

Pages 1 through 4 redacted for the following reasons:

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Sch3(6)(c)(i) Infringe the privileges of Parliament

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RTI Act 2009

Date : 22/11/2020 12:05:55 PM  
From : "CUBIS Mick"  
To : "DAVIES Matt" , "DARGUSCH Marc"  
Subject : Fwd: Cost of Air Craft and Use on K'GARI (FRASER)  
Attachment : image001.jpg;

FYI

Mick Cubis  
Regional Director  
Coastal and Islands | QPWS&Partnerships  
Department of Environment and Science  
P (07 ) 54471137 | Mobile Personal info

Begin forwarded message:

**From:** HEAD Damien <Damien.Head@des.qld.gov.au>  
**Date:** 22 November 2020 at 11:51:01 am AEST  
**To:** Tony Johnstone <Tony.Johnstone@qfes.qld.gov.au>  
**Cc:** CAMBOURN Neil <Neil.Cambourn@des.qld.gov.au>, CUBIS Mick <Mick.Cubis@des.qld.gov.au>, KLAASSEN Ben <Ben.Klaassen@des.qld.gov.au>  
**Subject: Re: Cost of Air Craft and Use on K'GARI (FRASER)**

Tony

Thanks for you time this morning. To confirm the QPWS will cover the costs of any requested aerial support. The nature of the aerial support needed will be confirmed through the onground IMT.

Appreciate outlining the costs.

QPWS will continue to evaluate the tactics and monitor their effectiveness to inform the ongoing requirement for aerial support each day.

Regards  
dAmien

Sent from my iPhone

On 22 Nov 2020, at 11:41 am, Tony Johnstone <Tony.Johnstone@qfes.qld.gov.au> wrote:

Damien,

Thanks for your time this morning.

For transparency, below is an extract from an email in regards to using air assets on K'GARI (FRASER)

- 
- For the purposes of being able to apply timely application of resources QPWS are happy to allow engagement of high-level air resources if an effective strategy can be determined.
  - The area of highest priority/concern is the area south of the Moon Point Track and west of the Northern Road. My understanding is that an **effective strategy for managing this area is as follows:**
    - Use of LAT + 802 waterbombers/gel to be used where environmental concerns can be addressed.
    - Specific tactics:
      - Squeeze flank northwards from south.
      - Black-out backing fire (to west).
    - Back-up Fireline control work by ground crews.
  - ***This is not confirmation that QPWS will pay for the above air resourcing. Payment to be sorted out at a high level between DES and QFES.***

Other areas of concern which are currently a lesser priority than the above are also being adequately managed by the IMT and are listed below:

- Moon Point Road east of the Northern road.
  - The area around Cathedrals on Fraser.
  - Sandy Cape lighthouse.
- 

As discussed on the phone:

- The Large Air Tanker (LAT) is worth \$10,000 per hour plus product . (\$700 for Gel)
- 802 Air Tractor (wheels) \$3000 per hour
- 802 Fire Boss (803 with floats) \$5,500 per hour.

A Fire Boss is more effective if water is close by, they can also pick up salt water if authorised. 802 will have to be resupplied through an air base, so there can be some delays.

As indicated this morning you are happy for the cost of the aircraft as described in the strategy above to be costed to QPWS.

I have also attached a copy of a map that shows the fire which I believe the above strategy is to be used on.

Any concern please let me know.

Regards

**Tony Johnstone**

Chief Superintendent

Director Regional Coordination Rural Fire Service

**Queensland Fire and Emergency Services**

P 07 3635 3835 M Personal info

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<image001.jpg>

Classified as OFFICIAL

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<PrintResult.pdf>

Date : 22/11/2020 10:35:05 AM

From : "CUBIS Mick"

To : "DAVIES Matt", "DARGUSCH Marc"

Subject : Fwd: Duling WF Sitrep 21-11-20 2300

Hi guys, approval from Ben and Neil. Please let us know once the plan is confirmed, but no need to wait for further approvals. Good luck, hope we have a win today.

Mick Cubis

Regional Director

Coastal and Islands | QPWS&Partnerships

Department of Environment and Science

P (07 ) 54471137 | Mobile Personal info

Begin forwarded message:

**From:** CUBIS Mick <Mick.Cubis@des.qld.gov.au>

**Date:** 22 November 2020 at 10:29:47 am AEST

**To:** KLAASSEN Ben <Ben.Klaassen@des.qld.gov.au>

**Cc:** CAMBOURN Neil <Neil.Cambourn@des.qld.gov.au>, HEAD Damien <Damien.Head@des.qld.gov.au>

**Subject:** Re: Duling WF Sitrep 21-11-20 2300

Thanks, will let you know the plan as soon as I can. I know that LAT's are being considered.

Mick Cubis

Regional Director

Coastal and Islands | QPWS&Partnerships

Department of Environment and Science

P (07 ) 54471137 | Mobile Personal info

On 22 Nov 2020, at 10:27 am, KLAASSEN Ben <Ben.Klaassen@des.qld.gov.au> wrote:

Ok happy to support what they need to do.

Sent from my iPhone

On 22 Nov 2020, at 10:14 am, CAMBOURN Neil <Neil.Cambourn@des.qld.gov.au> wrote:

My guess is it will be helicopters Ben, I saw one leaving Bundy airport with a bambi bucket Friday afternoon, but we wont know until they assess size, vegetation type etc.

<image002.png>

**Neil Cambourn**

Assistant Director-General

Queensland Parks and Wildlife Service and Partnerships

Department of Environment and Science

P 07 3199 7518 M Personal info

Level 5, 400 George Street, Brisbane QLD 4000

---

**From:** KLAASSEN Ben <Ben.Klaassen@des.qld.gov.au>

**Sent:** Sunday, 22 November 2020 10:04 AM

**To:** HEAD Damien

**Cc:** CUBIS Mick; CAMBOURN Neil

**Subject:** RE: Duling WF Sitrep 21-11-20 2300

Thanks Damien

Is that the LAT to be deployed? I assume we would bear the cost.

However with wind change forecast in next 24 hours makes sense to get on top of it as quickly as possible.

Neil do you agree?

Regards  
Ben

<image003.png>

**Ben Klaassen**

**Deputy Director-General**

**Queensland Parks and Wildlife Service and Partnerships**  
Department of Environment and Science

P 07 3199 7538 | M **Personal** | E [ben.klaassen@des.qld.gov.au](mailto:ben.klaassen@des.qld.gov.au)  
Level 5, 400 George St, Brisbane QLD 4000  
PO Box 15187, CITY EAST QLD 4002

<image006.jpg>

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**From:** HEAD Damien <[Damien.Head@des.qld.gov.au](mailto:Damien.Head@des.qld.gov.au)>

**Sent:** Sunday, 22 November 2020 9:48 AM

**To:** KLAASSEN Ben

**Cc:** CUBIS Mick; CAMBOURN Neil

**Subject:** Re: Duling WF Sitrep 21-11-20 2300

Ben/Neil

The request is to waterbomb the spot over to try and extinguish today. Given how all other measures deployed to date have been met with limited success and extent of island now burnt I am happy to support this tactic.

Sent from my iPhone

On 22 Nov 2020, at 9:33 am, KLAASSEN Ben <[Ben.Klaassen@des.qld.gov.au](mailto:Ben.Klaassen@des.qld.gov.au)> wrote:

Thanks Mick

Please let us know any updates when they are available.

Regards  
Ben

<image004.png>

**Ben Klaassen**

**Deputy Director-General**

**Queensland Parks and Wildlife Service and Partnerships**  
Department of Environment and Science

P 07 3199 7538 | M **Personal** | E [ben.klaassen@des.qld.gov.au](mailto:ben.klaassen@des.qld.gov.au)  
Level 5, 400 George St, Brisbane QLD 4000  
PO Box 15187, CITY EAST QLD 4002

<image005.jpg>

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**From:** CUBIS Mick <[Mick.Cubis@des.qld.gov.au](mailto:Mick.Cubis@des.qld.gov.au)>

**Sent:** Sunday, 22 November 2020 8:59 AM

**To:** KLAASSEN Ben; CAMBOURN Neil; HEAD Damien

**Subject:** Fwd: Duling WF Sitrep 21-11-20 2300

FYI. Has spotted over moon point road. Waiting for further updates this morning.

Mick Cubis  
Regional Director

Begin forwarded message:

**From:** DAVIES Matt <[Matt.Davies@des.qld.gov.au](mailto:Matt.Davies@des.qld.gov.au)>  
**Date:** 21 November 2020 at 11:50:52 pm AEST  
**To:** DARGUSCH Marc <[Marc.Dargusch@des.qld.gov.au](mailto:Marc.Dargusch@des.qld.gov.au)>, CUBIS Mick  
<[Mick.Cubis@des.qld.gov.au](mailto:Mick.Cubis@des.qld.gov.au)>, CIR Fire Team  
<[CIR.FireTeam@des.qld.gov.au](mailto:CIR.FireTeam@des.qld.gov.au)>, BLACKMAN Boyd  
<[Boyd.Blackman@des.qld.gov.au](mailto:Boyd.Blackman@des.qld.gov.au)>, HARVEY Peter  
<[Peter.Harvey@des.qld.gov.au](mailto:Peter.Harvey@des.qld.gov.au)>, SEELEITHER Jamie  
<[Jamie.Seeleither@des.qld.gov.au](mailto:Jamie.Seeleither@des.qld.gov.au)>  
**Cc:** DARGUSCH Anthony <[Anthony.Dargusch@des.qld.gov.au](mailto:Anthony.Dargusch@des.qld.gov.au)>, BULLEY  
Graeme <[Graeme.Bulley@des.qld.gov.au](mailto:Graeme.Bulley@des.qld.gov.au)>, TAPPLY Jenna  
<[Jenna.Tapply@des.qld.gov.au](mailto:Jenna.Tapply@des.qld.gov.au)>, MACDONALD Stirling  
<[Stirling.MacDonald@des.qld.gov.au](mailto:Stirling.MacDonald@des.qld.gov.au)>, Andrew Marnie  
<[Andrew.Marnie@qfes.qld.gov.au](mailto:Andrew.Marnie@qfes.qld.gov.au)>  
**Subject:** Duling WF Sitrep 21-11-20 2300

**Matt Davies**

Senior Project Officer – Technical Support

Coastal and Islands Region | Queensland Parks and Wildlife Service

Department of Environment and Science

P (07) 5459 6102 | M Personal info | E: [matt.davies@des.qld.gov.au](mailto:matt.davies@des.qld.gov.au)  
12 First Avenue, Maroochydore Q. 4558

Date : 4/12/2020 6:15:20 PM

From : Mick.Cubis@des.qld.gov.au

To : "CAMBOURN Neil", "BUCKLEY Andrew", "HEAD Damien", "KLAASSEN Ben", "HARRIS Leigh"

Cc : "OLIVER Nathan", "DAVIES Matt"

Subject : Fwd: INFORMATION FW: NCR Regional Incident Summary as at 1600 hours

Attachment : 20-12-04 IF-00-16-00-Regional-Incident-Summary-(ROC-to-SOC) 1600hrs.pdf;20-12-04 IF-00-16-00-Regional-Incident-Summary-(ROC-to-SOC) 1600hrs SIGNED.pdf;Control of Duling Fire 20-12-04 1600hrs.docx;  
FYI

Mick Cubis

Regional Director

Coastal and Islands | QPWS&Partnerships

Department of Environment and Science

P (07 ) 54471137 | Mobile Personal infor

Begin forwarded message:

**From:** OLIVER Nathan <Nathan.Oliver@des.qld.gov.au>

**Date:** 4 December 2020 at 5:02:37 pm AEST

**To:** CIR Fire Team <CIR.FireTeam@des.qld.gov.au>, CUBIS Mick <Mick.Cubis@des.qld.gov.au>, DARGUSCH Marc <Marc.Dargusch@des.qld.gov.au>, BULLEY Graeme <Graeme.Bulley@des.qld.gov.au>, SEELEITHER Jamie <Jamie.Seeleither@des.qld.gov.au>, BLACKMAN Boyd <Boyd.Blackman@des.qld.gov.au>, BARRACLOUGH Emma <Emma.Barracrough@des.qld.gov.au>, HARVEY Peter <Peter.Harvey@des.qld.gov.au>, YETMAN Brendon <Brendon.Yetman@des.qld.gov.au>, KLEKAR John <John.Klekar@des.qld.gov.au>, gadejould <gadejould@gmail.com>, rachel.killer@bac-kgari.org, LAYFIELD Wayne <Wayne.Layfield@des.qld.gov.au>

**Cc:** DAVIES Matt <Matt.Davies@des.qld.gov.au>, "PRICE Stephen (Cotton Tree - Caboolture)" <Stephen.Price@des.qld.gov.au>

**Subject:** FW: INFORMATION FW: NCR Regional Incident Summary as at 1600 hours



**Nathan Oliver**

Principal Ranger Fire Management

South East Queensland Region | QPWS & Partnerships

Department of Environment and Science

P Personal infor

Kabool Road, West Burleigh 4220

[www.des.qld.gov.au](http://www.des.qld.gov.au)

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**From:** ROC North Coast <[ROC.NorthCoast@qfes.qld.gov.au](mailto:ROC.NorthCoast@qfes.qld.gov.au)>

**Sent:** Friday, 4 December 2020 4:35 PM

**To:** SOC Admin <[soc.admin@qfes.qld.gov.au](mailto:soc.admin@qfes.qld.gov.au)>

**Cc:** ICC North Coast Region Maryborough <[ICCNorthCoastRegion.Maryborough@qfes.qld.gov.au](mailto:ICCNorthCoastRegion.Maryborough@qfes.qld.gov.au)>; Holly Sanders <[Holly.Sanders@qfes.qld.gov.au](mailto:Holly.Sanders@qfes.qld.gov.au)>; William Gretton <[William.Gretton@qfes.qld.gov.au](mailto:William.Gretton@qfes.qld.gov.au)>; Chris Hanlon <[Chris.Hanlon@qfes.qld.gov.au](mailto:Chris.Hanlon@qfes.qld.gov.au)>; Matthew Inwood <[Matthew.Inwood@qfes.qld.gov.au](mailto:Matthew.Inwood@qfes.qld.gov.au)>; [sawery.michaelg@police.qld.gov.au](mailto:sawery.michaelg@police.qld.gov.au)

**Subject:** NCR Regional Incident Summary as at 1600 hours

Good Afternoon

Please find attached the NCR Regional Incident Summary as at 1600 hours.

Thank you

**ROC North Coast Region**

Queensland Fire and Emergency Services

319 Kent Street Maryborough Q 4650

Phone: 07 4122 0347

[ROC.NorthCoast@qfes.qld.gov.au](mailto:ROC.NorthCoast@qfes.qld.gov.au)

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PLANNING

# REGIONAL INCIDENT SUMMARY

Version 1.0

## ROC to SOC

Region: **North Coast**

ROC Status: **Stand Up**

NAME OF EVENT: **Operation Quell - NCR Fires (Fraser Island) November 2020**

REPORT Date: **Friday, 4 December 2020**

No. of current incidents:

REPORT Time: **1600**

☐ **Final Report** (for this event)

Level 1:

Level 2: **1**

Level 3:

### ROC OPERATIONAL STATUS

Regional WAL/SWAL Status:

ROC staffing:  
(How many staff are in the ROC?)

Capacity and capability to support own region:

Capacity and capability to support other regions:

(can you provide resources to another region?)

Complete this section with the resources you have available to provide to another region.

Resources deployed to another region:

How many of your region's resources have you sent to support another region/s?

(Are currently absent from your region)

Resources received into your region:

How many resources from other regions have deployed into your region?

| Zone:          | WAL: | SWAL: |
|----------------|------|-------|
| Bundaberg      | 3    | 1     |
| Maryborough    | 3    | 1     |
| Sunshine Coast | 3    | 1     |
| Western        | 3    | 1     |
|                |      |       |
|                |      |       |
|                |      |       |

|            | F & R | RFS | SES | EM | QFES Support | Other Agencies |
|------------|-------|-----|-----|----|--------------|----------------|
| Personnel: | 5     | 1   | 1   | 1  |              | 1              |

MODERATE - enough resources to maintain current level of regional activity for a limited time

How many **DAYS**, without further assistance, will the Region be able to sustain current operational activities?

**2**

|                                        |                                        |                          |                          |                          |    |                                               |
|----------------------------------------|----------------------------------------|--------------------------|--------------------------|--------------------------|----|-----------------------------------------------|
| <input type="checkbox"/> Yes           | <input checked="" type="checkbox"/> No | F&R                      | RFS                      | SES                      | EM | OTHER USEFUL RESOURCE/S (available to deploy) |
| IMT (partial) <input type="checkbox"/> | IMT (full) <input type="checkbox"/>    |                          |                          |                          |    | 1.                                            |
| STRIKE TEAM / TASK FORCE               |                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    | 2.                                            |
| APPLIANCES                             |                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    | 3.                                            |
| BOATS                                  |                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    | 4.                                            |
| SPECIAL OPERATIONS                     |                                        | <input type="checkbox"/> |                          |                          |    | 5.                                            |
| URBAN SEARCH AND RESCUE (USAR)         |                                        | <input type="checkbox"/> |                          |                          |    | 6.                                            |
| AIR OPS                                |                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |    | 7.                                            |
| FIRE BEHAVIOUR ANALYSTS                |                                        | <input type="checkbox"/> | <input type="checkbox"/> |                          |    | 8.                                            |
| VOLUNTEER COMMUNITY EDUCATORS          |                                        |                          | <input type="checkbox"/> | <input type="checkbox"/> |    | 9.                                            |
| EM COORDINATOR                         |                                        |                          |                          | <input type="checkbox"/> |    | 10.                                           |

| Allocated            | F&R | RFS | SES | EM | QFES Support |
|----------------------|-----|-----|-----|----|--------------|
| Personnel/Volunteers | 5   |     |     |    |              |
| Appliances           |     |     |     |    |              |
| Aircraft             |     |     |     |    |              |
| Boats                |     |     |     |    |              |

| Allocated            | F&R | RFS | SES | EM | QFES Support |
|----------------------|-----|-----|-----|----|--------------|
| Personnel/Volunteers | 8   | 2   | 2   |    | 9            |
| Appliances           | 4   | 2   |     |    |              |
| Aircraft             |     |     |     |    |              |
| Boats                |     |     |     |    |              |

**If major event is in your region:**

How many of your region's home resources are dedicated to the major event in your region?

(Excluding ROC staffing, BAU and resources from other regions)

**Cyclone shelters / Evacuation centres:**

(Number of QFES personnel/Volunteers working at cyclone shelters/evacuation centres)

**Additional resource information:**

Use this space to provide any information on QFES resources in relation to event, that you deem important, or needs further explanation.

| Allocated            | F&R | RFS | SES | EM | QFES Support |
|----------------------|-----|-----|-----|----|--------------|
| Personnel/Volunteers | 35  | 23  | 1   |    | 4            |
| Appliances           | 14  | 9   |     |    |              |
| Aircraft             | 15  |     |     |    |              |
| Boats                |     |     |     |    |              |

**Cyclone shelter location:**

QFES personnel/volunteers:

**Evacuation centre location:**

QFES personnel/volunteers:

Included in above numbers:

Bundaberg Air base: 1 x SES, 4 x FRS, 2 x RFS

Maryborough Air base: 4 x FRS: 1 x FRS Appliance (Operational Support Unit)

Air Operations will be functioning in a north and south division - existing ground divisions/sectors structure remain unchanged.

Weight of air attack as per AC NCR direction.

Additional to above numbers:

QPWS, volunteers and Traditional owners supporting operations.

Personnel/Volunteers: 29

Vehicles: 15

1 x QPWS Loader

Contractor 1 x positrack + 2 operators

1 x Excavator

QPS Traffic Branch from Gympie and Maryborough assisting on Fraser Island

1x QPS 7m watercraft + 2 QPS Officers conducting water patrols in Great Sandy Strait waters off KBRV.

**QFES Infrastructure damage, injuries and loss of life:**

(In reporting period)

| QFES                 | No. | Details: |
|----------------------|-----|----------|
| Loss of life:        |     |          |
| Injury:              |     |          |
| QFES Infrastructure: |     |          |
| Appliances:          |     |          |
| Equipment:           |     |          |

**Water related assistance/rescues:**

| Swiftwater Floodwater Rescues (SFR) | Floodwater Evacuations | TOTAL |
|-------------------------------------|------------------------|-------|
|-------------------------------------|------------------------|-------|

**Additional Regional information:**

Local Fire Ban for the NCR imposed from 2355 hrs on Monday 30 November 2020 to 2355 hrs on Monday 7 December 2020. Exemptions issued to date 42.  
9 BAU vegetation fires within NCR currently being managed.  
Rainbow Beach ICC to relocate to Maryborough ICC (located at QFES Complex Howard) tomorrow Saturday 5 December 2020. Maryborough ICC to be operational from 0800 hrs Saturday 5 December 2020.

**Key Issues:**

Significant threats to QFES and/or community relating to the incident/event/disaster i.e. potential evacuation, worsening or improving of situation etc.

**Number of active ICC's:**

1

**Report on each active ICC individually.**

Only report on prevailing developments. Provide closure information on completed operations in current report - then remove from future reports (unless new developments on the closed issue are forthcoming).

**ROC incident reporting to the SOC****ICC:**

Rainbow Beach

**Incident Name/s:**

QF4-20-116117 Fraser Island Fire

## Situation: Incident

### overview:

(A brief description of the incident being attended by the ICC - include information such as; size (hectares), threat to community and structures)

### Situation:

(NB: include community assistance & rescues)

See attached word document.

### Mission: Objective:

#### Objectives:

To contain and extinguish the Fraser Island fire, utilising a combination of QFES assets (RFS, FRS, SES) in addition to QPWS and the Butchulla Aboriginal Corporation to preserve life, protect property, culturally significant sites, historic structures and the natural flora and fauna.

### Execution: Strategies:

Strategies planned for PPRR stages. (this may be a combination of phases due to the type and mode of incident/event/disaster the ROC is monitoring and coordinating)

NOTE: Not every phase requires a response. Only provide those relevant to the stages of incident/event/disaster.

| Phase       | Strategy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Prevention  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Preparation | QFES crews and appliances strategically positioned at Kingfisher Bay Resort and Happy Valley in preparation for potential impact. Operational Incident Action Plan for Asset Protection Happy Valley Township Reserve-developed by Happy Valley Community Coordination Committee and Happy Valley RFB. QPWS crews patrolling containment line on Cornwells Road (Smith Poyungan Track).                                                                                                                                               |
| Response    | 15 vehicles and crews comprising of QPWS and Butchulla Aboriginal Corporation on Fraser Island.<br>22 QFES appliances and crews on Fraser island.                                                                                                                                                                                                                                                                                                                                                                                     |
|             | Fraser Coast LDMG - Stand up.<br>In accordance with Queensland Disaster Management Arrangements (QDMA), Fraser Coast Regional Council (FCRC) will take the lead coordination role in the recovery process. Yesterday (2/12/2020) the key agencies of the Recovery Group of the LDMG had a virtual meeting with stakeholders in the ICC (Rainbow Beach).                                                                                                                                                                               |
| Recovery    | <u>Stakeholder Engagement:</u> <ul style="list-style-type: none"><li>• Gary McCormack, Assistant Commissioner North Coast Region, contacted Mr Tom Smith MP, Member for Bundaberg, and provided an update regarding the fire.</li><li>• Mr McCormack also contacted, and left messages for:<ul style="list-style-type: none"><li>○ Councillor George Seymour, Mayor of Fraser Coast Regional Council</li><li>○ Mr Bruce Saunders MP, Member for Maryborough</li><li>○ Mr Adrian Tantari MP, Member for Hervey Bay</li></ul></li></ul> |

**Community Impact:**

Provide information on the impact the incident is having on the community and/or public and any possible future impact.

(Include information such as; injuries, loss of structures/stock/livestock/life etc. to the community, and the impact QFES operations is having on the community)

Current and future adverse economic impacts on the Fraser Island and surrounding mainland business community (accommodation, providers, tourism, travel, hospitality and associated services). The Fraser Island tourism sector have suffered significant financial losses as a result of guests and campers leaving the Island.

Adverse environmental impacts on World Heritage listed flora and fauna.

Adverse impacts on culturally and ecologically significant sites.

**PREPARED BY:**

(Name and Position)

Craig Lovell - Planning Officer

Date:

Wednesday, 2 December 2020

Time:

4:00 PM

**ENDORSED BY:**

(Name and Position)

Peter Hollier - Operations Officer

**APPROVED BY ROC  
COORDINATOR/  
EVENT COMMANDER**

**(Planned Event):**

(Rank and name)

Sign hardcopy

A/Superintendent - John Pappas

Personal information

4/12/2020  
JOHN PAPPAS 032433

**ICC Rainbow Beach Situation:** (1600hrs Friday 4 December 2020)

Control of the Duling Fire (Fraser Island) was transferred to QFES on 27 November 2020 with support from Queensland Parks and Wildlife Service (QPWS) and partners. The fire is burning in predominantly inaccessible terrain with approximately 82 000 Ha burnt (approx. 50% of Fraser Island).

**Western Division:  
Lighthouse Sector**

A backing fire continues to travel northeast backing into the wind towards Sandy Cape. Sandy Cape Lighthouse infrastructure is secure. No crews are assigned to this sector; however, two volunteers are on site providing regular sitreps to DIVCOM. This location is currently closed to visitors. No change.

**Bogimbah Sector**

The southern edge of the main fire front has continued in a Southerly direction overnight crossing Dundonga Creek. Heavy water bombing continued yesterday (3/12/2020) which reduced the southward progression of the fire. Community warning level remains at Watch and Act (low).

Significant cultural information - Butchulla people - Butchulla people

Aerial mapping of the fire line to be conducted this morning to ascertain fire intensity, direction and exact position. Overnight crews have kept fire to the north of Cornwells Road. Water bombing activities will continue the western flank of the fire to Cornwells Road to the south. QPWS contracted machinery will continue working in this vicinity today to widen containment lines with ongoing aerial and ground support. There are currently 4 QPWS light attack appliances and 2 contracted machines working along Cornwells Road. The fire front is still to the north of Cornwells Road. 9 x QFES will assist in ground operations along Cornwells Rd today.

Strategies carried throughout the day have been to assist QPWS to strengthening containment lines along Cornwell Road, building containment lines along cultural significant sites just outside of the dingo fence. Preparing and assisting QPWS along Cornwell Road for tonight's burn.

4 QFES light attack appliances were sent at 0930 to assist QPWS.

A change over at 1730 with new crews to assist QPWS at tonight activities. Backburning will NOT be conducted. Crews will wait for fire to emerge to Cornwells Rd and extinguish. The LAT is intended to conduct 4 runs in this vicinity later this afternoon.

Night crews resting until 1700hrs. Remaining crews building containment lines. Significant cultural information - Butchulla 30 metre area cleared as well as bare earth break to walking tracks.

Tomorrow morning's crews will start to create bare earth breaks around Z force area.

Machinery operations continue to upgrade Cornwells Road between Kingfisher and Leading Hill. Separate machines are upgrading the road East along Cornwells Road. The condition for that side of the road is suitable for backburning this evening.

The crews on the ground have mainly been dealing with active fire as it travels south onto Cornwells Road, in the vicinity of Leading Hill.

**KBRV Sector**

22 Appliances (13 x FRS, 9 RFS) and 42 personnel (24 FRS and 18 RFS) are in place at KBRV.

KBRV Management have been advised of the situation. 7 KBRV personnel remain to support QFES operations. Staff have been moved to a safe central location, from lodge accommodation to the resort accommodation, within KBRV. A barge is stationed at KBRV for them to evacuate to Hervey Bay/River Heads if needed.

KBRV has been sectorised and crews briefed on the asset protection strategy. Monitoring of fire conditions and preparation for asset protection continues. An options analysis has been produced to conduct a backburn in the North East corner. This option will be assessed later today (this has not been approved at this stage). Options analyses continue to consider strategies to lessen the severity of the fire front as it impacts KBRV. A comprehensive risk assessment of all structure within KBRV has been undertaken by the QFES strike team. Safety and evacuation plans have been communicated to all on-site.

### **McKenzie sector**

Crews have completed asset protection in the Lake McKenzie vicinity. Crews are assessing the condition of nearby fire containment lines and will deploy machinery as required.

### **Eastern Division:**

#### **Orchid Beach Sector**

No current activity. No active fire. No change.

#### **Cathedrals Sector**

Active fire continues to burn on the western and southern sides. No current threat to property. Cathedral assets secure. Aerial mapping to occur this morning.

K'gari camp assets are secure. The fire is burning to the west of Knifeblade Sandblow. Waterbombing the active fire to the west of Knifeblade Sandblow has been undertaken today to slow the rate of spread to the south, which will enable ground operations to continue to consolidate the operations at Happy Valley. Fire is also burning both sides of the Woralie Track and is being pushed to the south west. Crews continue to patrol. [A potential firebreak along Old Happy Valley Rd is being considered.](#)

#### **Happy Valley Sector**

The urban crews will investigate the assets to the south of Happy Valley township to formulate plans to defend these assets, this includes Yidney Rocks, The Oaks, Poyungan Valley and Eurong. 2 x QFES appliances with 4 personnel have been deployed to Happy Valley to assist.

The township of Happy Valley is likely to be impacted by ember attack and/or fire in the coming days. Community has made great progress in being prepared with the construction of mulched breaks to the north and south west of the town. Houses have been cleared of all unnecessary growth and gutters cleared.

The Happy Valley Community Association has developed a conclusive IAP and this will be the basis for the proposed activities.

## QFES IAP for Happy Valley Township

### DESCRIPTION OF CRITICAL ISSUES

It is assumed that strategic tracks identified in the Happy Valley Community plan have been upgraded/mulched/widened

1. Fire Track limitations
  - a. Tracks are generally very narrow and will require substantial works to improve effectiveness
  - b. Historically the success of Fraser Island Fire breaks is low with high levels of spot overs and breakouts.
  - c. The tracks follow contours and as such have numerous corners/pinch backs
2. The township is situated in a valley with between two sand dunes. This has the potential to create a funneling effect that influences the localised winds
3. The fires will tend to have an 'uphill' run from the East & West into the town – this has the potential to create more air borne embers.
4. The community is as prepared as it can be under the circumstances
  - a. Sprinkler systems are in place
  - b. Houses have been cleaned around
  - c. Additional private resources (slip on units) are available

Residents will stay & defend

### Valley of the Giants Sector

This sector is approximately 370 Ha Significant cultural information - Butchulla people - Butchulla people  
Significant cultural information - Butchulla people - Butchulla people

Fire has reached this sector and is slowly backing into the forested area. Fire continues to burn at a low intensity and is expected to emerge to the east. The fire will be monitored, Significant cultural information - Butchulla people - Butchulla people be targeted by water bombing aircraft to protect them where possible and as required.

### Yidney Sector

No current fire suppression. Active fire is in the vicinity of Eli Creek and currently this sector is under a watching brief. Visitor nodes at Eli Creek have been closed. 3 x QPWS on scene.

Community warning Fraser Island (K'gari) - bushfire warning level: Advice

Community Warning Kingfisher Bay Resort and Village - bushfire warning level: Watch and Act (low)

Control of the Duling Fire (Fraser Island) was transferred to QFES on 27 November 2020 with support from Queensland Parks and Wildlife Service (QPWS) and partners. The fire is burning in predominantly inaccessible terrain with approximately 82 000 Ha burnt (approx. 50% of Fraser Island).

A backing fire continues to travel northeast backing into the wind towards Sandy Cape. Sandy Cape Lighthouse infrastructure is secure. No crews are assigned to this sector; however, two volunteers are on site providing regular sitreps to DIVCOM. This location is currently closed to visitors. No change.

The southern edge of the main fire front has continued in a Southerly direction overnight crossing Dundonga Creek. Heavy water bombing continued yesterday (3/12/2020) which reduced the southward progression of the fire. Community warning level remains at Watch and Act (low).

Aerial mapping of the fire line to be conducted this morning to ascertain fire intensity, direction and exact position. Overnight crews have kept fire to the north of Cornwells Road. Water bombing activities will continue the western flank of the fire to Cornwells Road to the south. QPWS contracted machinery will continue working in this vicinity today to widen containment lines with ongoing aerial and ground support. There are currently 4 QPWS light attack appliances and 2 contracted machines working along Cornwells Road. The fire front is still to the north of Cornwells Road. 9 x QFES will assist in ground operations along Cornwells Rd today.

Preparing and assisting QPWS along Cornwell Road for tonight's burn.

A change over at 1730 with new crews to assist QPWS at tonight activities. Backburning will NOT be conducted. Crews will wait for fire to emerge to Cornwells Rd and extinguish. The LAT is intended to conduct 4 runs in this vicinity later this afternoon.

Tomorrow morning's crews will start to create bare earth breaks around Z force area.

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Community Warning Kingfisher Bay Resort and Village - bushfire warning level: Watch and Act (low)

SITUATION ANALYSIS - BACKGROUND & OBJECTIVES

Form ICS 2

|                |               |               |              |
|----------------|---------------|---------------|--------------|
| Incident Name: | Date Prepared | Time Prepared | Prepared By: |
| Duling WF      | 21/11/2020    | 2300 hrs      | Matt Davies  |

Values at Risk:

Built assets south of the current fire area (Kingfisher Bay Resort and Village, Happy Valley Township, K'gari, Yidney Rocks & Poyungan Valley private accommodation, Eurong Township, Dilli Village, Central Station).

World heritage listing, RAMSAR wetlands, unique hydrology, unique vegetation communities, vulnerable pattern fens, water mouse and ground parrot habitat.

Cultural heritage values, indigenous and shared (Bogimbah, Postans Camp, Urang log dump, Bellert's Hut).

Constraints & Other Considerations:

Fire has been burning for 5 weeks, burning through previously burnt country (2018/19 burns), already covered more 52,000ha, melaleuca/sedgeland complex on the western side of the island south of Moon Point has potential to wick south towards Kingfisher Resort. South of Moon Point Road last burnt 2006 in places.

Safety Risks & Hazards:

Moon Point Road closed to public west from Lake Garawongera. – Part Alert modified to reflect this.  
Sandy Cape Lighthouse precinct closed through Park Alert.  
Southern containment line (Moon Point Rd) is established.  
Pending future fire behaviour there may be a need to close additional camping areas in the southern part of the island.  
K'gari leased camp area: Work has been carried out inside the fenced area to reduce fuel load immediately adjacent to the fence.  
Cathedral Beach Resort & camping area secured on the northern edge, further asset protection may be required.

Current Incident Behaviour: as per twice daily sitreps, SABER reports and QFES reports

21/11/20  
  
Flanking fire putting pressure on MPR around the Northern Road intersection and heading westward after lunch. 1 air attack unable to control. Additional rotary and fixed wing aircraft called in to support which is keeping fire off MPR (approx. 300-400). Air support continuing into afternoon.  
  
1830 – Numerous spot overs on MPR from fire front approaching 1.5km west of Northern Road. Crews unable to hold fire on containment line – going fire in block south of MPR.  
  
2200 – Backburning continues eastward towards Yidney Scrub.  
  
Intention is to continue backburning into Yidney Scrub tonight.  
  
Aerial survey and water bombing booked for 7:30am tomorrow to target spot over. Ground crews to be onsite at 0600 for assessment and patrol.  
  
IMT focus tomorrow on fallback planning with QFES support.  
  
Daily aerial mapping identified an active fire front south of Sandy Cape Light-Station (not posing any immediate threat). Also identified active fire fronts to the north west of Cathedral Resort (not posing any immediate threat)

| Weather        | Temperature | Rel. Humidity | Wind Sp & Dir  | Comments             |
|----------------|-------------|---------------|----------------|----------------------|
| Current - 2300 | 24          | 61%           | 13 km E        | Taken at fire ground |
| Projected -    |             |               |                |                      |
|                |             |               |                |                      |
|                |             |               |                |                      |
|                |             |               |                |                      |
|                |             |               |                |                      |
| 20-206         |             |               | File G Release | Page 18 of 39        |

|                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Comments &amp; Outlook:</b></p> <ul style="list-style-type: none"> <li>- Machinery contractor progressing east along Moon Pt Road – works expected to be completed by tomorrow lunchtime.</li> <li>- 2 fall back lines are prepared south of Moon Point - Bogimbah &amp; Smith / Poyungan Roads.</li> </ul> |
| <p>IMT securing further resources for future works at Sandy Cape and Cathedrals</p>                                                                                                                                                                                                                               |
| <p>Cathedral Beach Resort &amp; camping area secured on the northern edge, containment line established on the southern side for further backburning. 3000L Tanker on site</p>                                                                                                                                    |
|                                                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                                                                                                                                                                                   |

- ### IMT securing further resources for future works at Sandy Cape and Cathedrals

Cathedral Beach Resort & camping area secured on the northern edge, containment line established on the southern side for further backburning. 3000L Tanker on site

## Protect life and property on K'Gari (Fraser Island)

**Maintain/keep fire north of Moon Point Road.**

Strengthen Moon Point firebreak with machinery contractors Significant cultural information - Bu

Implement back burn along Moon Pt Road from Puthoo Haul Road to tie off point within Yidney Scrub. Light up will be supported by waterbombing aircraft during daylight hours today and tomorrow.

Aerial mapping of entire fire ground occurring tomorrow 1030

## Time

**hrs**

Date : 6/12/2020 2:36:37 PM  
From : "CUBIS Mick"  
To : "OLIVER Nathan"  
Cc : "DARGUSCH Marc" , "CAMBOURN Neil"  
Subject : RE: NCR Regional Incident Summary as at 1000 hours  
Attachment : IRPG2-20Bushfire Agents V5-1.pdf;image001.png;image003.png;  
Hi Nathan

Attached is the procedural guide for use of retardants.

Phos-chek is on the list, which mean it is approved for use, with some provisos regarding its use, particularly near waterways. It also states in part:-

Use of Phos-Chek® products with lower DAP and MAP content are preferable near waterways to minimise the risk of adverse effects from misapplication. If a particular formulation of any brand with a high content of DAP or MAP is to be used then the additional ammonium content may need to be considered in terms of potential acute toxicity for waterways. The relationship of the ammonium to phosphate in the three forms is illustrated below.

So as discussed, can be used if required to protect life and property, and/or in accordance with recommended applications in the procedural guide where possible. Happy to discuss further if needed, so call any time.

Hope it goes well protecting Happy Valley.

thanks

**Mick Cubis**  
Regional Director, Coastal and Islands Region  
GBRMC | QPWS & Partnerships  
Department of Environment and Science

P: 07 54471137 M: **Personal**  
240 Moorindil Street, Tewantin  
Qld 4565  
[mick.cubis@des.qld.gov.au](mailto:mick.cubis@des.qld.gov.au)

---

**From:** OLIVER Nathan <Nathan.Oliver@des.qld.gov.au>  
**Sent:** Sunday, 6 December 2020 12:03 PM  
**To:** CIR Fire Team; CUBIS Mick; DARGUSCH Marc; BULLEY Graeme; SEELEITHER Jamie; BLACKMAN Boyd; BARRACLOUGH Emma; HARVEY Peter; YETMAN Brendon; KLEKAR John; gadejould; rachel.killer@bac-kgari.org; LAYFIELD Wayne; CAMBOURN Neil; BUCKLEY Andrew; HEAD Damien; KLAASSEN Ben; HARRIS Leigh; BURNHAM Mark; SPINKS Troy; RCC Seqr  
**Subject:** NCR Regional Incident Summary as at 1000 hours



**Nathan Oliver**  
Principal Ranger Fire Management  
South East Queensland Region | QPWS & Partnerships  
Department of Environment and Science  
P: **Personal**  
Kabool Road, West Burleigh 4220  
[www.des.qld.gov.au](http://www.des.qld.gov.au)

### 2.20 – Use of bushfire firefighting agents

*This Guideline provides guidance, explanation and information to assist staff in the completion of specific tasks or in making certain judgments in the interpretation or application of standards used by the Department of Environment and Science in assessing compliance with standards related to environmental and regulatory requirements. This Guideline is for internal use only but may be referenced as the basis for a decision.*

#### Purpose and scope

This document guides personnel on the issues to consider in bushfires for the use of firefighting agents on Parks estate and more broadly for vegetation fires across Queensland. The purpose of this Procedural Guide is to pre-inform and facilitate decision-making on the use and response measures for firefighting agents in controlled burns and in emergencies. Products in use or proposed for use in Queensland are referenced but *this is not an endorsement or recommendation of any product*. This Procedural Guide does not cover the use of firefighting agents on industrial chemicals or liquid fuel fires such as oils, diesel, petrol, solvents or alcohol that are Class B fires.

#### Background

A variety of agents variously described as fire retardants, suppressants, water enhancers and firefighting foams are utilized in bushfires (rural) and rural-urban interface (i-zone) firefighting, in addition to, or to enhance the use of water [1]. These agents may be applied to the fire ground using methods including aerial fixed-wing tankers, helicopters and ground appliances. The composition of these agents influences both their behaviour in a fire and the potential environmental effects of unburned residues and decomposition products.

Most products currently in use for bushfire firefighting are of very low risk to the environment from their normal application or from their residues and breakdown products. However, the compositions of products and their use in each scenario need to be considered to assess the potential for adverse environmental effects on sensitive receptors and to assess whether mitigation measures are needed. This Procedural guide covers those classes and brands of agents that are in use or are proposed for bushfire firefighting in Queensland.

In assessing particular products, it is worth noting that safety data sheets (SDS) for many products can be unreliable, inadequate and even misleading and so should not be relied upon as the main source of product information and effects. The SDS for many chemicals including firefighting products can be particularly deficient in information relevant to environmental issues. However, provided there is sufficient information on product composition and effects from the SDS and other sources, an adequate assessment can be made of the potential risks to the environment, and how the risks should be managed.

Overall, the use of bushfire firefighting agents under normal application conditions of low concentrations spread along fire fronts is unlikely to have any long-term adverse environmental effects with a very low probability of significant acute short-term effects on the areas of application.

The main, but unlikely, risk from fire retardants, suppressants and foams is from concentrate spills or localised dumping that may then enter an enclosed waterway of limited volume, such as a billabong or pool of limited water volume that can be the dry-season refuge for many aquatic species and are particularly sensitive to upsets. Where there is limited dilution and flushing there is the potential for sufficient concentrations of contaminants to cause a fish-kill due to acute toxicity effects or dissolved oxygen depletion from biochemical oxygen demand (BOD) as organic components decay.

There is also the potential for fish-kills and environmental disruption in waterways from the delayed promotion of algal blooms, e.g., by nitrogen and phosphorous nutrient effects, that can lead to eutrophication and related dissolved oxygen depletion. As handling of large volumes of firefighting agents will usually be under controlled conditions at facilities away from the fire and sensitive environments this risk can be easily managed.

This Procedural Guide refers to three main groups of firefighting agents used in bushfire firefighting and control. Details of product compositions and environmental characteristics are given as a ready reference in case situations arise when further urgent assessment is needed. While some products crossover in their firefighting functions, the main classes of agents are:

**Section 1 – Bushfire retardants.** Used to form a chemical firebreak on vegetation ahead of the fire front.

**Section 2 – Bushfire suppressants** – Used in direct attack to extinguish the fire or to slow its progress.

**Section 3 – Firefighting foam** (Class A) – Used in direct attack to extinguish or slow the fire, penetrate burning fuel and to wet down areas to prevent re-ignition.

Where it is practicable, the landowner or manager of potentially affected land parcels should be consulted on the proposed use of firefighting agents to establish what sensitivities may be present and what mitigation measures may be needed.

## 1 BUSHFIRE RETARDANTS

Fire retardants are chemicals laid down on vegetation ahead of the fire front principally to act as a firebreak against the advancing fire front by inhibiting ignition and combustion. There are a number of different types and compositions of fire retardants available for use on bushfires.

The burning of solid fuels in flaming combustion primarily involves a three-stage process of:

- heating the fuel to initiate breaking of chemical bonds in the fuel
- thermal degradation (pyrolysis) to produce volatile gases
- ignition of the volatile gases with oxygen (vapour-phase combustion).

Combustion of the fuel continues in a feedback loop if the heat from the burning volatiles is sufficient to generate further volatile gases. Fire retardants for vegetation fires seek to interrupt one or more of these process stages [2, 3] through a combination of:

- Insulating the fuel from heat by reducing the temperature at which surface char is produced.
- Reducing generation of flammable gases by reducing fuel temperature.
- Suppressing ignition of volatile gases by generating water vapour or carbon dioxide.

Common formulations of fire retardants have inorganic ammonium phosphate, ammonium polyphosphates or ammonium sulfate as their main constituents, plus additives to improve the physical properties and behaviour and to enhance the retardant effect. Fire retardants in use in Queensland that function in this way include products by Phos-Chek® and FireLimit® products.

The main environmental concerns for the application of fire suppressants is in relation to direct acute short-term toxic effects (unlikely) and longer term chronic effects such as nutrient enhancement by nitrogen and phosphorous, particularly for enclosed waterways and low nutrient ecosystems. In general, adverse environmental effects are unlikely in normal application but retardant use needs to be considered in terms of the local values and sensitivities.

### 1.1 AMMONIUM PHOSPHATE RETARDANTS

Phos-Chek® is an ammonium phosphates-based retardant in use in Queensland, the primary components are combinations of:

- Ammonium polyphosphate, di-ammonium monophosphate and mono-ammonium phosphate.

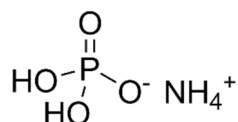
- Organic gum thickeners to enhance integrity of the droplets during aerial free fall.
- Corrosion inhibitors plus conditioners such as clay and inorganic calcium phosphate.
- Colouring agents (red/orange) to provide a visual indication of application [4,5].

| Product                                        | Composition                                                                                            | Acute toxicity concentrate (fish)        | Acute toxicity diluted (fish)                                      |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------|
| PHOS-CHEK® MVP-Fx<br>[4]                       | Mono-ammonium phosphate 80-90%<br>Di-ammonium phosphate 5-10%<br>Performance additives < 15%           | 2,183 mg/L<br><i>Relatively Harmless</i> | @10% 21,830 mg/L<br>@15% 14,533 mg/L<br><i>Relatively Harmless</i> |
| PHOS-CHEK® LC95A<br>PHOS-CHEK® LC95A-MV<br>[6] | Ammonium polyphosphate 60-80%<br>Performance additives 5-10%<br>Attapulugus clay & iron oxide 0.5-1.5% | 435 mg/L<br><i>Practically Nontoxic</i>  | @10% 4,350 mg/L<br>@15% 2,900 mg/L<br><i>Relatively Harmless</i>   |
| PHOS-CHEK® LC95W<br>[7]                        | Ammonium polyphosphate 80-100%<br>Performance additives 5-10%<br>Attapulugus clay 1-5%                 | 465 mg/L<br><i>Practically Nontoxic</i>  | @10% 4,650 mg/L<br>@15% 3,100 mg/L<br><i>Relatively Harmless</i>   |
| PHOS-CHEK® LC95A-Fx<br>[8]                     | Ammonium polyphosphate >85%<br>Performance additives <8%<br>Attapulugus clay <5%                       | 399 mg/L<br><i>Practically Nontoxic</i>  | @10% 3,990 mg/L<br>@15% 2,660 mg/L<br><i>Relatively Harmless</i>   |

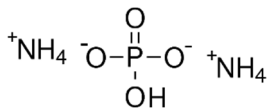
Note that the published Safety Data Sheet for Phos-Chek® MVP-Fx issued for Australia (15 May 2017) is inadequate, does not meet Queensland's SDS information requirements and cannot be relied upon as it provides little or no information in regards to composition of the product or environmental and disposal considerations. Instead, the US SDS has been used for the composition of Phos-Chek® MVP-Fx and other Phos-Chek® products. The main consideration from an environmental perspective between the different formulations of ammonium phosphate retardants are the degradation rates and ammonium content in that:

- Ammonium polyphosphates (APP) tend to degrade slowly to release nitrogen and phosphorous compounds that are environmentally available.
- Di-ammonium phosphate (DAP) and mono-ammonium phosphate (MAP) are forms that are readily soluble and therefore readily environmentally available.
- Di-ammonium monophosphate has twice the ammonium/nitrogen content of polyphosphates and mono-ammonium phosphate relative to the phosphate content.
- Di-ammonium phosphate and mono-ammonium phosphate (where they are the main component) are potentially of concern for aquatic environments via the high solubility and immediate availability of the toxic ammonium ion in the case of large spills.

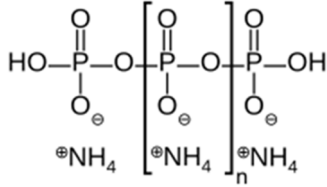
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Mono-ammonium phosphate. Note the single NH<sub>4</sub><sup>+</sup> ammonium ions per phosphate.



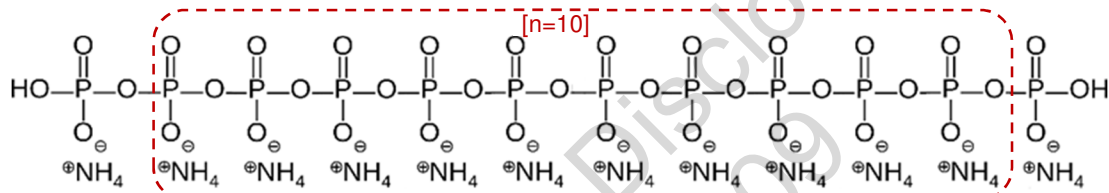
Di-ammonium monophosphate  $(\text{NH}_4)_2\text{HPO}_4$ . Note the 2 x  $\text{NH}_4^+$  ammonium ions per phosphate.



Ammonium polyphosphate  $\text{NH}_4\text{HPO}_4 [\text{NH}_4 \text{PO}_3]_n \text{HPO}_3$

Note the single ammonium ion ( $\text{NH}_4^+$ ) per phosphate group.

The “n” in the bracketed “[...]n” in the polyphosphate formula denotes that there are repeated  $[\text{NH}_4 \text{PO}_3]$  moieties in the molecule. For example, the “[...]10” in  $\text{NH}_4\text{HPO}_4 [\text{NH}_4 \text{PO}_3]_{10} \text{HPO}_3$  denotes “10” ammonium phosphate moieties between the  $\text{HPO}_4/3$  groups, attached at each end in the APP molecule shown below:



The overall length of the polyphosphate molecules affect their thermal and environmental stability and water solubility. Given that the mode of application is by 10-15% solution dissolved in water, the polyphosphate molecule lengths in fire retardants is likely to be the more soluble short chains of less than  $n=100$  but nonetheless large molecules. Short-chain polyphosphates start to decompose at about  $150^\circ\text{C}$ , which also triggers their decomposition and retardant effect as would occur as the bushfire front approaches [9].

### 1.1.1 Mode of phosphate fire retardant action in fires

Retardants are applied in solutions diluted in water for application spread over large areas, for Phos-Chek® dilution for application is from 10% to 15% [4]. The water involved in the delivery mode evaporates as the fire approaches and does not contribute to fire retardation. Thickeners in the retardant aid water droplet free-fall integrity and enable adhesion to the surfaces of the vegetation (fuel). Once the retardant coating is on the vegetation, the fire retardant effect is achieved through the combined action of:

- **Exposure to heat** decomposes the retardant to ammonia and phosphoric acid.
- **Phosphoric acid** acts in combination with the combustible material such as wood cellulose to catalyse the formation of heat-unstable phosphate esters.
- **Phosphate esters** then decompose to produce carbon dioxide to dilute the oxygen in the air plus water vapour that cools the fire.
- **A carbon char layer** is left on the fuel surface insulating it and inhibiting ignition.

Therefore, there are two circumstances to consider in regards to the potential releases to the environment by the use of ammonium phosphate and polyphosphate flame-retardants:

- Retardant combustion products and residues present after involvement in the fire front.
- Retardant left on materials not involved in the fire (vegetation, soils, rocks, etc.).

### 1.1.2 Phosphate retardant subject to the fire

Where the retardant has been involved in the fire front, the reactions that occur will result in the degradation of the polyphosphates and release of nitrogen and phosphorous end-point products being mostly as phosphates and some nitrates (given that most of the ammonia produced in early reactions may well have been lost by combustion or volatilisation to air). Some unaltered retardant may also remain; polyphosphates will degrade slowly according to available moisture and exposure to sunlight while mono-phosphates and nitrogen compounds will be immediately available for uptake by plants. Carbonaceous char layers produced by the retardant on the surface of partially burnt vegetation does not pose any environmental threat and will be an insignificant proportion of the other char layers and charcoal from the fire.

### 1.1.3 Un-combusted retardant polyphosphates

Short-chain polyphosphates ( $n < 100$ ) are non-volatile and relatively stable. In contact with water, they will hydrolyse to mono-ammonium phosphate (orthophosphate) which is unstable and will further react to form other phosphates thereby making the phosphorous environmentally available for uptake by plants as a nutrient. Photolysis by exposure to sunlight is likely to cause similar degradation. Any ammonium component ( $\text{NH}_4^+$ ) not consumed in the fire will be oxidised to nitrite ( $\text{NO}_2^-$ ) and then to nitrate ( $\text{NO}_3^-$ ) by *nitrosomonas* and *nitrobacter* microbes, reducing the toxicity and ultimately making the nitrogen available as a nutrient to plants.

Un-combusted retardant on an area is likely to degrade slowly through exposure to moisture and sunlight, until there is sufficient rainfall to promote degradation by hydrolysis and wash the resulting nitrogen and phosphorous products into the soil where they can be taken up by plants.

### 1.1.4 Phosphate retardant fate and effects in the environment

Releases of the ammonium phosphate compounds and their combustion products to the environment can have several effects if in sufficient concentrations including:

- **As sources of nitrogen and phosphorous** (N & P) that promotes local plant growth on land.
- **Promotion of algal blooms** in waterways from N and P nutrient effects leading to eutrophication and dissolved oxygen depletion.
- **Acute (short-term) toxicity** for aquatic fish and invertebrates from the ammonium component, but only at elevated concentrations ( $\sim > 1.8 \text{ mg/L NH}_4$ ) such as from a spill of concentrate.

Whether the retardant is involved in the fire or remains as un-combusted residue on the vegetation and soils, the eventual fate for the nitrogen and phosphorous content is their release to the environment. The difference between the scenarios of burnt *versus* unburnt retardant is mainly in the timing and rate of release of nitrogen and phosphorous in biologically available forms against consideration of the assimilative capacity of the local vegetation in an affected area to take up and use the nitrogen and phosphorous for plant growth. In a vegetation fire phosphorous is naturally released to the soil and nitrogen is volatilised so negative impacts are from the small amount of phosphorous contributed by the retardant are likely to be negligible.

Acute toxicity in aquatic environments from normal retardant use is highly unlikely given that acute toxicity for fish (Rainbow trout LC50) for polyphosphate retardant concentrates range from 399 mg/L to 2,183 mg/L [4,8].

Across the available formulations when dilution for application at 10-15% is factored in, the acute toxicity would require concentrations as high as 2,660 mg/L to 21,830 mg/L, which classes as *Relatively Harmless* [10] this is even before further large-scale dilution occurs if the already dilute retardant then enters a waterway.

Given that the application of retardant will be dispersed over areas of existing vegetation growth because that has a fuel load that will carry a fire, then there is likely to be sufficient potential for later uptake by

plants that will assimilate the nutrients, thereby limiting movement to waterways. To a small extent, the nitrogen and phosphorous nutrients may promote local vegetation regrowth after the fire.

## 1.2 AMMONIUM SULFATE RETARDANTS

FireLimit® FL-02 (also branded as LineLimit® LL-02) is an ammonium sulfate-based retardant that may be used in Queensland, the primary components are:

- Ammonium sulfate ( $(\text{NH}_4)_2\text{SO}_4$ ) (>60%).
- Organic gum thickeners, (<5%) to enhance integrity of the droplets during aerial free fall.
- Performance additives (inorganic, >35%).
- Colouring agents (red/orange) to provide a visual indication of application [11, 12].

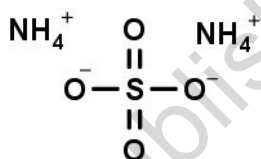
The manufacturer has advised that iron oxide (non-degradable) colourant use was discontinued from 2014 and that only 100% biodegradable food-grade colourants are now used.

| FireLimit® FL-02 retardant [12]                                          |                                 |                                                        |                                   |                                                                   |
|--------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------|
| Organism                                                                 | Concentrate acute toxicity mg/L | US Fish and wildlife toxicity category for concentrate | Suppressant dilute solutions mg/L | US Fish and wildlife toxicity category for dilute suppressant [8] |
| <b>Fish</b><br>LC50 96 hour<br>Zebrafish<br>( <i>Brachydanio rerio</i> ) | 6,930                           | >1,000 mg/L<br><i>Relatively Harmless</i>              | @10% 69,300                       | >1,000 mg/L<br><i>Relatively Harmless</i>                         |
| <b>Crustaceans</b><br>EC50 48 hour<br>( <i>Daphnia magna</i> )           | >10,000                         | >1,000 mg/L<br><i>Relatively Harmless</i>              | @10% >100,000                     | >1,000 mg/L<br><i>Relatively Harmless</i>                         |

The main consideration from an environmental perspective for the FireLimit® FL-02 retardant is the ammonium content in that:

- Ammonium sulfate is readily soluble making the ammonia mobile and environmentally available.
- Ammonium sulfate has two ammonium ions for each sulfate group, i.e.,  $(\text{NH}_4)_2\text{SO}_4$ .
- Ammonium sulfate is potentially of concern for aquatic environments via the high solubility and immediate availability of the toxic ammonium ion in the case of large spills.

The relationship of the ammonium ions to the sulfate group is illustrated below.



Di-ammonium sulfate. Note the two  $\text{NH}_4^+$  ammonium ions per sulfate.

Given that the mode of application FL-02 is as 10% concentrate dissolved in water with a 65% ammonium sulfate concentrate content, the final concentration of ammonium sulfate in the application solution is relatively low at about 6.5% with the ammonium content being about 1.8% by weight. The inorganic performance additives would add a small additional source of nitrogen.

### 1.2.1 Mode of ammonium sulfate fire retardant action in fires

Retardants are applied in solutions diluted in water for application spread over large areas, for FireLimit® FL-02 the dilution for application is 10% [11]. As for other retardants, the water involved in the delivery mode evaporates as the fire approaches and does not contribute to fire retardation. Thickeners in the retardant aid water droplet free-fall integrity and enable adhesion to the surfaces of the vegetation (fuel).

Once the retardant coating is on the vegetation, the fire retardant effect is achieved through the combined action of:

- **Exposure to heat** initiates reactions between the retardant and cellulose in the vegetation.
- **Dehydration reactions** reduce the production of combustible volatiles from the wood when it decomposes to produce carbon dioxide to dilute the oxygen in the air plus water vapour.
- **A carbon char layer** is generated on the fuel surface at a lower temperature than usual insulating it and inhibiting ignition.

Therefore, there are two circumstances to consider in regards to the potential releases to the environment by the use of ammonium sulfate flame-retardants:

- **Retardant combustion products** and residues present after involvement in the fire front.
- **Retardant left on materials** not involved in the fire (vegetation, soils, rocks, etc.).

### 1.2.2 Ammonium sulfate retardant subject to the fire

Where the retardant has been involved in the fire front, the reactions that occur will result in the degradation of the ammonium sulfate, primarily by the liberation and combustion of the ammonia. The residual sulfate is not likely to have any effect on environmental values, as sulfate is relatively common and benign in the environment. Any small amount of residual ammonia or related compounds would be taken up by plants or utilised by soil microbes. The inorganic performance additive content would contribute some additional nitrogen that would also be taken up by plants.

Carbonaceous char layers produced by the retardant on the surface of partially burnt vegetation would not include significant concentration of ammonium sulfate (if any) and char does not pose any environmental threat and will be an insignificant proportion of the other char layers and charcoal from the fire.

### 1.2.3 Un-combusted ammonium sulfate retardant

Residual ammonium sulfate from FireLimit® FL-02 on vegetation not involved in the fire is unlikely to cause adverse environmental effects. The most sensitive environmental receptors are enclosed waterways, low nutrient soils and their associated plant species. The dilute form of the retardant and its low rate of application over broad areas make adverse effects on low-nutrient soils and plants highly unlikely. However, retardant application may need to be considered for particularly sensitive locations on a case-by-case and net-benefit analysis basis.

For example, an area with sufficient fuel load to carry a fire may be an indication that there is sufficient vegetation present with the assimilative capacity to take up a small extra load of nutrients from retardants. The alternative of allowing the vegetation and fallen litter to burn may have an adverse effect by the immediate release of nutrients from burning, interrupting the normal, much slower, vegetation-to-soil nutrient cycling process.

Retardant application to riparian areas and waterways is undesirable due to the small risk from acute toxicity, BOD and nutrient effects. However, acute toxicity in aquatic environments from normal ammonium sulfate retardant use is highly unlikely, given that acute toxicity for fish and crustaceans for FireLimit® FL-02 retardant concentrate is 6,390 mg/L and >10,000 mg/L respectively. This falls in the acute aquatic toxicity category of *Relatively Harmless* (>1,000 mg/L) [11, 10] for both the concentrate and for the 10% application solution. This is even before further large-scale dilution occurs if small amounts of the already dilute and dispersed retardant then enter the water body.

The composition of FireLimit® FL-02 is almost entirely soluble inorganic chemicals with very low organic content and therefore very low biochemical oxygen demand (BOD) potential so it does not pose a risk of oxygen depletion in waterways.

Any ammonium component ( $\text{NH}_4^+$ ) and other nitrogenous compounds from any retardant not consumed in the fire will be volatilised or eventually oxidise to nitrite ( $\text{NO}_2^-$ ) and then to nitrate ( $\text{NO}_3^-$ ) by *Nitrosomonas* and *Nitrobacter* microbes in the soils and water, progressively reducing the toxicity and ultimately making the nitrogen available as a minor source of nutrient to plants.

The ammonia content of un-combusted retardant on an area is likely to degrade slowly through exposure to moisture and sunlight until there is sufficient rainfall to promote degradation by microbial action and hydrolysis, the resulting nitrogen and sulfate products into the soil where they can be taken up by plants.

#### 1.2.4 Ammonium sulfate retardant fate and effects in the environment

Releases of the ammonium sulfate to the environment can have several effects if in sufficient concentrations including:

- **As a source of nitrogen** that promotes local plant growth on land.
- **Promotion of algal blooms** in waterways from the nutrient effect of nitrogen leading to eutrophication and dissolved oxygen depletion.
- **Acute (short-term)** toxicity for aquatic fish and invertebrates from the ammonium component, but only at elevated concentrations ( $\sim >1.8 \text{ mg/L NH}_4$ ) such as from a spill of concentrate that reaches a waterway.

Whether the retardant is involved in the fire or remains as un-combusted residue on the vegetation and soils, the eventual fate for the nitrogen and sulfate content is their release to the environment. The difference between the scenarios of burnt *versus* unburnt retardant is mainly in the timing and rate of release of nitrogen and sulfate in biologically available forms against consideration of the assimilative capacity of the local vegetation in an affected area to take up and use the nitrogen for plant growth.

### 1.3 OVERALL CONSIDERATIONS FOR FIRE RETARDANT USE

Fire retardants are applied as a dilute solution (10%-15%) resulting in a very thin coating on vegetation, soils and other surfaces spread over a large area. Residues and combustion products will be limited in concentration with the immediate and progressive slow release of end-point nutrients generally unlikely to result in noticeable effects on plant growth or waterway health or other values.

Where the retardant is applied to existing vegetation because there is a fuel load that will carry a fire, then there is likely to be sufficient potential for later uptake by plants that will assimilate the nutrients, thereby limiting movement to waterways. To a small extent, the nitrogen nutrients resulting from the phosphorous and ammonia content (nitrite and nitrate) may promote local vegetation regrowth after the fire.

Where there are particular values present in an area the pros-and-cons of retardant use, mitigation measures or avoidance areas will need to be considered on an individual basis in the context of the particular threats posed by the fire and/or retardant use including:

- **Sensitive, rare or threatened** flora, fauna, or habitats are present.
- **Proximity of sensitive waterways** (e.g., dry-season refuge pools for aquatic species).
- **Cultural resources**, historic properties or sacred sites.
- **Very large volumes of retardant** is spilled or applied in one location that could impact the adjacent values.

It is assumed that fire retardant would only be used when the fire front is about to overtake an area with the result of full involvement and possible severe damage to or loss of infrastructure, environmental or other values. On that basis, a net impact-versus-benefit analysis would be heavily in favour of retardant use given the fire protection benefits versus the much lower risk of related adverse and probably temporary effects.

Subject to proper handling and management of concentrates and proper response to large spills, ammonium phosphate, polyphosphate and sulfate fire retardants would be suitable for use on QPWS estate.

The general composition of the Phos-Chek® MVP-FX and Phos-Chek® LC95 fire retardants for use in Queensland have been reviewed based on the manufacturer's composition data. Retardants of similar composition would also be suitable. A range of Phos-Chek LC95 product variants were reviewed, while they are all based on ammonium phosphates some, such as Phos-Chek LC95A and LC95A-MV contain iron oxide colourant that could result in long-term rust staining of vegetation, rocks and facilities. The composition of the FireLimit® FL-02 retardant has been reviewed based on published public data and information supplied by the manufacturer.

### 1.3.1 Flora and fauna

In some circumstances there may be a low risk of temporary acute effects on sensitive flora or fauna from intense retardant use such as:

- **Photosynthesis inhibition** from colouring agents on leaves, especially non-degradable iron oxide pigments that may permanently stain leaf surfaces.
- **Leaf scalding on sensitive species** from the retardant components, degradation products or use of non-potable water such as seawater (e.g., ferns and orchids).
- **Tainting of resources** such as food items consumed by wildlife.

Given the likely conditions during a fire would be extended hot, dry weather, retardant is unlikely to be taken up significantly by the foliage of plants, as the stomata on their leaves are likely to be closed to prevent water loss. Similarly, the long molecular chains of the polyphosphates are likely to be too big to be adsorbed through the leaf surfaces. The use of saline water from brackish or seawater sources for firefighting are unlikely to have significant adverse effects, as application will be spread over a wide area as only a minor contribution to natural soil salts levels.

As a precaution against long-term staining of long-lived or sensitive foliage that may inhibit photosynthesis, for example, cycads (*Cycas* spp.) and grass trees (*Xanthorrea* spp.), and to prevent aesthetic visual staining of vegetation or infrastructure, especially on Parks estate, it should be specified that:

- **Retardants containing iron oxide colourants are not to be used** as they may cause long-term staining.
- **Only retardants with fugitive (biodegradable) colourants are to be used.**

For example, a retardant that is described as containing a fugitive colourant, that will slowly fade during exposure to sunlight would be suitable and not result in significant effects.

### 1.3.2 Sensitive waterways

Generally, polyphosphate fire retardants are unlikely to have any significant short or long-term effects on waterways in normal use. Retardants based on di- and mono-ammonium phosphates and ammonium sulfates would be of slightly higher risk due to their immediate solubility with the immediate availability of the ammonium component. The main environmental risk would be from spillage or dumping of large volumes of concentrate where it may then travel to a waterway.

Enclosed waterways with limited volumes and turnover are sensitive to acute effects of ammonia toxicity and nutrient enrichment by nitrogen and phosphorous. Where practicable it is desirable to have a buffer (50m to 100m) between the waterway and the application of retardants not only to limit the direct effects of the retardants but also to protect the corridor of riparian vegetation along the waterway for wildlife.

However, in some circumstances, it may be necessary to apply retardants directly to riparian vegetation along a waterway, such as when it is particularly high-value, under direct threat and likely to be lost. Preserving riparian vegetation may also be a priority to maintain ground cover prevent erosion. A net

benefit analysis may show it is better to protect that environmental value and integrity of the habitat from fire versus potential short-term low-level nutrient enhancement. For example, the threat of fire spot-overs that may jump a chemical or physical firebreak into very high-value vine-forest with very long recovery times (decades).

## 2 FIRE SUPPRESSANTS

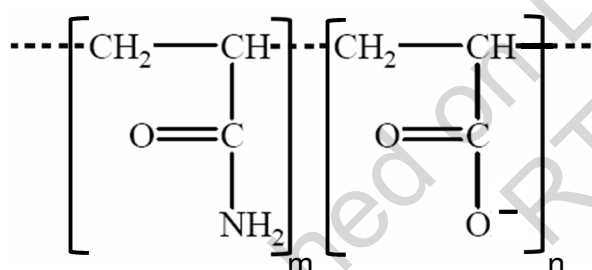
Bushfire suppressants are usually water enhancing gels comprised of super absorbent polymers that can absorb and retain aqueous solutions many times their own weight. They are applied by aerial drops or ground appliances to the fire front as dilute solutions over large areas to suppress and extinguish the fire [13]. The polymers in fire suppressants add to the firefighting effect of the water by:

- **Enhancing the cohesion of the water** droplets during freefall and reducing drift off target.
- **Reduce evaporation of water** as the suppressant enters the heat zone of the fire.
- **Adhesion to vegetation** to cool the fire by evaporation and breaking polymer-to-water bonds.

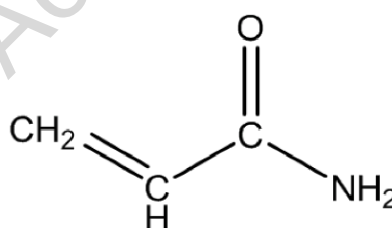
The fire suppressant BlazeTamer380, available for use for bushfires in Queensland, is a water enhancer but differs from other suppressants in that it uses a modified linear polymer emulsion to enhance application behaviour and fire suppression characteristics. The primary components of BlazeTamer380 are:

- Anionic polyacrylamide and surfactants (unspecified content).
- “Distillates (petroleum), hydrotreated light” up to 20% [14].

The anionic polyacrylamide in BlazeTamer380® has a very high molecular weight (i.e., large molecules), low mobility in soil, low acute toxicity and is resistant to microbial biodegradation but it will degrade to smaller polymer segments (oligomers) subject to photolysis (sunlight UV exposure) [16]. Degradation to smaller components significantly increases the polymer mobility and raises the concern that the polyacrylamide may produce acrylamide (the single monomer) that is a known toxin and carcinogen [16].



**Anionic polyacrylamide** unit with “m” denoting the number of acrylamides and “n” denoting the number of anionic (negatively charged) acrylates repeated in the chain.



**Acrylamide monomer.** A potential breakdown product of high molecular weight polyacrylamides.

Similar polyacrylamides have long been used in drinking water treatment for flocculation, agricultural soil conditioning, geotechnical soil stabilization and as a viscosity enhancer in the oil industry. In these applications, the polyacrylamide remains largely intact, as it is resistant to degradation under normal conditions.

### 2.1 Mode of fire suppressant action in fires (BlazeTamer380®)

For BlazeTamer380® the concentrate is used at a rate of less than 1% (0.2% to 0.65%) [15]. The anionic polyacrylamide elastomer used in BlazeTamer380® increases the cohesion and viscosity of the firefighting water so that aerial drops used for direct attack disperse less, evaporate less and adhere to vegetation on contact. As well as direct fire attack, BlazeTamer380® can be used as a retardant in front of the fire. The elastomer binds strongly with the water acting to provide:

- **Cohesion and less drift** of the water droplets during freefall.

- **Cooling the fire** as heat energy is used to break the elastomer–water bonds.
- **Adhesion to vegetation** that is or may be fuel in the fire.
- **Penetration further into the canopy** on heating as the suppressant on upper vegetation become less viscous and drips down.

## 2.2 Suppressant subject to the fire

With normal application of suppressants directly to the fire front, some suppressant will be completely degraded to carbon dioxide, water and nitrogen oxides in the fire with no significant potential to cause environmental harm. Assuming the suppressant is effective on the fire front as a suppressant or firebreak, a proportion will remain un-degraded or only partially degraded from the original composition.

Considerations for BlazeTamer380® involved in the fire include:

- **Complete combustion in the fire** is unlikely to produce hazardous breakdown products but residues are likely in unburnt and partially burnt areas such as when used for firebreaks.
- **Hydrocarbon distillates** component of BlazeTamer380® in the fire will mostly be combusted or volatilised. Residues of kerosene-based distillates, where they are not involved in the fire, are likely to occur only at very low levels from the dilute suppressant solution and widely dispersed from application. Any remaining hydrocarbons will volatilise or biodegrade under environmental conditions.

Polyacrylamide residues after involvement in the fire are likely to be minor instances of nitrogen compounds such as nitrate and traces of sooty carbonaceous material from partial combustion.

## 2.3 Un-combusted suppressant

Where the polyacrylamide suppressant is not involved in the fire or a proportion remains un-degraded or only partially degraded from the original composition the overall, key considerations BlazeTamer380® use include:

- **Acute (short-term) toxicities** for aquatic fish, invertebrates, algae and bacteria are very low for the BlazeTamer380® product [14] either as concentrate or as dilute suppressant.
- **Hydrocarbon distillates** residues of BlazeTamer380® kerosene-based distillates not involved in the fire, are likely to rapidly volatilise or biodegrade under environmental conditions.
- **Unaltered anionic polyacrylamide** residue in soils is largely inert, has low mobility and low toxicity and is unlikely to have any direct adverse effects.
- **Nitrogen from the amide component (-NH<sub>2</sub>)** of intact polyacrylamide will be released slowly and only contribute a small proportion of nitrogen (as a plant nutrient) in breakdown products.

Acute toxicity LC50 and EC50 values for aquatic environments are cited for the product as sold [14] and summarised in the table below.

| BlazeTamer380® suppressant [14]                                          |                                 |                                                        |                                                  |                                                                    |
|--------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------|
| Organism                                                                 | Concentrate acute toxicity mg/L | US Fish and wildlife toxicity category for concentrate | Suppressant dilute solutions mg/L                | US Fish and wildlife toxicity category for dilute suppressant [10] |
| <b>Fish</b><br>LC50 96 hour<br>Zebrafish<br>( <i>Brachydanio rerio</i> ) | 178 - 357                       | 100-1,000 mg/L<br><i>Practically Nontoxic</i>          | @0.2% - 89,000-178,500<br>@0.65% - 27,385-54,923 | >1,000 mg/L<br><i>Relatively Harmless</i>                          |
| <b>Crustaceans</b><br>EC50 48 hour<br>( <i>Daphnia magna</i> )           | 212                             | 100-1,000 mg/L<br><i>Practically Nontoxic</i>          | @0.2% - 106,000<br>@0.65% - 32,615               | >1,000 mg/L<br><i>Relatively Harmless</i>                          |
| <b>Algae</b><br>EC50 48 hour<br>( <i>Chlorella vulgaris</i> )            | >1,000<br>(NOEC 708)            | >1,000 mg/L<br><i>Relatively Harmless</i>              | @0.2% - 500,000<br>@0.65% - 153,846              | >1,000 mg/L<br><i>Relatively Harmless</i>                          |

| BlazeTamer380® suppressant [14]                              |                                 |                                                        |                                                   |                                                                    |
|--------------------------------------------------------------|---------------------------------|--------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------|
| Organism                                                     | Concentrate acute toxicity mg/L | US Fish and wildlife toxicity category for concentrate | Suppressant dilute solutions mg/L                 | US Fish and wildlife toxicity category for dilute suppressant [10] |
| <b>Bacteria</b><br>EC10/EC50 18 hour<br>(Pseudomonas putida) | EC10 127<br>EC50 892            | 100-1,000 mg/L<br><i>Practically Nontoxic</i>          | @0.2% - 63,500-19,583<br>@0.65% - 446,000-137,231 | >1,000 mg/L<br><i>Relatively Harmless</i>                          |

Toxic acrylamide monomer may be released slowly as a minor component during breakdown of the polyacrylamide but this is likely to be transient and degraded microbially to traces of acrylic acid, ammonia and nitrates that can be taken up by plants.

## 2.4 Fire suppressant fate and effects in the environment

Water enhancing and gel fire suppressants based on super absorbent polymers need to be considered in terms of composition and application rates. While the polymers and surfactants used in fire suppressants will ultimately be degradable, their persistence in the environment and potential for adverse effects depends on their formulations.

In the case of BlazeTamer380® used in Queensland, the composition includes anionic polyacrylamide, surfactants and solvent hydrocarbons. Acute toxicity effects for BlazeTamer380® probably relate mostly to the hydrocarbon solvent content (up to 20%) or other surfactants and enhancers and not to the polyacrylamide. In normal application, it is highly unlikely that there would be acute toxicity effects for waterways or soils.

The carrier solvent for the polyacrylamide in BlazeTamer380® is “*Distillates (petroleum), hydrotreated light*”, this is effectively a form of deodorised kerosene (similar to white spirit) composed of a mixture of alkane and alkene hydrocarbons with chain lengths from C8 to C19 [14]. These hydrocarbons are probably the primary influence on acute (short-term) environmental effects; the mixed hydrocarbon chain lengths will influence the extent of acute toxicity, volatility, persistence and biodegradation.

Shorter-chain hydrocarbons are more toxic but also more volatile and less persistent while the longer-chains are less volatile and more persistent but less toxic. Other suppressants may use similar hydrocarbon carriers. REACH registrations identify that these distillates are *toxic to aquatic life with long lasting effects* (Aquatic Chronic 2) [17]. However, at a proportion in the concentrate of 20% or less in BlazeTamer380®, with further dilution for application to 0.2% to 0.65%, the solvent would only be a minor component of 0.04% to 0.13% of the suppressant applied to the fire.

There is little known about the potential for generation of toxic acrylamide monomers from breakdown of polyacrylamide due to partial combustion or environmental degradation. Given the high dilution of the original polyacrylamide in the applied suppressant, wide dispersal in application and slow breakdown, significant effects are unlikely. If acrylamide monomers are generated, that will occur slowly limiting the immediate toxicity load, the monomer should then biodegrade relatively quickly (~5 days in soils, ~14 days in waterways [16]).

However, in line with the *Precautionary Principle* [18] and the recommendation in the SDS to prevent releases to waterways, it is desirable that application and spills of polyacrylamide suppressants avoid releases to waterways, or drains that lead to waterways. The other characteristics of BlazeTamer380® should not present a threat to rare and threatened species, amenity and condition of infrastructure or historic and cultural heritage places.

## 3 FIREFIGHTING FOAMS (Class A)

Firefighting foams are used across a range of fires broadly divided into two classes:

- **Class A** – Carbonaceous materials fires (e.g., vegetation, wood, coal, tyres, etc.).
- **Class B** – Liquid fuel fires (e.g., oil, petrol, diesel, ethanol, etc.).

The principle difference between the action of each foam type is the mode of cooling and extinguishing of the fire:

- **Class A** foams are designed to penetrate into and wet the burning material to cool, extinguish, exclude oxygen and prevent re-ignition (e.g., vegetation, paper, tyres, etc.).
- **Class B** foams are designed to form a blanket and float on top of the liquid hydrocarbon fuel to suppress the vapour, cool the fuel and exclude oxygen.

Only Class A rated firefighting foams that act to penetrate and wet the burning material are used on vegetation fires. Some foams are rated for use on both Class A and Class B fires.

- **NOTE - AFFF, FFFP, FP or their –AR variants** must NEVER be used for bushfire or non-licensed firefighting under any circumstances (e.g., 3M Light Water, Ansulite, Tridol, etc.).

These foams contain toxic PFAS, fluorinated organic permanent pollutants, which have caused widespread global contamination impacting wildlife, human health and resource values.

Queensland has banned the use of PFAS foams except for a few very limited and regulated uses where they cannot be released to the environment [18]. PFAS foams may be encountered at industrial or remote locations where there are leftover drums of legacy AFFF/FFFP/FP foams that may be offered or “donated” for use.

If PFAS foams are encountered, they must be quarantined and the occurrence reported to the regional compliance team. All foams for use on bushfires must be non-persistent “fluorine-free” foam. If there is any doubt, seek advice from the Incident Response Unit or the local SIRN (State Incident Response Network) officer via the Pollution Hotline 1300 130 372.

### **3.1 Mode of firefighting foam action in fires**

Class A firefighting foams can be applied by aerial drops or ground appliances to the fire front as dilute solutions (~0.5% to 1%) to suppress and extinguish the fire. Class A firefighting foams increase the effectiveness of water by:

- **Acting as wetting agents** to penetrate into, cool and extinguish burning materials
- **Absorbing heat** reducing the amount of water needed to extinguish a fire.
- **Penetrating and wetting** vegetation to prevent ignition in “wet fire breaks”.
- **Reducing water evaporation** and maintain wetting of dampened down areas.

### **3.2 Firefighting foam fate and effects in the environment**

Several Class A foams are available for use in Queensland. Solberg foams are in common use by QFES urban and rural fire brigades, all are fluorine-free and fully biodegradable including Solberg Fire-Brake™ 3150A, a Class A foam for bushfire firefighting.

The primary components of Class A firefighting foams are:

- Surfactants (organic biodegradable detergents).
- Solvents (organic biodegradable glycol ethers)
- Saccharides, emulsifiers, thickeners, stabilizers and preservatives.

Class A firefighting foams are generally applied at low concentrations of ~0.5% to 1 % from the air or by ground appliances. Acute environmental toxicity values for Fire Brake 3150A are very low for the dilute application solutions [19].

| Solberg Fire-Brake™ 3150A Class A foam                                         |                                 |                                                        |                                               |                                                            |
|--------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------|-----------------------------------------------|------------------------------------------------------------|
| Organism                                                                       | Concentrate acute toxicity mg/L | US Fish and wildlife toxicity category for concentrate | Fire Brake Class A foam dilute solutions mg/L | US Fish and wildlife toxicity category for dilute foam [8] |
| <b>Fish</b><br>LC50 96 hour<br>Rainbow trout<br>( <i>Oncorhynchus mykiss</i> ) | 22                              | 10-100 mg/L<br><i>Slightly Toxic</i>                   | @0.5% – 4,400<br>@1% – 2,200                  | >1,000 mg/L<br><i>Relatively Harmless</i>                  |
| <b>Crustaceans</b><br>EC50 48 hour<br>( <i>Daphnia magna</i> )                 | 72                              | 10-100 mg/L<br><i>Slightly Toxic</i>                   | @0.5% - 14,400<br>@1% - 28,800                | >1,000 mg/L<br><i>Relatively Harmless</i>                  |

Fire-Brake™ 3150A is non-bioaccumulative and readily biodegradable in waterways to about 86% in 28 days and to 99% in about 45 days. Overall, it classes as relatively harmless to aquatic species and is unlikely to have any adverse effects.

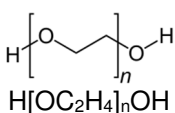
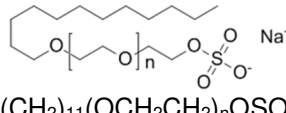
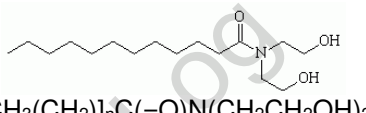
Class B Solberg RF6™ and Solberg RF3x6™ ATC (RF re-healing foams) can also be used on Class A fires. Solberg Class B/A foams are usually used on Class B hydrocarbon fuel spills and fires, they can also be used on vegetation fires to penetrate and wet fuels. Urban appliances are likely to carry RF6™ or RF3x6™ ATC Class B/A foams.

Solberg RF6™ is usually applied at 6% but may be applied further diluted to a lower percentage for vegetation fires. Acute toxicity for Solberg RF6™ is summarised below [20]. RF6 is non-bioaccumulative and readily biodegradable in waterways to about 87% in 28 days and to 99% in about 45 days, overall, it classes as practically non-toxic to aquatic species.

| Solberg RF6™ Class B/A foam                                                    |                                 |                                                        |                                                  |                                                             |
|--------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------|
| Organism                                                                       | Concentrate acute toxicity mg/L | US Fish and wildlife toxicity category for concentrate | Solberg RF6 Class B/A foam dilute solutions mg/L | US Fish and wildlife toxicity category for dilute foam [10] |
| <b>Fish</b><br>EC50 96 hour<br>Rainbow trout<br>( <i>Oncorhynchus mykiss</i> ) | 42                              | 10-100 mg/L<br><i>Slightly Toxic</i>                   | @6% – 700                                        | 100-1,000 mg/L<br><i>Practically Nontoxic</i>               |
| <b>Crustaceans</b><br>EC50 48 hour<br>( <i>Daphnia magna</i> )                 | 644                             | 10-100 mg/L<br><i>Slightly Toxic</i>                   | @6% – 11,067                                     | >1,000 mg/L<br><i>Relatively Harmless</i>                   |
| <b>Algae</b><br>EC50 96 hour<br>( <i>Selenastrum capricornutum</i> )           | >6.9                            | 1-10 mg/L<br><i>Moderately Toxic</i>                   | @6% – >115                                       | 100-1,000 mg/L<br><i>Practically Nontoxic</i>               |

Some rural ground appliances have adopted a Class A wetting agent in-line mixing system based on a solid block of surfactant that dissolves into the flow of branch line water for application. For example, the QuickCorp *Solid EF* units of this type are in use on some rural and QPWS ground appliances in Queensland [21,22]. The surfactant is dissolved in a fixed proportion of 0.02% (1kg / 5,000L) into the branch line. The composition of the Solid EF block is similar to liquid Class A foams with a mixture of surfactants, glycol ether solvent and enhancers that are biodegradable.

Test results for the as-sold *Solid EF* product were not available, but given that the composition is relatively simple EC50 and LC50 values and proportions for the two ingredients with the greatest effect on the most sensitive aquatic species, (*Daphnia*/invertebrates) were used to estimate the LC/EC50 at about 3.07 mg/L as per the table below [22]. Given that the product is used in small quantities (200g to 1kg) of a solid material, spills that could enter a waterway are unlikely to occur.

| QuickCorp Solid EF                                                                               |                                                                                   |                                                                                   |                                                                                     |
|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Component                                                                                        | Polyethylene glycol (MW 4000)                                                     | Sodium lauryl ether sulphate                                                      | Cocamide diethanolamide                                                             |
| Proportion in Solid EF                                                                           | 75%                                                                               | 20%                                                                               | 5%                                                                                  |
| Structure                                                                                        |  |  |  |
| EC50 Daphnia (48 hr)                                                                             | 1000 mg/L                                                                         | 3.43 mg/L                                                                         | 2.15 mg/L                                                                           |
| Fish LC50 (96 hr)                                                                                | 100 mg/L                                                                          | 7.42 mg/L                                                                         | 3.6 mg/L                                                                            |
| Most sensitive receptor ( <i>Daphnia</i> ) EC50 = (20+5)/((20/3.43)+(5/2.15)) = <b>3.07 mg/L</b> |                                                                                   |                                                                                   |                                                                                     |
| Wetting agent in use dilution 1:5000 = <b>3,065 mg/L (=Relatively Harmless) [10]</b>             |                                                                                   |                                                                                   |                                                                                     |

The primary environmental risk from Class A firefighting foams and wetting agents is from large concentrate spills that enter aquatic environments where they may cause dissolved oxygen depletion due to BOD from the decay of the organic components. Where practical, application to waterways with standing water present and to riparian vegetation close to waterways should be avoided.

### 3.3 Firefighting foam subject to the fire

With normal application of firefighting foam to the fire front and in damping down of embers in burned areas, some foam involved in the main fire will be completely degraded to carbon dioxide and water with no significant potential to cause environmental harm. Assuming the foam is effective on the fire front and in the case of damping down and forming of wet firebreaks, a proportion will remain un-degraded or only partially degraded from the original composition.

Overall, key considerations for Class A non-persistent (fluorine-free) firefighting foams are:

- Combustion in the fire will not produce hazardous breakdown products but residues are likely in unburnt and partially burnt areas such as when used for firebreaks.
- Acute (short-term) toxicities for aquatic fish, invertebrates, algae and bacteria are very low for the Class A foams that are primarily based on biodegradable surfactants and solvents.
- Class A firefighting foam components subject to the fire will mostly be combusted or volatilised.
- Residues and unaltered Class A firefighting foams are readily biodegradable with low toxicity in dilute form.

Residues from Class A firefighting foams applied to soils will act as a wetting agent to allow water (rain) infiltration and the composition breakdown products will be a source of carbon for plant growth. No significant adverse effects from application of Class A foams are likely where the application is not directly to the water body.

## 4 FURTHER INFORMATION

For further information and advice on these or related products contact the Department of Environment and Science, Incident Response Unit via the 24 hour Pollution Hotline 1300 130 372.

## **Roles and Responsibilities**

### **Department of Environment and Science (DES)**

DES division of Environmental Services and Regulation (ESR) provides advice on environmental protection issues, clean-up, recovery and waste disposal matters. DES participates within established incident control systems as required, generally under the direction of QPS or QFES. For bushfires involving QPWS estate ESR would provide advice on an as-needs basis to assess and manage the use of firefighting agents.

### **Queensland Parks & Wildlife Service (QPWS)**

QPWS provides incident control and/or combat agency support for bushfires as appropriate in conjunction with QFES. For bushfires involving QPWS estate QPWS would engage with ESR on an as-needs basis to assess the use and management of firefighting agents.

### **Office of Water Supply Regulator, Water authorities and Users**

Where there is the potential for contaminants to adversely affect public drinking water supplies, for both surface and groundwater situations, the Office of Water Supply Regulator and relevant water authorities and users should be contacted.

### **Qld Police Service (QPS)**

Where the *Public Safety Preservation Act* has been declared the responsibilities of the QPS are to provide:

- Control and coordination of the incident (including the on-site and off-site emergency environment).
- Coordination of the efforts of contributory agencies.
- Securing the incident scene from unauthorised entry or departure.
- Crowd and traffic control.

### **Queensland Fire & Emergency Service (QFES)**

QFES has lead responsibility for protection of persons, property and the environment from fire and hazardous materials emergencies. It also provides an advisory service, and other measures to promote safety and protect property if a fire or hazardous materials emergency happens.

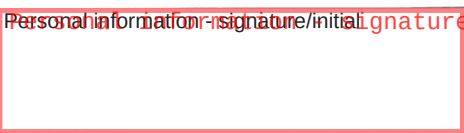
### **Relevant guidelines, policies, codes, regulations and legislation**

*Environmental Protection Act 1994*

*Environmental Protection Regulation 2008*

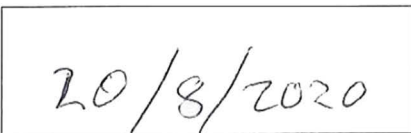
DES Operational Policy – *Environmental Management of Firefighting Foam*.

### **Approved by:**

Personal information - signature/initials  


Signature

Rob Lawrence  
Deputy Director-General  
Environmental Services and Regulation



Date

## Resource References

### US Department of Agriculture

Fish and Wildlife acute toxicity scale [8].

| Toxicity Category    | Effective concentration |
|----------------------|-------------------------|
|                      | Range (mg/L)            |
| Super Toxic          | < 0.01                  |
| Extremely Toxic      | 0.01 –0.1               |
| Highly Toxic         | 0.1 –1                  |
| Moderately Toxic     | 1 –10                   |
| Slightly Toxic       | 10 –100                 |
| Practically Nontoxic | 100 –1,000              |
| Relatively Harmless  | > 1,000                 |

US Fish and Wildlife Service toxicity scale  
Aquatic EC50 or LC50 (freshwater)

- [1] Plucinski M, R. Hurley; A. Sullivan and V. Koul (2015) – The development of standard methods for evaluating the effectiveness of aerially applied bushfire suppressants. CSIRO client report No EP155521. CSIRO Land and Water. <https://doi.org/10.4225/08/584af207dd751>
- [2] LeVan SL (1984) – Chemistry of Fire Retardancy in The Chemistry of solid Wood Am. Chem. Soc. 531-574.
- [3] George CW and RA Sussott (1971) – Effects of Ammonium Phosphate And Sulfate On The Pyrolysis And Combustion Of Cellulose. USDA Forest Service Research Paper INT-90, 1971.
- [4] US Dept of Agriculture (2009) – Phos-Chek® Fire Retardants For Use in Preventing& Controlling Fires in Wildland Fuels. [https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprd3851594.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3851594.pdf)
- [5] Perimeter Solutions (2018/19) – Phos-Chek® Safety Data Sheet - MVP-Fx. <https://phoschek.com/product-class/fire-retardant-for-wildland/>
- [6] Perimeter Solutions (2019) – Safety Data Sheet, PHOS-CHEK® LC95A/PHOS-CHEK® LC95A-MV
- [7] Perimeter Solutions (2019) – Safety Data Sheet, PHOS-CHEK® LC95W
- [8] Perimeter Solutions (2019) – Safety Data Sheet, PHOS-CHEK® LC95A-Fx
- [9] Fu, S.; P. Song and X. Liu (2017) – Thermal and flame retardancy properties of thermoplastics/natural fiber biocomposites. In: *Advanced high strength natural fibre composites in construction. Composites Science and Engineering* (74).
- [10] El-Harbawi M. (2014) – Toxicity Measurement of Imidazolium Ionic Liquids using Acute Toxicity Test. *Procedia Chemistry* 9, 40-52. DOI: 10.1016/j.proche.2014.05.006
- [11] Forest Systems Pty Ltd (2019) – Material Safety Data Sheet. FireLimit FL-02. <https://firelimit.com.au/>
- [12] FireLimit (2017) – Technical Data sheet. FL-02 Long-Term Retardant. <https://firelimit.com.au/>
- [13] US Dept of Agriculture Forest Service Fire and Aviation Management (2019) – Implementation Guide for Aerial Application of Fire Retardant. <https://www.fs.usda.gov/managing-land/fire/chemicals>
- [14] BioCentral Laboratories (2017) – BLAZETAMER380 Safety Data Sheet. <https://www.blazetamer.com/safety-data-sheet>
- [15] BlazeTamer380 FAQ (2019) <https://www.blazetamer.com/faq>
- [16] Xiong B.; R. Loss; D. Shields; T. Pawlik; R Hochreiter; A Zydneý and M. Kumar (2018) – Polyacrylamide degradation and its implications in environmental systems. *Nature, npj Clean Water* 1, 17 <https://www.nature.com/articles/s41545-018-0016-8>
- [17] ECHA (2020) – Chemical Registration CAS 265-149-8 <https://echa.europa.eu/registration-dossier/-/registered-dossier/15375/1>
- [18] Queensland (2016) – *Environmental Management of Firefighting Foam, Operational Policy*. Qld Dept. of Environment and Heritage Protection.
- [19] Solberg Scandinavian AS (2015) – Solberg Fire-Brake 3150a Class A Foam Safety Data Sheet. <https://www.pacfire.com.au/download/1339/>

- [20] Solberg Scandinavian AS (2008/12) – Solberg RF6 Material Safety Data Sheet ENG.  
[http://www.solbergfoam.com/getattachment/dd6f1e03-6719-45bf-9032-8a8ff54e0ede/SDS\\_RF6\\_Safety\\_Data\\_ENG.aspx](http://www.solbergfoam.com/getattachment/dd6f1e03-6719-45bf-9032-8a8ff54e0ede/SDS_RF6_Safety_Data_ENG.aspx)
- [21] QuickCorp (2018) - Solid EF surfactant proportioning unit Safety Data Sheet.  
<http://www.qcfe.com.au/Products/Accessories-500/Foam-441/SolidEF-479/>  
[http://www.qcfe.com.au/adm/filemanager/userfiles/QUIK\\_CORP\\_FIRE/Foam/QUIKCORP%20SOLID%20EF%20SDS\\_V1\\_01.06.2018.pdf](http://www.qcfe.com.au/adm/filemanager/userfiles/QUIK_CORP_FIRE/Foam/QUIKCORP%20SOLID%20EF%20SDS_V1_01.06.2018.pdf)
- [22] QuickCorp / Davoren Environmental 2018 – Report, Hazard assessment of QuickCorp Solid EF.

#### Other issues to consider

QFES and CASA guidelines for aerial application of firefighting agents.

QFES 2019 - Use of Water Additives in Controlling Bushfires - Information Guide.

[https://www.ruralfire.qld.gov.au/BushFire\\_Safety/Pages/Water-Additives.aspx](https://www.ruralfire.qld.gov.au/BushFire_Safety/Pages/Water-Additives.aspx)

Bushfire CRC 2005 - Using chemicals in firefighting operations

<https://www.bushfirecrc.com/resources/firenote/using-chemicals-firefighting-operations>

Date : 6/12/2020 2:37:37 PM  
From : "OLIVER Nathan"  
To : "CUBIS Mick"  
Subject : RE: NCR Regional Incident Summary as at 1000 hours  
Attachment : image001.png;image002.png;  
Thanks Mick

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From: CUBIS Mick <Mick.Cubis@des.qld.gov.au>  
Sent: Sunday, 6 December 2020 2:37 PM  
To: OLIVER Nathan  
Cc: DARGUSCH Marc; CAMBOURN Neil  
Subject: RE: NCR Regional Incident Summary as at 1000 hours

Hi Nathan

Attached is the procedural guide for use of retardants.

Phos-chek is on the list, which mean it is approved for use, with some provisos regarding its use, particularly near waterways. It also states in part:-

Use of Phos-Chek® products with lower DAP and MAP content are preferable near waterways to minimise the risk of adverse effects from misapplication. If a particular formulation of any brand with a high content of DAP or MAP is to be used then the additional ammonium content may need to be considered in terms of potential acute toxicity for waterways. The relationship of the ammonium to phosphate in the three forms is illustrated below.

So as discussed, can be used if required to protect life and property, and/or in accordance with recommended applications in the procedural guide where possible. Happy to discuss further if needed, so call any time.

Hope it goes well protecting Happy Valley.

thanks

**Mick Cubis**  
Regional Director, Coastal and Islands Region  
GBRMC | QPWS & Partnerships  
Department of Environment and Science  
P: 07 54471137 M: Personal info  
240 Moorindil Street, Tewantin  
Qld 4565  
[mick.cubis@des.qld.gov.au](mailto:mick.cubis@des.qld.gov.au)

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From: OLIVER Nathan <[Nathan.Oliver@des.qld.gov.au](mailto:Nathan.Oliver@des.qld.gov.au)>  
Sent: Sunday, 6 December 2020 12:03 PM  
To: CIR Fire Team; CUBIS Mick; DARGUSCH Marc; BULLEY Graeme; SEELEITHER Jamie; BLACKMAN Boyd; BARRACLOUGH Emma; HARVEY Peter; YETMAN Brendon; KLEKAR John; gadejould; [rachel.killer@bac-kgari.org](mailto:rachel.killer@bac-kgari.org); LAYFIELD Wayne; CAMBOURN Neil; BUCKLEY Andrew; HEAD Damien; KLAASSEN Ben; HARRIS Leigh; BURNHAM Mark; SPINKS Troy; RCC Seqr  
Subject: NCR Regional Incident Summary as at 1000 hours



**Nathan Oliver**  
Principal Ranger Fire Management  
South East Queensland Region | QPWS & Partnerships  
Department of Environment and Science  
P: Personal info  
Kabool Road, West Burleigh 4220  
[www.des.qld.gov.au](http://www.des.qld.gov.au)