Common template for risk assessment and management operational tools and best practices identification (Action B1)

Title: Operational Tools and Best Practices for Risk Assessment and Management

The identification of tools and best practices on risk assessment and management helps providing an idea of the state of the art in the field. By completing this form, the best practice will be included in the knowledge repository platforms and available for the practitioner community to use. We encourage the user to complete as many fields as possible from the template in order to provide the most relevant information needed to apply the best practice to other practitioners. Instructions:

- **Blue boxes are mandatory fields**
- **More than one item can be selected in multiple choice boxes**

Document classification

Title	**Use of chemical additives during fire suppression operations**
Description	**Types of products and instruction for use of chemical additives in France**
Country, location	**France**
Date	**2017**
Contact e-mail	
Institution	**National Civil Protection Directorate, Local Fire and Rescue Units**
Net Risk Work Partner	**EPLFM**
Document type	**Best practice**
Language	☐Catalan ☒English ☒French ☐German ☐Italian ☐Spanish ☐Other
Source/origin	☒Partner's expertise ☐Expertise from the network ☐Other (internet)

Topic

Area	☐Risk assessment	☐Risk Planning	☒Risk Management
Risk	☒**Wildfires**	☐Fire behaviour patterns and typologies ☐Fire ignition and spread models ☐Wildland urban interface	☒Fuel management ☒Fire service needs ☐Prescribed burning ☐Other *[Introduce which ones]*
	☐**Storms**	☐First measures after storm ☐Work safety during salvage logging ☐Timber storage and cost containment ☐Forest protection and pest control	☐Regeneration and afforestation ☐Preventive sylvicultural measures ☐Other [*Introduce which ones*]
	☐**Avalanches**	☐Technical protective measures ☐Maintenance of protection forests	☐Other [*Introduce which ones*]
	☐**Floods**	☐Prevention through land use management ☐Technical protective measures	☐Other [*Introduce which ones*]
	☐**Other**		[*Introduce which ones*]
Cross-sectoral topics	☐Risk and vulnerability assessment and mitigation		☐ Risk planning, governance and policy framework

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	☐Cost-effectiveness assessment ☒ Civil protection, emergency and post-disaster management	☐Community involvement and risk communication ☐Other: [Introduce which ones]
Level	☒Local ☐Regional ☒National ☐Cross-border ☐EU ☐Global	
DRM cycle phase	☐Prevention ☐Preparedness ☒Response ☐Recovery	
DRM domain	☐Policy making ☐Early warning system ☒Disaster response	
Sendai priorities	☐Priority 1: Understanding disaster risk ☐Priority 2: Strengthening disaster risk governance to manage disaster risk ☐Priority 3: Investing in disaster risk reduction for resilience ☒Priority 4: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction	
Contribution to Sendai Targets	☐Reduce global disaster mortality ☒Reduce the number of affected people ☒Reduce the direct disaster economic loss ☒Reduce disaster damage to critical infrastructure ☐Increase the number of national and local disaster risk reduction strategies ☐Enhance international cooperation to developing countries ☐Increase availability of and access to multi-hazard early warning systems and disaster risk information and assessment	

Description and analysis

Summary: quick presentation of the Good Practice *[Objective: summarize in a few lines the key elements of the good practice]*

Place in national/regional policy

The use of chemical additives for wildfire suppression operations is recommended in the national Forest Fire General Strategy both on new fires and on large fires.

Goals and achievements

Definition: chemical substance capable of decreasing forest fire intensity or slowing down its spread. They are ordered in 3 categories:

- Short term retardants
- Long term retardants
- Water enhancers or polymers (☐ are being tested but not yet operationally used in France)

Actors involved

- Aerial Means Office at the Directorate General for Civil Protection – fleet operator
- Fire and Rescue services (SDIS) – fire suppression operations management
- Valabre – testing and qualification of chemical additives; requirements specifications for purchase
- Private companies – development of chemical additives

Implementation stage

Chemical additives have been used for more than 40 years at the response phase (to reduce speed and intensity of the fire), but also at the preparedness phase, as protective barriers to protect specific points of interest. Chemical additives are used by aerial and terrestrial national means and by local Fire and Rescue Services (SDIS) ground and aerial means.

State of technical knowledge

Short term retardants - action mode: increase the viscosity of water

- Wetting agents: reduce superficial tension and improve the propagation and penetration characteristics of water in the vegetation
- Viscosing products: prevent run-off or slow down evaporation

Foam (as a short-term retardant)

Foam results from air operation on a solution of foaming agent in water (liquid concentrate)

The expansion rate is calculated by the ratio between the total foam volume and the initial foam solution volume:

- Low expansion: de 0 à 20
- Medium expansion: de 20 à 200
- High expansion: > 200

The release speed is the time required for the solution to separate from the foam

Heat absorption by the foam

- Cover vegetation with an insulating layer,
- By insulating effect: foam is composed of 90% of air. It is an insulating material capable of absorbing heat of the fire by maintaining the fuel cooler.
- Action by water evaporation: water is released during the foam disappearance. The water temperature increases and can be transformed into vapor

Foam product:

- Foam agent
- Corrosion inhibitor
- Stabilizer
- Anti-freezing agent

Long term chemical additives

Action mode: decreases the fire temperature, slows down distillation and releases incombustible gazes

- Composition:
- 93.5 % Ammonium polyphosphate (APP: Nitrogen: 10%; Phosphate: 34%; Sulphate: 2%; Water: 44 %; Iron as Fe_2O_3: 1 %)
- 4 % clays
- 1 % iron oxide (red colour for dropping visualisation)
- 1.5 % sodium ferrocyanide (Corrosion inhibitor)
- Dilution rate: 20 % (1 volume of liquid concentrate / 4 volumes of water)

Context

The law regulates the selection of chemical additives:

National call for tender every 4 years

- One tender for National aerial retardant means
- One tender for National ground retardant means
- One tender for National aerial retardant foam

Departmental call for tenders

- On demand of the director
- Call for tender made by the department
- For aerial and ground departmental means

Detailed Characteristics [*Objective: detail the implementation conditions of the Good Practice*]

Description of the implementation steps - testing protocol

During summer time, when the fire risk is very high, Civil protection aircraft carry out loaded (with chemical additives) aerial monitoring (i.e. GAAR). 16 loading stations (pélicandromes) are available in the South-east of France (including 4 in Corsica) covering most part of the area at risk with an action range of 30 minutes.

The ground means (tankers) that are prepositioned in high risk areas are also loaded with chemical additives (groupe retardant). Retardant Intervention Group is composed of 3 tankers of 6000 L, 1 tanker of 14 000L 1 unit for production and provision of retardant (containing 18 000 L of pure retardant and 12 000 L of water) and armed with 27 men. Its missions are twofold: defence of a specific point of interest of drop of a support line (2000 m x 12m in 90 minutes).

Chemical additives are artificially coloured (red for aerial drops and purple for terrestrial use) to

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help visual check of the treated areas.

Governance

The General directorate is responsible for the choice of chemical additives for its own means while the Local Fire & Rescue services are responsible for their own means.

Necessary means to implement the Good Practice in efficient conditions

- Aerial means: (aircraft) Tracker, Dash, Canadair Helicopters?
- Ground means: some departments of South of France have their own retardant units, and the Retardant Intervention Group (national military mean)
- Ground means can intervene when aerial ones are not available and cannot be used (night conditions)
- Fix retardant stations to refuel (pélicandromes): covering the territory (30 minutes action range)

Challenges encountered during implementation and solutions incurred

Corrosion

Tests are carried out to evaluate the corrosion behaviour of foaming and retardant products such as the resistance to the corrosion and the type of corrosion (General or localized). They are realised both for the liquid concentrate and the solution in water on various types of alloys used for the storage, transport and products use.

Solution incurred are twofold: modification or improvement of transportation means (terrestrial and aerial); and adaptation of the solution and its conditioning.

Long term stability is tested against thermic stress to check that the product has not undergone modifications so to ensure that the product can be stored outside (in Pélicandrome) for some time without jeopardizing its efficiency or making it dangerous to use.

Environmental impact is tested by evaluating chemical additives impact on terrestrial flora (i.e. germination tests and vegetation growth tests):

- Herbaceous stratum: Ray Grass
- Shrub stratum: Spanish boom
- Tree stratum: Alepo Pines

Some positive impacts on the growth of the vegetation have been demonstrated with some long-term retardants.

Practicality: additives need to be compatible with: fresh water, salted/see water and hard water.

Priorities identified for successful implementation of the Good Practice

- Careful choice of product (requirements)
- Logistical aspects (specific standardization of the means associated to the use of chemical additives, notably regarding the cooling of motor pumps engines and the mixing of additives with water)
- Training of the users (operational units)

Impact of the Good Practice *[Objective: evaluate the impact of the Good Practice].*

Future developments *[Objective: understand the follow-up perspectives]*

External resources *[Objective: provide further information]*	
Attached materials	*[include format (document, photo, video…) and name of the file]*
Web links	
Contacts	

[Additional information - optional]

Lessons learnt [*Objective: compare the results obtained to the objectives set at the start of the Good Practice]*
Evaluation process Physio-chemical tests for short term chemical additives are carried out by Valabre on the following criteria: – Density – pH – Surface tension of the concentrate and of the solution – Freezing point determination – Flash point determination – Initial boiling point determination – Stability tests – Compatibility with different types of water – Decanting time – Pumpability tests (between -10 and 60 °C) The long term chemical additives are evaluated by means of: – Wind tunnels – TGA (Thermo Graphical Analysis) – Prescribed burnings (with field instrumentation) Drop assessment of air tankers and ground means (tankers) are also evaluated: – measure of ground patterns and calculation of the quantity of retardant on the ground
Assessment of results (quantitative and qualitative) and comparison with main goals No general assessment on the impact of using chemical additives (in terms of saved lands for instance). The average burnt area of the fires treated by the aerial monitoring (aircraft loaded with retardant) is less than 10 hectares, while it reaches 70 hectares when there is no first intervention by the GAAR. However, this is also due to the very short delay of intervention, not only to the use of chemical additives.
Negative aspects identified Pollution through washing waters of air tankers and deballasting before landing. The tests carried out in Marignane base camp show important concentrations of dangerous products like phosphates, ammonium (in particular for Trackers), and large volumes of discharged liquids. Environmental externalities: impact on the vegetation. Tests (germination and growth) are ongoing on the three strata to assess the long-term impact of the use of retardants on three stratums of the vegetation Sanitary impact: not evaluated Accessibility: concerning terrestrial means, only large tankers are loaded with retardant making it difficult to access some sensible points / hot spots (in WUI for instance). Infrastructures: Chemical additives may have negative impacts on sensible points or critical infrastructures (electricity networks for instance: the isolators need to be hand washed after a retardant drop- even the drop tail).
Unexpected consequences (short / mid / long term) and corrective measures implemented Drops on electrical lines are avoided as much as possible.

Durability and transferability [*Objective: evaluate the integration of the Good Practice and its sustainability, give recommendations for transferability]*		
Is this information:	**Replicable** ☒	**Measurable** ☒
Regulatory Framework		
Stability of the human environment Has been widely used for many years, not questioned any more.		
Financial requirements Mixed national and local, depending on the types of means involved.		
Success factors High level of acceptance, both by the practitioners and by the larger public.		
Risk factors		
Additional and non-formal experiences contributing to the implementation of Good Practice		

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