

" Attachment One "

Interim Report Firefighters and Climate Change

**A report for
United Firefighters Union of Australia**

**Prepared by the
National Institute of Economic and Industry Research**

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Preface

The National Institute of Economic and Industry Research (NIEIR) has been asked by the United Firefighters Union of Australia (UFU) to prepare a report on the implications of climate change for firefighters and emergency services. The report is intended to support a UFU submission to the Senate Environment and Communications Reference Committee on *Recent trends in preparedness for extreme weather events*. Given the short timeframes, this report represents an initial interim report that provides a building block for subsequent work by NIEIR. It canvasses the issues and updates a project undertaken in 2009 by the Workplace Research Centre at the University of Sydney¹ that examined the implications for Victorian firefighters from a changing climate.

The overall goal of this project is to provide insights for the union on changing requirements of firefighting services based on climate change scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) and the Commonwealth Scientific and Research Organisation (CSIRO). This report is the first of three proposed reports for this project. The project will build on NIEIR's extensive database of regional Australia (developed for the annual State of the Regions report) and comprehensive regional modelling and forecasting capability. It is anticipated the reports will be finalised by the end of February

Future work

The second report will both deepen and broaden the analysis expanding the scope to Australia as a whole and taking in a wider range of considerations. We will build a regional model based on our 67 State of the Regions regions (see <http://alga.asn.au/?ID=165&Menu=50,95>). For this, NIEIR will:

- Gather baseline data on the distribution of firefighters by region and cross-check that with the ABS Census data and agency annual reports to ensure we have a sound baseline.
- Review this base line data in the context of performance indicators identified through a literature review of recent reports on community expectations of emergency service provision.
- Forecast change in resident population to 2030 for each region (this will capture changes between regions particularly new growth areas, urban fringe development and rural urban drift)

¹ Concise Report to Inform the United Firefighters Union (Victoria) Staffing Claim for MFB and CFA Paid Firefighters, Wright, S, Workplace Research Centre, University of Sydney, December 2009

- Examine changes in volunteerism and national implications for firefighting for inclusion in the model.
- Forecast a 'business as usual' scenario'.
- We will apply scenarios for changed demand for fire fighting (and generally first responder requirements) based on climate change scenarios from the CSIRO and others for different regions and use this to forecast the impact on firefighter numbers
- Map firefighter numbers in relation to current property assets as well as people (by region)
- The report will expand on discussion in this report on capacity and capability, qualifications, interoperability, mutual aid, accreditation, equipment, uniformity in a more extensive manner than this report. It will touch on socio-economic factors (such as equity), costs and economic loss although these points will be a focus for the final report.

The third report will provide deeper analysis of the potential costs of failure to provide adequate emergency service preparation and response. It will expand the analysis of potential economic loss and social equity. This would bring into the model data on the number of properties, value of properties, types of properties, household types, investment and forecast development for each of the 67 regions. Discussion of personnel requirements will be conducted with a view to the risk to people and property (and household type). It would draw on data already in the NIEIR regional model (property type, value) and the Insurance Council of Australia disaster database (and any other data that may become available over the course of the previous two projects). Whereas in the first two reports, the question will be what number of firefighters are required, in the third report we will ask: What are the risks and costs to the community of not having enough firefighters?

It is expected the second report will be available in mid February and the final report by the end of February.

Executive Summary

The role and expectations of firefighters in the community is changing rapidly in the context of 'all hazards all agencies' philosophies being evolved within emergency services. The range of emergencies firefighters can be expected to deal with as first responders has fewer boundaries today than yesterday and will have less again tomorrow. A focus on building community resilience will continue to expand the role of firefighters in the area of skills development and community education.

The nature of hazard risk in Australia is changing; weather in the south of the continent is becoming drier and hotter with increased bushfire risk as well as health risk associated with extreme heat. Bushfire risk is increasing in most parts of Australia and bushfire seasons are becoming longer with fewer respite years. More intensive rainfall periods increase the likelihood of major floods. Northern Australia is becoming wetter and while the number of tropical cyclones may decrease, the proportion of intense cyclones will increase. All coastal communities face risks associated with sea level rise and storm surges.

Current population and climate change forecasts for operational staff needed to address increased bushfire activity would suggest a 28 to 40 per cent increase in operational staff (660 to 950 FTE) between now and 2026. In addition, up to an additional 240 staff could be required to address the decline in volunteerism that is reducing CFA capacity. These staff will need to be better trained, better equipped and better integrated than their predecessors in order to address changing expectations, increased hazards and different types of hazards they will be expected to deal with in Australia (and potentially our region).

Changing role of firefighters

The role of firefighters is evolving from dealing with a specific hazard - urban fires or bushfires – to one that is integrated with a range of other agencies providing emergency services as ‘first responders’. This evolution has been emphasised by a number of inquiries most recently the Victorian Bushfire Royal Commission Implementation Monitor (BCRIM) in his final report. Citing the inquiry into the 2012 Victorian floods, the BCRIM says:

Emergency management agencies are no longer restricted to responding to one type of hazard. This was apparent during the Victorian floods of 2010-11 and 2012 where the CFA provided substantial expertise and assistance to VICSES.²

Firefighters due to their dispersal through the community, based on minimising response times, and their training can be expected to deal with fire, floods, storms and cyclones to name just some the major hazards. As first responders, firefighters can also be expected to provide services such as emergency medical assistance until medical personnel arrive.

While the BCRIM notes an ‘all hazards, all agencies’ philosophy has not been fully operationalized (because of barriers to culture, communication, coordination, interoperability, information collation and sharing) it is clearly the direction for the future.

The BCRIM notes that the Victorian Government Green Paper on Emergency Management sought to strengthen emergency management by focusing on:

- Service delivery to Victorians across government and communities
- Building community resilience
- Achieving a genuine ‘all hazards, all agencies’ approach
- Enduring and sustainable change.

The goal of building community resilience will embed the role of firefighters in providing education, training and other support to build community resilience. The changing role of firefighters will require not only suitable numbers of personnel but appropriate training, national standards, interoperability etc.

In summary, the role and expectations of firefighters in the community is changing rapidly in the context of ‘all hazards all agencies’ philosophies being

² Bushfire Royal Commission Implementation Monitor, Final Report, November 2012 p 231

evolved within emergency services. The range of emergencies firefighters can be expected to deal with as first responders has fewer boundaries today than yesterday and will have less again tomorrow. A focus on building community resilience will continue to expand the role of firefighters in the area of skills development and community education.

Changing nature of risk

The IPCC has produced a range of scenarios for how greenhouse gas emissions might develop over the course of this century and the impact of global warming and on the earth's climate. Sadly, evidence would suggest that the planet is tracking at the more pessimistic end of these scenarios. This was highlighted in a report prepared by the Potsdam Institute for Climate Impact Research and Climate Analytics for the World Bank and released in November 2012. The Report predicts that a 4°C warmer world could be a reality by the 2060s if current commitments and pledges are not met and even if they are there is a 20 per cent chance of 4°C warmer planet by 2100³. In his introduction to the report, the President of the World Bank, Dr Jim Yong Kim says:

The 4°C scenarios are devastating: the inundation of coastal cities; increasing risks for food production potentially leading to higher malnutrition rates; many dry regions becoming drier, wet regions becoming wetter; unprecedented heat waves in many regions, especially in the tropics; substantially exacerbated water scarcity in many regions; increased frequency of high intensity tropical cyclones; the irreversible loss of biodiversity, including coral reef systems.⁴

Dr Kim goes on to say that these scenarios come with higher uncertainty and new risks that threaten our ability to anticipate and plan for future adaptation needs.

In her recent report on how climate change will affect Victoria, the Victorian Commissioner for Environmental Sustainability makes the following observation that reinforces the relevance of the World Bank statements:

Importantly it needs to be noted that our global emissions are currently tracking at close to [the IPCC] A1F1 [scenario], the first and most resource intense scenario. This business-as-usual path represents a worst case scenario for climate change outcomes.⁵

CSIRO/Bureau of Meteorology State of the Climate (2012) modelling suggests:

³ Turn Down the Heat,, Why a 4°C Warmer World Must be Avoided, A report for the World Bank by the Potsdam Institute for Climate Impact and Analytics, November 2012

⁴ *ibid* p. v

⁵ Climate Change Victoria: the science, our people and our state of play, Commissioner for Environmental Sustainability, Melbourne, December 2012

- Australian average temperatures are projected to rise by 1.0 to 5.0°C by 2070 when compared to climate in recent decades – this means an increase in the number of hot days and warm nights and a decline in cool days and cool nights
- An increase in the number of droughts is expected in southern Australia but it is also likely that there will be an increase in intense rainfall events in many areas
- It is likely there will be fewer tropical cyclones in the Australian region, on average, but the proportion of intense cyclones is expected to increase.⁶

Discussing the implications of these scenarios for south-eastern Australian, the Victorian Commissioner for Environmental Sustainability says:

Although there are likely to be decreases in average rainfall we are also expected to experience an increase in the intensity of the highest 1% of rainfall events. In other words, there will be more dry days but the days when it does rain will be wetter. These changes will be most pronounced in summer and autumn. This means we will continue to have the kind of extreme rains we saw in February and March of 2011 and 2012 and that events of this nature may become more severe. This possibility must be a key factor in future planning.⁷

These changes will have implications for floods, bushfires and human health impacts of heatwaves. In addition, sea level rises will effect many coastal communities and, from an emergency response perspective, increases in extreme weather and associated storm surges will increase demand for disaster assistance to which firefighters will be expected to contribute.

Discussing the implications of climate change for bushfires, the Commissioner says:

If we see the last 15 years of climate as more representative of future climate than the entire 20th century record, we see that the severity of fires in Victoria has changed in the period 1995-2009, when these events are compared to our complete record.

When the [Forest Fire Danger Index] data are analysed in more recent periods, it becomes clear that not-significant seasons are becoming rarer.

⁶ State of the Climate 2012, CSIRO/BOM, Australian Government

⁷ Commissioner for Environmental Sustainability, op cit, p 19

Almost every season can be categorised as having produced fire events which can be described at least as “important”.

More concerning, the analysis of the data prompts the conclusion that “serious” and “major” fire seasons are becoming more common.

This analysis of the data suggests that even though the number of fires may not have changed, their impacts are presently (and, upon extrapolation, in the future) expected to worsen.

It is anticipated that an increase in ‘serious’ – ‘major’ seasons may be more likely. Further – and of concern to planners, environmentalists, land managers, health professionals, governments and the general public – seasons with no significant impact may become a thing of the past.⁸

Reviewing the recent (January 2013) heatwave experienced in Australia, the Australian Climate Commission issued a report⁹ saying:

- The length, extent and severity of the current heatwave are unprecedented in the measurement record.
- Although Australia has always had heatwaves, hot days and bushfires, climate change is increasing the risk of more frequent and longer heatwaves and more extreme hot days, as well as exacerbating bushfire conditions.
- Climate change has contributed to making the current extreme heat conditions and bushfires worse.

The report goes on to say:

While many factors influence the potential for bushfires, so called ‘fire weather’ is highly sensitive to changes in climatic conditions (Clarke et al., 2012). Changes such as hotter temperatures, longer duration of heat events, high winds due to strong temperature gradients and drier soils and fuel can dramatically exacerbate fire conditions. Thus when fire occurs in more extreme weather conditions, there is the potential for the fire to be far more intense and difficult to control.¹⁰

A leading research on bushfire risk, Lucas, C, finds that heightened bushfire risk

⁸ Commissioner for Environmental Sustainability, op cit, p 107

⁹ Off the Charts: Extreme Australian Summer Heat, Karoly, J, England, M, Steffen, W, Climate Commission, Canberra, January 2013

¹⁰ *ibid* p 2

is not confined to south eastern Australia and that the greatest increase in risk periods are in Autumn and Spring so fire seasons are becoming longer.

Fire weather is clearly changing across Australia with a tendency towards more dangerous conditions being observed across the country. Significant trends in median and 90th percentile FFDI are observed in all seasons, but overall, it is the summer months – the peak of the southern fire season-- that shows the least amount of change. The largest changes are occurring in the spring and autumn, broadly consistent with the model projections. The fire season is lengthening, with an earlier start and a later end. The number of ‘extreme’ fire weather days is increasing in spring, summer and autumn. In a regional sense, the Murray Darling Basin region is seeing the biggest change in fire weather danger, with significant positive trends observed in all four seasons. In general, the eastern portion of Australia is seeing larger trends in more seasons, but almost every region shows some degree of change.¹¹

Both the Australian Climate Commission and the Victorian Commissioner for Environmental Sustainability have noted the impacts of heatwaves on human health with increased mortality (particularly for the elderly) and higher risk of accidents due to impaired judgment and behavior on the roads, at home or in the workplace.

In summary, the nature of hazard risk in Australia is changing; weather in the south of the continent is becoming drier and hotter with increased bushfire risk as well as health risk associated with extreme heat. Bushfire risk is increasing in most parts of Australia and bushfire seasons are becoming longer with fewer respite years. More intensive rainfall periods increase the likelihood of major floods. Northern Australia is becoming wetter and while the number of tropical cyclones may decrease, the proportion of intense cyclones will increase. All coastal communities face risks associated with sea level rise and storm surges.

¹¹ Climate Change Impacts on Fire Weather, Lucas, C, Centre for Australian Weather and Climate Research, Melbourne, 2009

Implications for fire services

The implications for fire services and fire fighters will be significant and include an ability to deal with all hazards in all parts of Australia and, potentially, the broader region. Issues to be addressed would include:

- Enhanced capability through training and skills development for firefighters to handle a wider range of situations
- Enhanced capacity of fire services (people, resources)
- Interoperability – more intense disasters will require pooling of resources between states and internationally
- The latter has implications for equipment specification
- This will also require standardization and mutual agreements
- National coordination between states and agencies

In addition, the potential for Australian firefighters to be deployed internationally to assist with disaster relief (particularly in the Pacific and Asia) to help deal with emergencies needs to be addressed. This could become as common as the dispatch of Australian troops to assist neighboring countries as intense cyclones, sea level rise and storm surges will become more common.

Assessing additional personnel requirements

As an initial step for this Interim Report, NIEIR has revised tables contained in the 2009 Workplace Research Centre study for Victoria to include current 2012 data as the new baseline. In future stages of the project, this data will be expanded to include the whole of Australia. The 2009 study took baseline staffing data for both the metropolitan and country fire services in Victoria and established a ratio of firefighter to ABS Estimated Resident Population (ERP). It used ABS projections for growth in ERP to grow the required number of firefighters based on 'business as usual'. It used projections from Lucas et al (2007) for increase in the 'very high or greater' Fire Danger Index days based on two climate change scenarios to adjust this growth for climate change.

In the Table 1a – 1c, NIEIR has adjusted the baseline staff to levels reported by the MFB in its Annual Report for 2012 and derived from the CFA Chief Officer Staffing Chart (April 2012). ERP forecasts have been updated in line with those published by the ABS in 2012 for Victoria. The data for CFA operational staff does not include Board of Reference Disputes Tribunal increases anticipated in the 2009 report as NIEIR has been advised that these have not occurred in the manner expected at the time. The same Lucas et al (2007) forecasts used in the original report have been used (while the 2012 figure has been derived by NIEIR

assuming a linear progression in the fire index it should be noted that the progression will not necessarily be linear).

The adjusted projected staff increases required to meet demand based on these factors is listed in the bottom line of the table. This shows that for the low case, operational staff will need to grow by about 28 per cent or 661 FTEs and for the high case 40 per cent or 953 FTEs. It should be noted that current expectations are more likely to be closer to the high case unless governments are prepared to take much stronger action to address carbon pollution. The forecasts in this report are higher than those expected in 2009 reflecting higher population forecasts for Victoria and variation on the baseline staffing numbers.

Of particular note in this report is the more rapid decline in volunteerism than anticipated in the 2009 report. NIEIR notes that if the number of volunteers was to keep pace with growth in operational staff (based on the factors outlined above) Victoria would require between 70 000 and 77 000 volunteers by 2026. Forecasts based on current trends suggest Victoria will be between 15 000 and 24 000 short of that number. It is unlikely these trends will be reversed although it is expected government will try to increase volunteer recruitment. The implication however would be that, based on the current ratio of operational staff to volunteers, some additional 180 to 240 professional staff will be required to address this deficit. This issue will be further explored in subsequent reports.

In summary, current population and climate change forecasts for operational staff needed to address increased bushfire activity alone would suggest a 28 to 40 per cent increase in operational staff (between 660 and 950 FTE) between now and 2026. In addition, up to an additional 240 staff could be required to address the decline in volunteerism that is reducing CFA capacity. These staff will need to be better trained, better equipped and better integrated than their predecessors in order to address changing expectations, increased hazards and different types of hazards they will be expected to deal with in Australia (and potentially our region).

Risks of failure to act

The risks of failure to act will be increased threat to those values the fire services were originally established to protect – life and property. Each of the hazards mentioned in this report is life-threatening but there is also significant economic cost associated with disasters. Insurance industry costs of natural disasters during 2011 alone were in the order of \$5.5 billion and the industry has warned Australia's exposure to natural disaster risks is increasing. The Council recently called on governments to step up efforts to limit losses and prevent insurance costs spiraling higher. Costs of higher insurance premiums will be born by all Australians. In addition consideration needs to be given to indirect costs such as loss of earning by people involved in disasters, loss of primary production and biodiversity impacts. These issues will be further explored in subsequent reports.

Table 1a: Victorian Firefighter Staffing Projections based on ABS Estimated Residential Population (ERP) Projections and Climate Change Impacts on Fire Danger Rating (as per Lucas 2007)

	2009	2012	2016	2021	2026
Total Population	5,381,146	5,636,808	6,067,702	6,500,653	6,924,141
Persons in Non-Private Dwellings (PNPD)	87,109	94,807	101,841	111,346	123,624
Persons in Occupied Private Dwellings (POPD)	5,294,037	5,542,001	5,965,860	6,389,307	6,800,517
Occupied Private Dwellings (OPD)*	2,097,987	2,138,574	2,335,105	2,531,437	2,722,084
Average Household Size**	2.52	2.59	2.55	2.52	2.50
MFB Total Operational Staffing	1669	1,805	1943	2082	2217
MFB Trainers (ratio 8 FF:1 trainer)	209	226	243	260	277
MFB Staffing:Population Ratio	3,224	3,123	3,123	3,123	3,123
CFA Total Core Staffing	514	561	604	647	689
CFA Total Core Staffing :Population (1:ratio)	10,469	10,048	10,048	10,048	10,048
MFB:CFA Staffing Ratio	3.25	3.22	3.22	3.22	3.22
MFB + CFA Total Operational Staffing	2,183	2,366	2,547	2,729	2,906
Staffing:Population Ratio	2,465	2,382	2,382	2,382	2,382
Days with FDR 'very high' or greater; low Mark 2 CCAM simulation, Victoria***	20.4	20.7***			21.6
Days with FDR 'very high' or greater; high Mark 3 CCAM simulation, Victoria***	20.4	21.5***			24.6
Projected staff increases low Mark 2 CCAM simulation Victoria (No.12 + Mk2 CCAM)	2,183	2366			3027
Projected staff increases high Mark 3 CCAM simulation Victoria (No. 12 + Mk3 CCAM)	2,183	2366			3319

* Household numbers are assumed to equal Occupied Private Dwelling numbers

** To calculate average household size, divide POPD by OPD

***These were calculated from 2007 figures and assume linear progression

Table 1b: MFB Operational Staffing based on ERP only

	2009	2012	2016	2021	2026
Estimated Resident Population (ERP)	3,947,730	4,149,504	4,483,604	4,808,836	5,118,448
Persons in Non-Private Dwellings (PNPD)	58,707	61,270	67,508	73,239	79,987
Persons in Occupied Private Dwellings (POPD)	3,889,023	4,088,234	4,416,096	4,735,596	5,038,460
Occupied Private Dwellings (OPD)*	1,515,705	1,552,152	1,699,132	1,841,512	1,977,219
Average Household Size**	2.57	2.63	2.60	2.57	2.55
MFD Operational Staffing based on ERP	1669	1805	1950	2092	2226
MFD Trainers (1 trainer:8 ff)	209	226	244	261	278
MFB Operational Staffing:Population Ratio	2,365	2,299	2,299	2,299	2,299

Table 1c: CFA Operational Staffing based on ERP and Volunteer Decline

	2009	2012	2016	2021	2026
Estimated Resident Population (ERP) Regional Victoria	1,433,416	1,487,304	1,584,097	1,691,817	1,805,693
Persons in Non-Private Dwellings (PNPD)	28,402	33,537	34,333	38,106	43,637
Persons in Occupied Private Dwellings (POPD)	1,405,014	1,453,767	1,549,764	1,653,711	1,762,056
Occupied Private Dwellings (OPD)*	582,282	586,422	635,973	689,926	744,865
Average Household Size**	2.41	2.48	2.44	2.40	2.37
CFA Total Core Staffing	514	561	598	638	681
CFA Staffing:Population Ratio	2,789	2,651	2,651	2,651	2,651
CFA Volunteers	58,258	55,063	54,362	53,498	52,647
Active CFA Volunteers (1/3)	19,419	18,354	18,121	17,833	17,549
Active CFA Volunteers:Population (1:ratio)	74	81	87	95	103
CFA Staffing:Active CFA Volunteers (1:ratio)	37.78	32.72	30.33	27.94	25.77