

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	Personal protective equipment of French fire-fighters in wildfire suppression operations
Description	Results of a study to find the best compromise between thermal protection, physical tolerance and ergonomics
Country, location	France
Date	2017
Contact e-mail	
Institution	Local Fire and Rescue Unit
Net Risk Work Partner	EPLFM
Document type	Best practice
Language	<input type="checkbox"/> Catalan <input checked="" type="checkbox"/> English <input checked="" type="checkbox"/> French <input type="checkbox"/> German <input type="checkbox"/> Italian <input type="checkbox"/> Spanish <input type="checkbox"/> Other
Source/origin	<input checked="" type="checkbox"/> Partner's expertise <input type="checkbox"/> Expertise from the network <input type="checkbox"/> Other (internet)

Topic

Area	<input type="checkbox"/> Risk assessment	<input type="checkbox"/> Risk Planning	<input checked="" type="checkbox"/> Risk Management
Risk	<input checked="" type="checkbox"/> Wildfires	<input type="checkbox"/> Fire behaviour patterns and typologies <input type="checkbox"/> Fire ignition and spread models <input type="checkbox"/> Wildland urban interface	<input type="checkbox"/> Fuel management <input checked="" type="checkbox"/> Fire service needs <input type="checkbox"/> Prescribed burning <input type="checkbox"/> Other <i>[Introduce which ones]</i>
	<input type="checkbox"/> Storms	<input type="checkbox"/> First measures after storm <input type="checkbox"/> Work safety during salvage logging <input type="checkbox"/> Timber storage and cost containment <input type="checkbox"/> Forest protection and pest control	<input type="checkbox"/> Regeneration and afforestation <input type="checkbox"/> Preventive silvicultural measures <input type="checkbox"/> Other <i>[Introduce which ones]</i>
	<input type="checkbox"/> Avalanches	<input type="checkbox"/> Technical protective measures <input type="checkbox"/> Maintenance of protection forests	<input type="checkbox"/> Other <i>[Introduce which ones]</i>
	<input type="checkbox"/> Floods	<input type="checkbox"/> Prevention through land use management <input type="checkbox"/> Technical protective measures	<input type="checkbox"/> Other <i>[Introduce which ones]</i>
	<input type="checkbox"/> Other		<i>[Introduce which ones]</i>

Cross-sectoral topics	<input type="checkbox"/> Risk and vulnerability assessment and mitigation <input type="checkbox"/> Cost-effectiveness assessment <input checked="" type="checkbox"/> Civil protection, emergency and post-disaster management	<input type="checkbox"/> Risk planning, governance and policy framework <input type="checkbox"/> Community involvement and risk communication <input type="checkbox"/> Other: [Introduce which ones]
Level	<input checked="" type="checkbox"/> Local <input type="checkbox"/> Regional <input type="checkbox"/> National <input type="checkbox"/> Cross-border <input type="checkbox"/> EU <input type="checkbox"/> Global	
DRM cycle phase	<input type="checkbox"/> Prevention <input type="checkbox"/> Preparedness <input checked="" type="checkbox"/> Response <input type="checkbox"/> Recovery	
DRM domain	<input type="checkbox"/> Policy making <input type="checkbox"/> Early warning system <input checked="" type="checkbox"/> Disaster response	
Sendai priorities	<input type="checkbox"/> Priority 1: Understanding disaster risk <input type="checkbox"/> Priority 2: Strengthening disaster risk governance to manage disaster risk <input type="checkbox"/> Priority 3: Investing in disaster risk reduction for resilience <input checked="" type="checkbox"/> Priority 4: Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction	
Contribution to Sendai Targets	<input checked="" type="checkbox"/> Reduce global disaster mortality <input checked="" type="checkbox"/> Reduce the number of affected people <input type="checkbox"/> Reduce the direct disaster economic loss <input type="checkbox"/> Reduce disaster damage to critical infrastructure <input type="checkbox"/> Increase the number of national and local disaster risk reduction strategies <input type="checkbox"/> Enhance international cooperation to developing countries <input type="checkbox"/> 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 French standards for wildfire equipment are low and not grounded on scientific basis. A study was needed to improve the first responders' safety (prevent burns) and increase the fire fighters comfort during intervention. It has no legal force but suggests recommendations and advices for the choice and purchase of equipment, which is now followed by some of the Fire and Rescue services (in particular SDIS 13).

Goals and achievements

- Study not only the thermal performance but also the physical tolerance;
- Test the whole equipment, not piece by piece (existing standards);
- Assess the performance of existing equipment and prototypes
- Search for the best compromise between thermal protection, physical tolerance and ergonomics

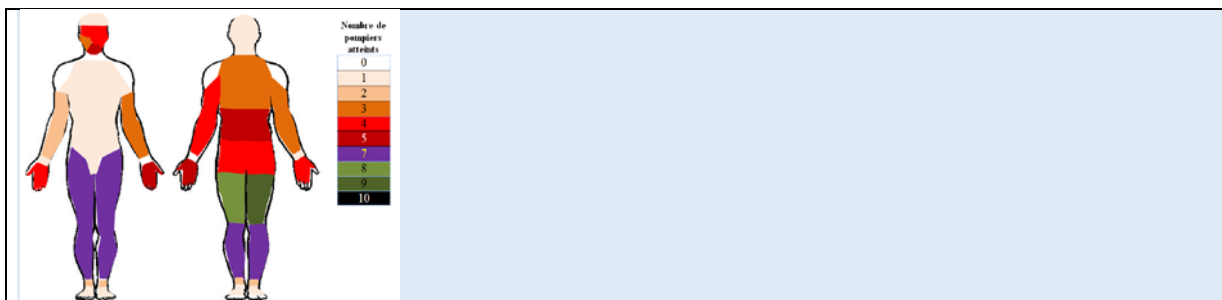
Actors involved

This study was commissioned by the Fire and Rescue service of Bouche du Rhône (SDIS 13) and carried out by Valabre in collaboration with the General Directorate for Civil Protection, the Fire and rescue services from Var and Vaucluse (SDIS 83 and SDIS 84) and the Fire fighters of Marseille (Bataillons de Marins Pompiers).

Implementation stage

The study was completed in 2013 and the results have been share with the General Directorate for Civil Protection and the Fire and Rescue services which are members of Valabre. SDIS 13 used the results of the study to procure new equipment for their interventions on forest fires. Based on the results of the study the General Directorate for Civil Protection published in 2014 a manual (no legal force, only recommendations) to support the procurement of such clothes with particular requirement specifications.

State of technical knowledge



During wildfire fighting, main burns are localised on lower members and forearm.

Context

There is a norm on the personal protective equipment for wildfires (NF EN 15614), but it treats the different pieces of clothes separately, not as a complete dress code.

In France, the Fire and Rescue Services are autonomous in terms of public procurement and they purchase their own equipment as they see fit. Most of the time, the fire fighters don't use the wildland fire protective equipment which they found is not protective enough. They use the urban fire equipment which is more protective but very heavy and not adapted for wildland terrains. The study was launched after the occurrence of a few accidents, and in particular of the accident of Lt Maggiani in the Bouches du Rhône department.

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

Description of the implementation steps - testing protocol

Thermal evaluation:

- Recreate a radiant panel close to real forest fires conditions
- Expose a dummy equipped with the outfit and thermal sensors

Results using 4 parameters:

- Pain threshold: delay to reach 55 °C
- Delay before burn: delay to reach 65°C
- Burn duration: time where $T \geq 65^\circ\text{C}$
- Tmax.: Highest Internal Temperature under the cloths.

Physical constraint evaluation by measuring three parameters during a calibrated effort:

- Central temperature,
- Heartbeat,
- Hydric loss.

Governance

Each Fire and rescue service is responsible for the choice of equipment, provided that it follows the national norm.

Necessary means to implement the Good Practice in efficient conditions

Human means: operators to set up the fire and realise the measurement and analyse the results for the thermal part of the tests and a doctor with volunteers for the physical part of the test.

Material means:

- FUEL: 30 kg + 5 kg of dry branches and Alep Pine needles, Homogeneous vertical distribution, Fire power: Heat Flux $\geq 20 \text{ kW/m}^2$, Exposure: 30s
- SENSORS: 4 Flux meters, 20 Thermocouples internal/external, 11 areas: knee, thigh, lower abdomen, abdomen, forearm, arm, chest, shoulder, neck and face (nose and eyes)

Challenges encountered during implementation and solutions incurred

Priorities identified for successful implementation of the Good Practice

The protective equipment has to be tested and classified depending on their assembling type.

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

- Publication of a manual for supporting the purchase of such equipment
- Modification of some prototypes
- Use of the direct results by operational units (SDIS 13) to purchase their equipment

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

External resources *[Objective: provide further information]*

Attached materials	<i>[include format (document, photo, video...) and name of the file]</i>
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

No evaluation process on the deployment of the method was carried out.

Assessment of results (quantitative and qualitative) and comparison with main goals

- The performed thermal and physical tests are representative of the risks encountered in forest fires.
- Good compromise arises: 2/2 assembling that lighten the equipment and protect the legs: 2 layers for the top, two layers for the legs.
- Not only one choice but several choices:
 - o Choice of the good assembling (jackets, polo, trousers...)
 - o Two kind of jackets: lightened without membrane or forest fire specific with an adapted length,
 - o Lining of certain parts of the body (forearm, thigh and lower abdomen)
 - o Interesting input of the “no fire” technical polo shirt

Importance of

- The global performance of the equipment,
 - The localisation of the accessory fixings and the external pockets,
 - The cut of the cloths (appearance, inverted pleat and ergonomics)
- The breadth of the cloths (protection from the air layer present in the equipment).

Very precise and discriminatory results were obtained. The tests were therefore satisfactory.

Negative aspects identified

Warning High visibility material: Plastic added to the fibre, very dangerous, inferior to the acceptability threshold

Overalls: To be proscribed as heat climbs upwards inside the clothing and causes intense burns on the chest

Survival aluminized poncho: Good thermal performance but careful for size, fragility, requires training to be put on in emergency situations while wearing gloves

Unexpected consequences (short / mid / long term) and corrective measures implemented

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

<u>Stability of the human environment</u>
<u>Financial requirements</u>
<u>Success factors</u>
<u>Risk factors</u>
<u>Additional and non-formal experiences contributing to the implementation of Good Practice</u>



net risk work



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