

## STATE FIRE MANAGEMENT COUNCIL

### Position Paper

## Management of Smoke arising from Prescribed Burning of Vegetation

### INTRODUCTION

**Smoke** consists of the visible and invisible airborne by-products of combustion, and is composed of water droplets and vapour, particulates (tar, ash, carbon, unburnt fuel fragments), and gases (CO<sub>2</sub>, CO, N<sub>2</sub>O, SO<sub>2</sub>, NH<sub>3</sub>, CH<sub>4</sub>, NO<sub>x</sub>, ozone and other non-methane hydrocarbons).

On average, the amount of smoke produced by a fire represents between 1.5 and 2% of the quantity of fuel burnt. (*Vines et al. 1971*).

The production of smoke is an unavoidable and natural process in all vegetation fires.

**Particulates** result from the incomplete combustion of fuels. The proportion of the fuel that is released from fires as particulate matter can be as low as 0.44% for a high-intensity fires burning under very dry conditions, and as high as 2 - 4% for low intensity fires burning under mild weather conditions. (*Evans et al. 1976*).

**Prescribed burning** is the controlled application of fire, under specified environmental conditions, to a predetermined area and at a time, intensity of heat, and 'rate of spread' required to achieve planned resource management objectives. Examples include 'fuel reduction burning' and 'ecological burning' (*Anon. 2006*).

Prescribed burning is ideally carried out under relatively stable atmospheric conditions. These conditions may be accompanied by the occurrence of atmospheric temperature inversions which can restrict the dispersal of smoke through the atmosphere and trap smoke close to the ground, either throughout the burn operation (if low intensity) or as the fire diminishes in intensity and enters the smouldering stage after the main part of the fuels have been consumed (high intensity burning operations).

Whatever the origin low altitude smoke may reduce visibility, affect the health of sensitive individuals and create a general nuisance.

In the Tasmanian environment smoke may be generated by the burning of vegetation in a wide range of contexts, including;

- the management of fuels and habitat,

- the disposal of agricultural, forest industry and domestic residues and waste,
- seedbed preparation in forest regeneration, and,
- in bushfires.

Thick smoke from vegetation burning does not necessarily cause health problems for everyone exposed to it. Most healthy people recover quickly from exposure to smoke and do not suffer long-term effects. There are a number of factors that determine whether exposure to smoke results in health problems: the concentrations of the air pollutants, the length of exposure, age, individual susceptibility and whether or not there is pre-existing lung or heart disease. (*Anon, 2005*)

Smoke has a range of health effects – from eye and respiratory tract irritation to serious disorders such as breathing problems, bronchitis, increased severity of asthma, cancer and premature death. The very fine particles in smoke can go deep into the lungs and fine particles, and by themselves or in combination with other air pollutants, can make pre-existing diseases of the heart and lungs worse. Where there is short-term exposure to smoke, the particles are the most significant threat to public health. (*Anon, 2005*).

Most healthy people, including children, recover quickly from exposure to smoke and do not suffer long-term consequences. However, certain sensitive groups can experience more severe short-term and chronic effects. These groups are: people with asthma and other respiratory disease, people with cardiovascular disease, children and the elderly. (*Anon, 2005*)

Bushfires and smoke are inevitable and natural components of the Australian and Tasmanian environment.

## **THE LEGAL ENVIRONMENT**

Land owners, occupiers and land managers have statutory obligations to prevent fires occurring, and if any such fire does occur, to attempt to contain the fire to the land they own, occupy or manage.

Meeting these obligations will commonly require the use of prescribed burning to manage fuel loads and fuel arrangement.

Both Commonwealth and Tasmanian legislation imposes requirements and restrictions upon actions producing smoke.

## **NATIONAL LEGISLATION**

Tasmania is a participant in the National Environment Protection Council (NEPC), consisting of Commonwealth, State and Territory Ministers which, on 26 June 1998, made Australia's first national ambient air quality standards as part of the National Environment Protection Measure for Ambient Air Quality (*the 'Air NEPM'*).

The NEPC is a statutory body with law making powers established under the National Environment Protection Council Act 1994 (Commonwealth) and corresponding legislation in the other jurisdictions.

The Air NEPM established a set of standards and goal, for six air pollutants (carbon monoxide, nitrogen dioxide, photochemical oxidants (as ozone), sulphur dioxide, lead, and particles as PM<sub>10</sub>) legally binding on each level of Government, and required the NEPC member jurisdictions to monitor air quality. In Tasmania this is done by the Environment Protection Authority Division of the Department of Primary Industries, Parks Water and Environment (*DPIPWE*).

In terms of smoke management the most critical standard is that for particles as PM<sub>10</sub>, i.e. particles of aerodynamic diameter of 10 microns or less.

The PM<sub>10</sub> standard sets a maximum level of 50 micro-grams per cubic metre of air (50µg/m<sup>3</sup>) averaged across each 24 hr. period midnight to midnight.

## **TASMANIAN LEGISLATION AND POLICY**

The following Tasmanian legislation, code, policy and strategy deal with the production of smoke in the course of the burning of vegetation.

- *Fire Service Act 1979*
- *Environmental Management and Pollution Control Act 1994*
- Forest Practices Code 2000
- Tasmanian Environment Protection Policy (Air Quality) 2004
- Tasmanian Air Quality Strategy June 2006

In addition, in some Municipalities the burning of vegetation is governed by bylaws.

Section 4(1) of the *Environmental Management and Pollution Control Act 1994* (EMPCA) describes “best practice environmental management” in relation to an activity as being the management of the activity to achieve an ongoing minimization of the activity's environmental harm through cost-effective measures assessed against the current international and national standards applicable to the activity.

Section 5 of EMPCA then goes on to describe and define environmental harm as “any adverse effect on the environment (of whatever degree or duration) .....” and distinguishes between “material environmental harm” and “serious environmental harm”

EMPCA further states that the occupier or person in charge of a place or vehicle at or from which a pollutant escapes or is discharged, emitted ..... is taken to have polluted the environment with the pollutant”

Smoke is a pollutant, capable of causing both material and serious environmental harm according to the circumstances of the event. Consequently any person or persons undertaking burning, for whatever reason must consider the provisions of EMPCA

However, in 1995 the *Fire Service Act 1979* was amended by the insertion of Section 66(12) which provides that “A person who lights and controls a fire in accordance with the conditions of a permit granted to that person under this section is exempt from the [Environmental Management and Pollution Control Act 1994](#)”.

This amendment arose from Recommendation 8 of the report of the Tasmanian Fire review Committee, established by the Tasmanian Government in September 1993:

“the *Fire Service Act 1979* be amended to provide that a person who lights and controls a fire in accordance with the conditions contained in a permit issued pursuant to the Act is exempt from the provisions of the Environmental Management and Pollution Control legislation (Bale 1994).

That the government accepted and implemented this recommendation remains a clear acknowledgement of the role of and need for managed fire, and the smoke arising from that fire in the Tasmanian environment.

Subsequently the Tasmanian Environment Protection Policy (Air Quality) 2004, made under Section 96K of the *Environmental Management and Pollution Control Act 1994* came into effect on 1 June 2005. The Policy requires that persons undertaking planned burning should use best practice environmental management practices to minimise the effects of smoke pollution on individuals and the community, and in particular that those "...agencies, companies or organisations undertaking burning on a regular basis or on a large scale should:

- *adopt efficient and effective air quality monitoring programmes;*
- *adopt a uniform approach to recording and assessing complaints;*
- *focus upon minimising the impact of smoke on the community in terms of health, amenity and safety;*
- *encourage the planning and execution of planned burning in a way that minimises the generation of smoke and improves the management of the effects of smoke; and*
- *require a responsible person involved in planned burning for land management to be competent in relevant burning procedures.”*

In June 2006 the Tasmanian Government launched the Tasmanian Air Quality Strategy which among other things, places an emphasis on improved management of pollution sources such as outdoor burning.

This State Fire Management Council Position Paper is consistent with Actions 6.2 and 6.3 of that strategy (i.e. ‘develop smoke management guidelines’ for open burning and ‘educate the community on open burning restrictions’).

## Improving the management of smoke from planned burning

The Environment Protection Policy (Air Quality), “the Air Quality Policy”, requires that persons undertaking planned burning should use best practice environmental management to minimise the effects of smoke pollution on individuals and the community.

The Air Quality Policy also requires that:

### **SFMC POSITION**

The State Fire Management Council’s position on smoke management is that:

Persons lighting fires for the management of vegetation fuels must act responsibly in ensuring the protection of human and environmental values and minimising any adverse or undue effects of the smoke arising from that burning.

In particular the State Fire Management Council advocates that:

1. Smoke arising from both wildfires and prescribed burning must be recognised as inevitable and natural components of the Tasmanian environment
2. Low intensity prescribed burning be recognised as the most cost effective tool available to those managing vegetation fuel loads.
3. In appropriate vegetation types prescribed burning is an efficient, ecologically sound and economically suitable method of reducing fuel loads over large areas
4. Cooperative interaction between the Tasmania Fire Service, The Parks and Wildlife Service, Forestry Tasmania, the Bureau of Meteorology, the Environment Protection Authority, the EPA Division of DPIPWE, and appropriate special interest groups should be developed and encouraged to disseminate information on the effects on quality of life of smoke emanating from prescribed burning
5. Smoke from prescribed burning should be managed to minimise affecting population centres and other sensitive areas by a combination of strategies including, but not limited to:
  - Scheduling burning in periods in which meteorological conditions will assist in the dispersion of smoke
  - modifying burn prescriptions to minimise smouldering of partly consumed fuels
  - separating burns in time and space when and where possible.

### **PLANNING**

6. Smoke sensitive locations or areas (e.g. residential areas, schools, scenic areas, retirement villages and hospitals etc.) should be identified in fire management plans.
7. Fire management plans should identify strategies to minimise the risk of adverse smoke impacts in smoke sensitive areas.
8. Alternatives to burning (e.g. slashing, selective shrub removal, construction of radiation barriers, chipping, mulching and composting etc.) should be considered as fuel management and hazard/risk management strategies where a high risk of adverse smoke impacts is likely.

9. Operational burn plans should incorporate appropriate prescriptions for fuel moisture content, wind speed and direction and atmospheric stability so as to reduce the risk of smoke effects on sensitive locations or areas.

### **TRAINING AND EDUCATION**

10. Smoke management principles, policies and procedures should be incorporated within fire management training delivered by Forestry Tasmania, the Parks and Wildlife Service and the Tasmania Fire Service.

### **PERMITS AND NOTICES**

11. Fire Permit Officers should consider the likelihood of adverse smoke effects on sensitive locations or areas arising from fires lit under permit, and specify appropriate conditions in the permit.
12. Fire Permit Officers should make smoke management guidelines available with each permit issued.
13. When issued for burning in or near identified smoke sensitive locations or areas fire permits should detail wind directions which minimise nuisance
14. To avoid excessive smoke generation, fire permits should detail fuel moisture content parameters where this can be controlled (e.g. heap burning).

### **MANAGEMENT OF BUSHFIRE SUPPRESSION OPERATIONS**

15. Incident Action Planning should give due consideration to the smoke management aspects of public safety including:
  - Management of special areas at high risk of adverse health impacts from high level smoke exposure (e.g. aged care facilities, hospitals, schools etc)
  - Public safety management and service disruption in smoke affected transport corridors (e.g. airports, freeways, major roads, railways etc)
  - Safety and operational implications of smoke for other, concurrent fire fighting operations, particularly those involving aircraft.
16. Smoke management should be included in the list of topics that are to be routinely covered during fire debriefs.

### **MANAGEMENT OF PRESCRIBED BURNING OPERATIONS**

17. Fire control and safety requirements should not be compromised in accommodating smoke dispersal objectives.
18. Weather systems which provide for good smoke dispersal should be used to advantage when conducting large scale burning operations.
19. Wherever it is safe and practical to do so, burning should not be undertaken when:
  - The likelihood of prolonged poor dispersion conditions is high;
  - The likelihood of smoke adversely affecting significant community events is high, and
  - CSMS smoke management prescriptions are not likely to be met.

## **OPERATIONAL TECHNIQUES**

20. Where safe to do so, lighting techniques and patterns that reduce the smouldering phase of combustion and minimise the burning of material during times of the day where atmospheric dispersion is poor should be used.
21. Where practical and safe to do so (e.g. small scale burns along road edges or property boundaries, and pile burns) aggressive mop-up procedures (e.g. maximum use of water and the breaking up or dousing of large fuel masses such as logs and stumps) should be applied so as to minimise the smouldering phase of combustion.
22. The use of backing fires (i.e. fires burning down slope and/or against the prevailing wind direction) is encouraged as an operational technique to maximise combustion and minimise smoke emissions.
23. Any person undertaking burning operations should whenever possible:
  - take advantage of weather conditions which optimise smoke dispersion without compromising other fire management objectives,
  - be aware of appropriate smoke impact mitigation strategies and tactics and the location of any nearby smoke sensitive areas,
  - avoid the burning of noxious smoke producing debris (e.g. tyres, dumped rubbish etc.),
  - avoid the burning of rubbish piles and backyard clippings.

## References

Anon, (2005) *Smoke from biomass burning: Air quality fact sheet*, Department of the Environment and Heritage,  
<http://www.environment.gov.au/atmosphere/airquality/publications/biomass.html> (as viewed Feb. 2012)

Anon. (2006) *Smoke and the Control of Bushfires*, FireNote 3 Bushfire CRC Melbourne.

Bale, W.C.R. (Committee Chair) *Review of Vegetation Based fire in Tasmania* (1994) Report of the Tasmanian Fire Review Committee, Hobart.

Evans, L.F., King, N.K., and MacArthur, D.A., Packham, D.R. and Stephens, E.T. (1976). *Further studies of the nature of bushfire re smoke*, CSIRO Aust., Div. Appl. Organic Chem., Tech. Pap. No. 2, 1-12. (In Anon. (2006) *Smoke and the Control of Bushfires*, FireNote 3 Bushfire CRC Melbourne).

Vines, R.G., Gibson, L., Hatch, A.B., King, N.K., MacArthur, D.A., Packham, D.R. and Taylor, R.J. (1971), *On the nature, properties and behaviour of bushfire re smoke*, CSIRO Div. Applied Chemistry, Tech. Pap. No.1. (In Anon. (2006) *Smoke and the Control of Bushfires*, FireNote 3 Bushfire CRC Melbourne).

## Further Reading: Legislation and Policies

### ***Environmental Management and Pollution Control Act 1994***

#### ***Fire Service Act 1979***

Both of the above Acts are available on line from the Tasmanian Legislation website,  
<http://www.thelaw.tas.gov.au/index.w3p>

### **Forest Practices Code 2000**

Available online from the Forest Practices Authority website:

[http://www.fpa.tas.gov.au/\\_data/assets/pdf\\_file/0020/58115/Forest\\_Practices\\_Code\\_2000.pdf](http://www.fpa.tas.gov.au/_data/assets/pdf_file/0020/58115/Forest_Practices_Code_2000.pdf)

### ***Environment Protection Policy (Air Quality) 2004***

Available online from the Tasmanian Environment Protection Authority website:

<http://epa.tas.gov.au/policy/air-quality-epp>)

### **Tasmanian Air Quality Strategy June 2006**

Available online from the Tasmanian Environment Protection Authority website:

<http://epa.tas.gov.au/epa/tasmanian-air-quality-strategy>