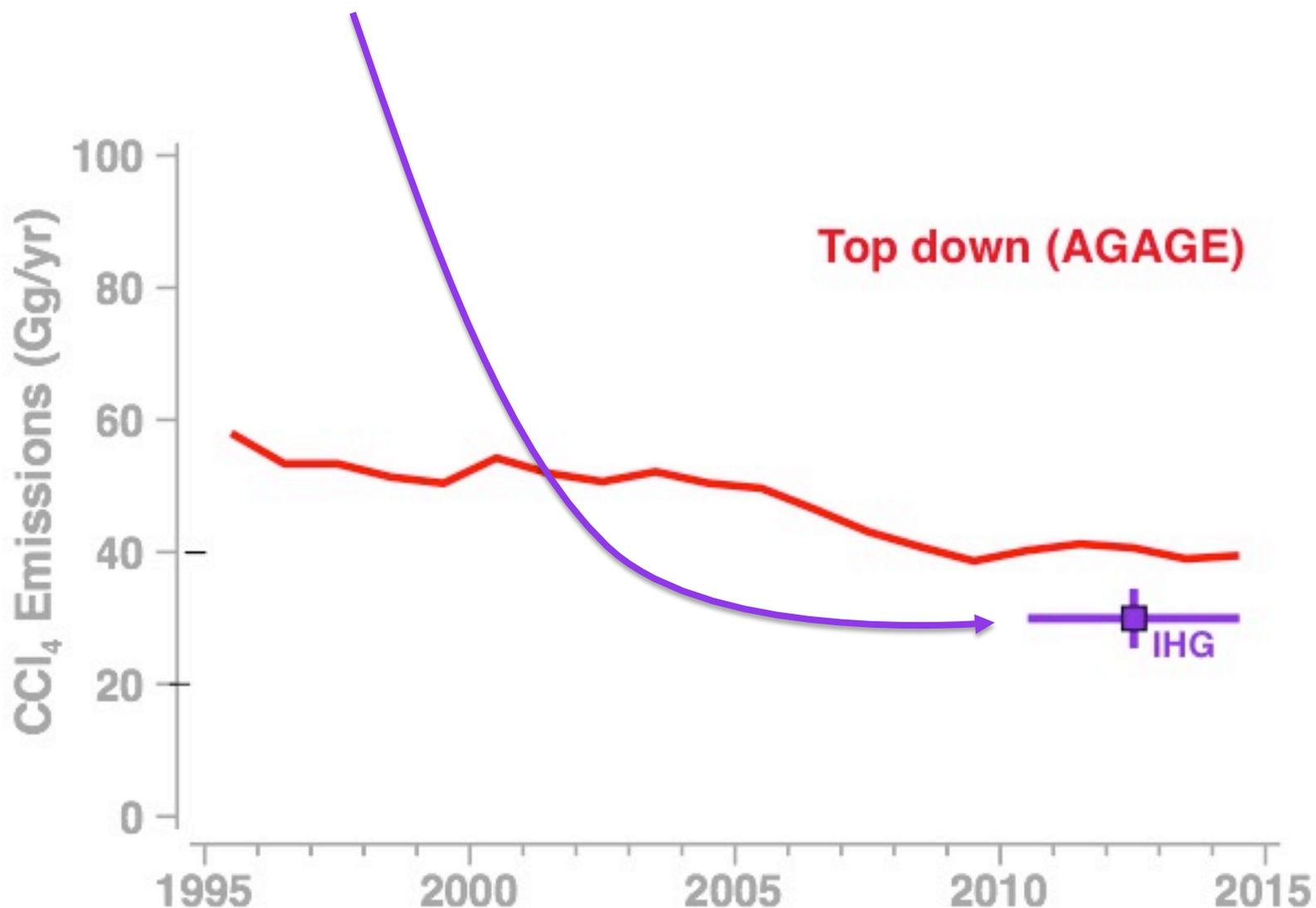
These four pathways are estimated to account for ~ 25 Gg of emissions



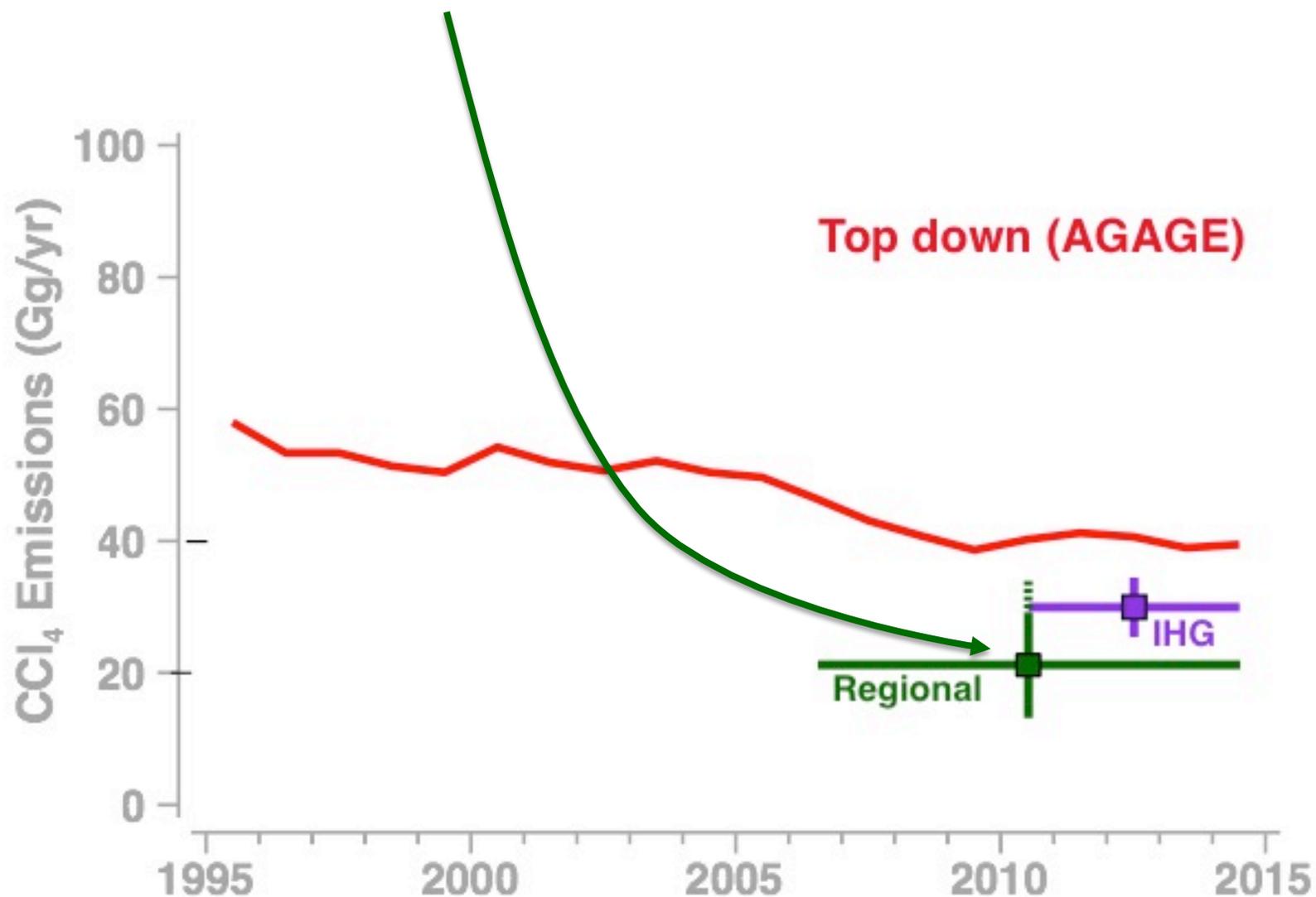
Top-down emissions estimates based upon the new 33-y lifetime have been revised downward to 40 ± 15 Gg yr⁻¹



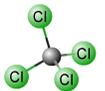
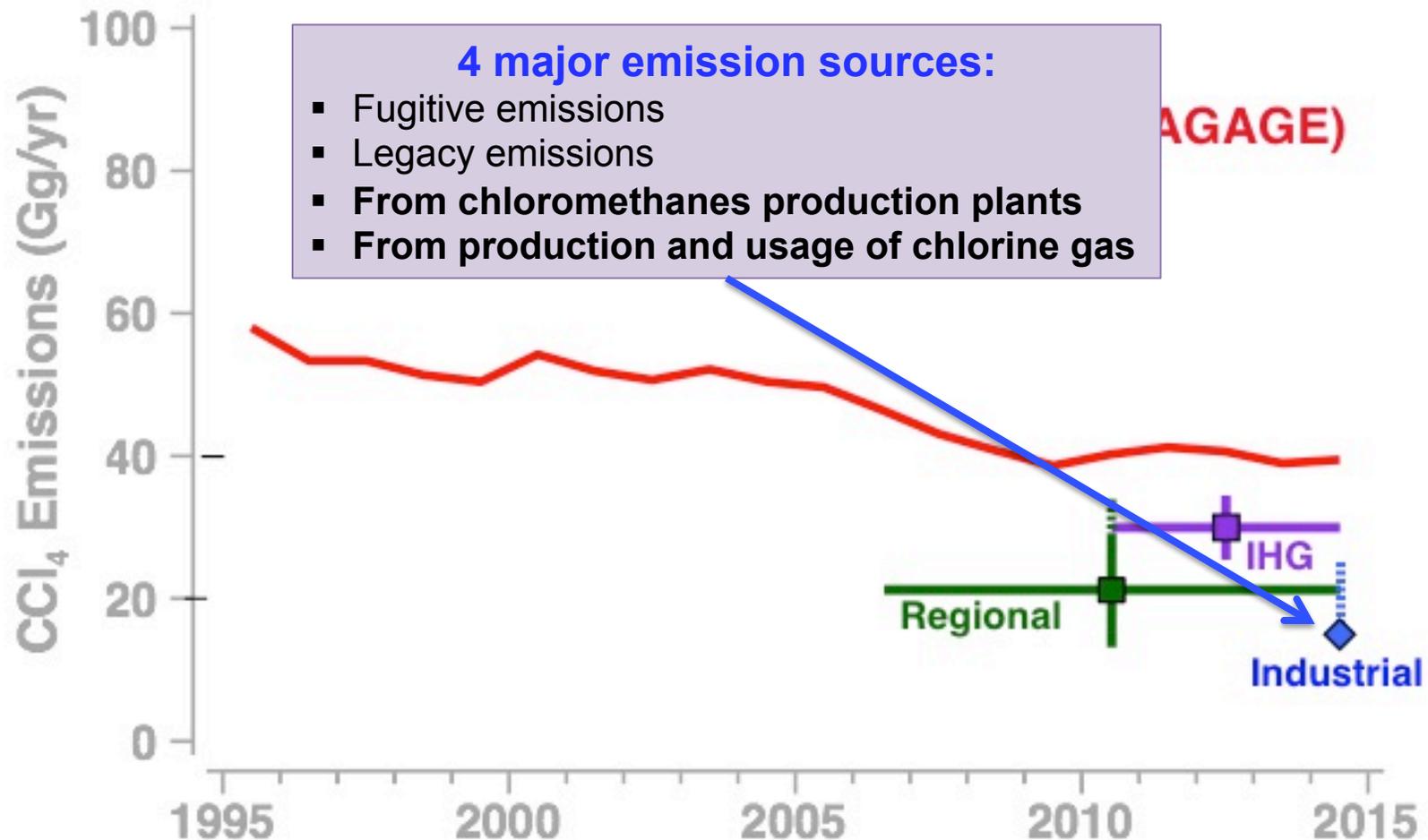
The interhemispheric gradient yields emissions estimate of 30 ± 5 Gg yr⁻¹



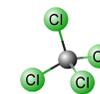
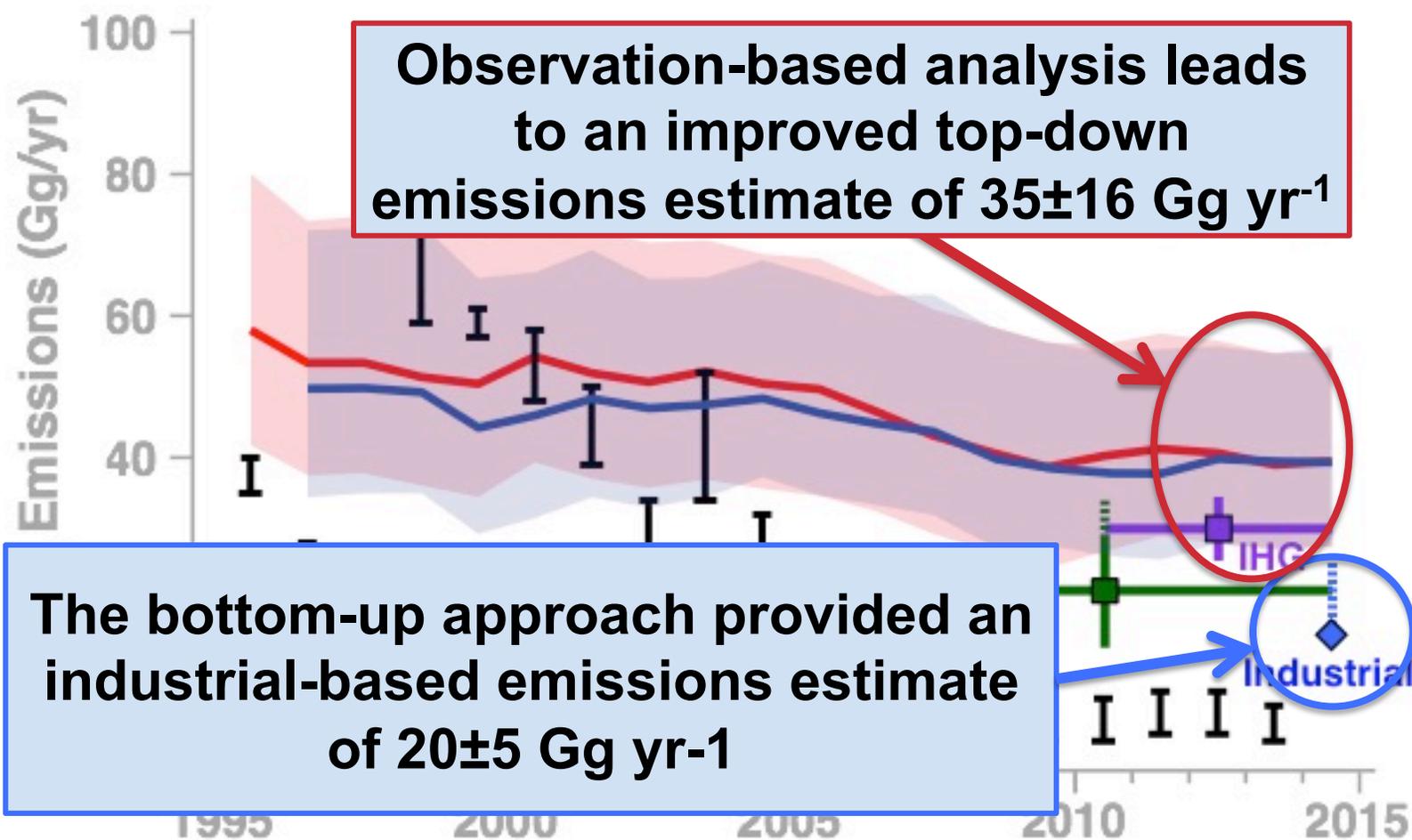
Totaled emissions estimates from observation-derived regional values yield $21.4 \pm 7.5 \text{ Gg yr}^{-1}$



Bottom-up emissions estimate from industrial sources total 20 ± 5 Gg yr⁻¹



These new emissions estimates reconcile the CCl_4 budget discrepancy when considered at the edges of their uncertainties



SPARC Report Summary

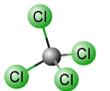
- Four emission pathways are identified
 - A. Fugitive: 2 Gg yr⁻¹, from UNEP Reports
 - B. Unreported non-feedstock: 13 Gg yr⁻¹
 - C. Unreported inadvertent emissions:
 - D. Legacy: combined C. & D. ~10 Gg yr⁻¹

Total = 20±5 Gg yr⁻¹

- Observation based estimates
 - CCl₄ global top-down emissions: 40 Gg yr⁻¹
 - Interhemispheric gradient top down: 30 Gg yr⁻¹

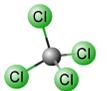
Total = 35±15 Gg yr⁻¹

- ***These new emissions estimates reconcile the CCl₄ budget discrepancy when considered at the edges of their uncertainties.***



SAP/TEAP Conclusions

- Previous MP assessments have omitted some CCl₄ emissions sources from bottom-up emissions estimates
 - Article 7 data reports to UNEP are not adequate on their own for deriving bottom-up global CCl₄ emissions estimates
- Further scientific research needed in order to tighten observations-derived top-down emissions estimates
- Continuing need to develop improved methodologies for estimating bottom-up CCl₄ emissions, with some questions remaining.



SAP/TEAP Recommendations

- SAP and TEAP recommend the following for consideration by Parties:
 - A joint TEAP/SAP working group could be established for estimating emissions of CCl_4 in support of their quadrennial assessments.
 - To address remaining questions, a joint TEAP/SAP workshop could be held in coordination with the Ozone Secretariat in order to further evaluate the emissions pathways outlined in SPARC [2016]. This workshop could also be tasked with developing improved methodologies for estimating bottom-up CCl_4 emissions.
 - SPARC [2016] includes a “Research Direction Suggestions” section. Parties may request the Ozone Secretariat to forward it to the Vienna Convention’s Ozone Research Managers for consideration and evaluation for their next report.

