Background briefings on emerging issues for fire managers from AFAC and Bushfire CRC.

FIRE NOTE

ISSUE 68 NOVEMBER 2010

TANKS ON TRIAL: PERFORMANCE OF RAINWATER TANKS IN BUSHFIRE CONDITIONS

SUMMARY

This Bushfire CRC and CSIRO research project examined the performance of different rainwater tanks when faced with the threat of fire through testing conducted in 2004 at the only bushfire simulator of this type in the world – at the New South Wales Rural Fire Service Eurobodalla Training Centre, on the south coast of New South Wales (pictured above). The research investigated how effective steel and plastic water tanks were in storing water during typical Australian bushfire exposures. Polyethylene (plastic) tanks were found to provide the least resistance to various bushfire simulations.

ABOUT THIS PROJECT

Project D1 Building and Occupant Protection was part of Bushfire CRC Program D: Protection of People and Property.

Researchers involved in the project acknowledge the financial support of BlueScope Steel and the valuable collaboration of the NSW Rural Fire Service.

Author: Justin Leonard is a Bushfire Research Project Leader with CSIRO Sustainable Ecosystems. For more information about this research, contact Justin Leonard at justin.leonard@csiro.au

BACKGROUND

Different types of rainwater tanks can play an important role in the defence of a home against a bushfire attack. Indeed, such storage tanks are critical to active and passive protection against bushfires. Anecdotal evidence already existed to suggest steel water tanks would offer greater protection to both residential and commercial properties in the event of a bushfire than alternative materials because of their non-combustibility. However, the full results from this research has and is being used by the relevant agencies to:

- Influence how building codes and planning guides are developed, particularly around bushfire-risk areas.
- Help provide advice to property owners on the level of risk their homes and businesses face.
- Help develop education programs for local communities.

BUSHFIRE CRC RESEARCH

Three types of rainwater storage tanks were tested in the course of this research, including:

- "Conventional" steel construction BlueScope Water Waterpoints.
- Steel construction Pioneer Galaxy Water Tanks with Aqualiners (bladder bags).
- Polyethylene constructed tanks.

Each tank type was subjected to three levels of flame exposure including:

1. Litter ignited – Leaf litter placed typically around the base of the tank and ignited to investigate and observe the influence of small amounts of leaf deposition during the fire event.
2. Litter ignited plus radiant heat – Typical of an advancing bushfire occurring on a fire danger day of FFDI (Forest Fire Danger Index) 40, but with sufficient clearing to avoid direct flame contact with the tank.
3. Simulation of structural fire – Full continuous flame immersion for a period of 30 minutes. Designed to simulate a worst case structural fire exposure or influent from an adjacent combustible element. Note: Behaviour under this exposure can also help inform us as to how a tank may behave under severe bushfire conditions such as Black Saturday.

▲ Plastic tanks at Kinglake after the 2009 Black Saturday fires.

RESEARCH OUTCOMES

Researchers observed and recorded details of structural damage and water loss during and after exposure.

Steel Construction

Of the different materials tested, spiral-wound steel tanks performed best under all exposure conditions. Under the first two levels of exposure, no structural damage or water loss was recorded. When faced with the adjacent structural fire simulation, steel manufactured tanks were scorched but maintained structural integrity. Small leaks at a rate of less than 2 litres per minute were recorded after a 30 minute flame immersion.

Steel Construction With Bladder Bag Style Liner

Steel construction tanks with bladder bag style liners performed next best with tanks maintaining structural integrity during all tests. A small loss of water was recorded over the top of the liner following the 30 minute flame immersion, but the bladder construction proved able to retain water during and after the fire-front, which is critical for the protection of property and assets in the event of a bushfire.

Polyethylene (Plastic) Construction

Polyethylene (plastic) constructed tanks fared worst under all levels of exposure. The first condition created a small ignition of the tank around the base and combustion of the polyethylene to a depth of 20mm in one localised area, but no water loss. Under threat from ignited litter and pre-radiation, the polyethylene tank melted and deformed to the level of the water, and while some leaks were detected and the front surface was involved in flaming combustion for some time, the tank still held water. Under simulation of structural fire the tank quickly split and collapsed, emptying itself and melting down in complete failure.

This research indicates that steel construction tanks have the greatest chance of retaining their structural integrity and preventing water loss under bushfire conditions, while polyethylene tanks are at risk of total failure when adjacent combustible items are present, such as heavy forest fuels, fences, structures or even other polyethylene tanks. It is important to state that the bladders in steel tanks so fitted survived long enough to help with defence, but the bladder would need replacement. The findings suggest that plastic rainwater storage tanks require a clearance zone of around 30 metres, free of excess leaf build up, combustible material or other plastic tanks.

This work is now informing policy and regulation where a fixed water supply is recommended or is a mandatory requirement for bushfire defence. Understanding the reliability of the stored water source and the way in which advice or regulation can give confidence to the adequacy of this supply is a significant step forward.

END USER STATEMENT

"This valuable research contribution to bushfire safety and preparedness provides community educators with detailed information that informs the fire safety planning of residents. This is particularly important post Black Saturday as residents in fire prone areas are eager to purchase defensive equipment including water tanks and are seeking from firefighters advice on the 'best' type. The research clearly identifies the structural integrity issues of water tanks under a range of fire impact scenarios which in turn leads to recommendations regarding fuel clearance and the lessening of vulnerability of tanks. Residents are installing tanks for a variety of reasons beyond fire safety so this research is vital to ensure that where tanks are already installed, owners understand the additional steps necessary to ensure the integrity of one of their chief fire safety strategies."

– Russell Taylor, AFSM, Group Manager Executive Support, NSW Rural Fire Service

FUTURE DIRECTIONS

While not fully explored, it was observed in site inspections and interviews undertaken by the Bushfire CRC Task Force immediately after Victoria's Black Saturday fires of February 2009 that the test results from this research were consistent with the effects on water tanks of the extreme events of that time.

No further work is planned on this subject. The behaviour of these elements inform broader risk frameworks which model the interaction of all combustible and non-combustible elements in an urban environment.

There is the potential now to focus on pipework and pump reliability as other essential elements in the water defence system.

Fire Note is published jointly by the Bushfire Cooperative Research Centre (Bushfire CRC) and the Australasian Fire and Emergency Service Authorities Council (AFAC). This Fire Note is prepared from available research at the time of publication to encourage discussion and debate. The contents of the Fire Note do not necessarily represent the views, policies, practices or positions of any of the individual agencies or organisations who are stakeholders of the Bushfire CRC.

Bushfire Cooperative Research Centre
Level 5/340 Albert Street
East Melbourne VIC 3002
Telephone: 03 9412 9600
www.bushfirecrc.com

Bushfire CRC is a national research centre in the Cooperative Research Centre (CRC) program, formed in partnership with fire and land management agencies in 2003 to undertake end-user focused research. Bushfire CRC Limited ABN: 71 103 943 755

Australasian Fire and Emergency Service Authorities Council
Level 5/340 Albert Street
East Melbourne VIC 3002
Telephone: 03 9418 2388
www.afac.com.au

AFAC is the peak representative body for fire, emergency services and land management agencies in the Australasia region. It was established in 1993 and has 26 full and 10 affiliate members.