

Submission to the Senate Select Committee on Government Budget Measures – Proposed CSIRO Job Cuts

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This submission contains my personal opinions concerning the impact that the proposed job cuts at CSIRO Oceans and Atmosphere (O&A), based at Aspendale, will have on programs to measure and model Australian greenhouse and ozone depleting gas emissions, and will likely have on CSIRO's, the nation's and global capabilities to conduct vital research on the role that these emissions play in current and future climate change impacting Australia.

To reach these conclusions, I draw on my 42 year scientific career at CSIRO, Aspendale, during which time I was Research Program Manager and Chief Research Scientist for Greenhouse Gases (2002-2012) and CSIRO Fellow (2012-2014)/CSIRO Honorary Fellow (2014-present). I have published over 250 research papers on greenhouse and ozone depletion science, and have received several national and international awards, including the Eureka Prize (1995), US EPA Ozone Protection Award (2002), CSIRO Lifetime Achievement Award (2004), Australian Academy of Technological Sciences and Engineering Fellow (2005), Nobel Peace Prize (IPCC WG1, 2007), CSIRO Newton-Turner Award (2010), RACI - Living Luminary of Australian Chemistry (2011) and The Metals Society (USA) Award (2016).

It is my judgement that CSIRO's scientific leadership and measurement/modelling capabilities for estimating greenhouse gas emissions and their impact on climate change will be **unable to survive** the proposed 50%-100% (?) cuts to CSIRO resources in this area. If CSIRO's capability in this arena is shut down, then the greenhouse gas measurement capability at **Cape Grim and at Aspendale will fail and will also be shut down**, after 40 years of unparalleled innovation, scientific achievement and support for Australian initiatives in mitigation of greenhouse gas emissions.

What I am attempting to do here is to communicate to this Committee the scale of the impending tragedy for Australian science that the loss of CSIRO's climate change capability in greenhouse gas measurements and modelling will precipitate.

Achievements and Global Reputation

There are numerous stories (achievements) to tell about CSIRO scientists and their climate change research at Aspendale and, in particular, their involvement at Cape Grim and with international colleagues and institutions. Here's a selection, starting in the late 1970s but proceeding at pace through the decades to 2016:

- Two world-class, inter-dependent laboratories, at CSIRO Aspendale (since 1970) and at Cape Grim (since 1976), for the first and continuing measurements of major greenhouse gases (carbon dioxide, methane, nitrous oxide, CFCs, HFCs etc.) at Southern Hemisphere mid-to-polar latitudes, in particular over the Southern Ocean.
- The most important greenhouse monitoring network in the Southern Hemisphere – Cape Grim (Tas), Gunn Point (NT), Cape Ferguson (Qld), Macquarie Island, Mawson, Casey, South Pole, Cape Matatula, American Samoa, Baring Head NZ.
- A robust data storage system that secures, updates, investigates and distributes the invaluable 45 year records of global and Southern Hemisphere greenhouse gases and 2000 year records of greenhouse gases in Antarctic ice and firn.

- The invention and global deployment of the world's most precise and accurate instrumentation for measuring carbon dioxide levels in the atmosphere.
- The concept and delivery of the Cape Grim Air Archive, the world's most important archive of the global background atmosphere.
- Iconic 2000-year records of the major greenhouse gases in the Southern Hemisphere used by the global community for high-visibility demonstrations of the anthropogenic impact on the drivers of climate change.
- The first clear demonstration from isotopic measurements that rising carbon dioxide levels in the atmosphere are due to the combustion of fossil fuels.
- The first clear demonstration of the ability of the atmosphere to 'self-cleanse' with the identification and explanation of the annual cycle of methane in the background atmosphere.
- The first demonstration, via isotopic measurements, that rising nitrous oxide levels in the atmosphere are due to the world-wide use of nitrogenous fertilizers in agriculture
- The discovery of more than 20 new greenhouse gases (CFCs, HCFCs, HFCs etc.)
- First to show that the 'mystery' emissions of carbon tetrachloride (a potent ozone depleting/greenhouse gas) were likely from chlor-alkali plants, Australia and world-wide.
- The discovery that the emissions of HFCs (CFC replacements) from refrigeration (Australia, globally) were being over-reported to the UN Framework Convention on Climate Change.
- The discovery that emissions of the most-powerful greenhouse gases in the atmosphere (PFCs) were being significantly under-reported by the semi-conductor production industry.
- Significant partnerships with Australian industry (refrigeration, aluminium and chemical industries) for measuring and modelling industrial greenhouse gas emissions
- One of CSIRO's most decorated Research Team (Greenhouse Gases) with 30 prestigious national and international awards from 1990 to 2016.
- One of CSIRO's highest achieving Research Team in terms of high-impact, prestigious publications (40) in *Science*, *Nature*, and the *Proceedings of the National Academy of Science* (USA).
- Innovative/productive collaborations with 25 of the world's leading research institutions, enhancing CSIRO's reputation world-wide as the premier climate change research institution in the Southern Hemisphere, attracting visiting academics, scientists and students from:

USA	MIT, NASA, NOAA, Scripps Oceanography, Georgia Tech.,
UK	Met. Office, Cambridge University, Bristol University, University of East Anglia
Switzerland	Swiss Federal Laboratory, WMO
Norway	Norwegian Institute for Air Research
Italy	University of Urbino, University of Naples
Germany	University of Heidelberg, Max Planck Institute
France	LSCE
Malaysia	Malaysian Meteor. Service
South Korea	Gwangju Institute of Science, Kyungpook National Uni., Korean Meteor. Adm.
Japan	National Institute for Environmental Studies
China (PRC)	China Meteorological Administration
New Zealand	NIWA

These achievements are not 'past glories', but are evolving 'stories' that result from brilliant innovation by CSIRO scientists of the highest calibre and feed into the evolving processes (for example the Montreal Protocol and the Paris Agreement) that underpin and verify Australia's and the world's initiatives to mitigate emissions of greenhouse and ozone-depleting gases.

All this will be lost if the draconian CSIRO cuts (50% or more) proposed for this area of research will come to pass.

The assertion, recently attributed to the CEO of CSIRO, that this field of research had matured and we (CSIRO) can now move on to other (more profitable?) areas of R&D activity demonstrates a level of misunderstanding of climate change science that is extremely disappointing.

We are on the cusp of being able to demonstrate whether all our national (and international) policies and efforts to reduce greenhouse gas emissions are having a demonstrable impact on their levels in the atmosphere and thus mitigating climate change. If we cut CSIRO research to the extent proposed we will never be able to demonstrate whether greenhouse gas emissions mitigation is working, certainly in Australia and likely globally.

In the recent words of an eminent Professor at the Scripps Institution for Oceanography 'Quantifying greenhouse gas emissions from statistical data without testing against atmospheric data is like dieting without weighing oneself'

Financial Summary

These financial data are based on my previous experience as Program Leader.

CSIRO's program at Cape Grim and at Aspendale for the measurement and modelling of greenhouse gases, aerosols and reactive gases involves about 15 FTEs (distributed over about 30 staff), a total cost, including overheads of \$4.0M/yr, about 20% of which is externally funded (BoM, NASA, RRA, DoE). The requisite laboratory infrastructure at Aspendale costs about \$2M. The approximate split between greenhouse gases and aerosol/reactive gases is 70:30.

In order to maintain the existing program, which is essentially public good research, CSIRO needs to commit to the existing funding model (which is significantly at odds with a mandated minimum level of external funding of 60%) or transfer to another willing host organisation \$2M for capital expenditure (to fund instrumentation in an Aspendale-replacement laboratory) and \$4M/yr for operating and research.

What's at risk

It is not possible to reduce the commitment to this program by, for example, 50% and anticipate the program will continue to produce the innovation, excellence and data acquisition/storage/distribution currently achieved.

In my judgement a significant cut to this program would see Australia withdraw from the measurement and modelling of greenhouse gases. This would mean that:

- Australia could no longer conduct atmospheric verification research on national, State and regional greenhouse gas emissions.
- The global measurement capability to estimate global greenhouse gas emissions would be rendered uncertain, given that the Australian program is responsible for nearly half of the global atmosphere and all of the massive carbon dioxide sink that is the Southern Ocean – how can we reliably predict future global carbon dioxide levels, the primary driver of climate change, if we do not know how much carbon dioxide is being taken up by the Southern Ocean?
- Australia will lose its climate change leadership role in Antarctica, with the closure of CSIRO's Casey, Mawson, Macquarie Island and South Pole measurement stations, and the cessation of greenhouse gas measurements on ice cores and firn.

- Australia would lose its IPCC leadership role for greenhouse gas reporting and evaluation as part of its commitment to the UNFCCC.
- Australia would no longer be able to contribute to national State of the Environment/State of the Climate Reporting in relation to greenhouse gas trends and emissions.
- Australia would no longer be able to support fledgling greenhouse gas measurement activities in developing countries, in particular Indonesia and Malaysia, which, I understand, are part of Australia's commitments in the Paris Accord.
- Future activities (collection, measurement) in the Cape Grim Air Archive would cease and the existing Archive would deteriorate, to the point of being rendered useless, without the current curation activities (leak testing, sample corruption testing, container evaluations...)
- Greenhouse gas measurement capability on the RV Investigator would be closed down.
- CSIRO's international reputation (brand) has taken a massive hit while this change is being introduced (see *New York Times* from page article February 28 – 'Australian Cuts Imperil World Climate Studies'
<http://www.nytimes.com/2016/02/28/world/australia/cape-grim-climate-change-research.html?hp&action=click&pgtype=Homepage&clickSource=story-heading&module=second-column-region®ion=top-news&WT.nav=top-news&r=0>
and March 4 editorial 'Australia Turns Its Back on Climate Science' <http://www.nytimes.com/2016/03/04/opinion/australia-turns-its-back-on-climate-science.html?ref=opinion&r=0>
- If these changes proceed and CSIRO essentially closes down its research on the measurement and modelling of greenhouse gases, its reputation as a reliable research partner in the Southern Hemisphere in climate change research will be irreversibly trashed.