European Union Aviation Safety Agency

Rescue and Firefighting

Is it required to perform a ‘Task and Resource Analysis’ as referred to in ICAO Airport Service Manual (Doc 9137) and GM2 ADR.OPS.B.010(a)(2)?

Answer

Although the term ‘Task and Resource Analysis’ is used in GM2 ADR.OPS.B.010(a)(2), it should be considered as a generic term not linked to the ICAO Airport Service Manual, Part 1. Therefore, it is neither a certification requirement to conduct a Task and Resource analysis nor an obligation to follow the example in the ICAO documentation.

Regardless, the aerodrome operator is expected to demonstrate to the competent authority the adequacy of the staffing levels. For that, the aerodrome operator may choose any existing or established approach to determine the number of personnel (e.g. adapted from public firefighting services or structural firefighting).

However, the aerodrome operator is expected to develop a transparent approach to determine the minimum number of personnel and equipment for a credible scenario, which might be validated in further scenarios, in accordance with its published rescue and firefighting aerodrome level(s) of protection. In case of reduced aerodrome level of protection during anticipated periods (see AMC2 ADR.OPS.B.010(a)(2)(b)), an additional determination is required with a credible scenario in each of the published levels of protection.

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What considerations for determining the number of personnel are already given in the regulatory framework?

Answer

Although Regulation (EU) No 139/2014 does not contain specific considerations on the number of required rescue and firefighting services (RFFS) personnel, the existing EU regulatory framework contains different factors that may influence the number of RFFS personnel and

should be taken into account. The following four key aspects affecting the number of personnel should be considered:

- **RFFS Level of Protection** (AMC2 ADR.OPS.B.010(a)(2));
- **Core Tasks** as indicated in the scope of RFFS (GM1 ADR.OPS.B.010(a)(1));
- Comparison of **available and required resources** (AMC6 ADR.OPS.B.010(a)(2)); and
- **Human Performance** (AMC6 ADR.OPS.B.010(a)(2)).

However, the determination should always be guided by the question whether an aerodrome operator is confident with its tactics and the associated number of personnel.

GM1 ADR.OPS.B.010(a)(1) specifies that the principal objective […] is to **save lives** […]. The rescue and firefighting service is provided **to create and maintain survivable conditions**, to **provide egress routes** […] and **initiate the rescue of those occupants unable to make their escape without aid**. The rescue may […] **use equipment and personnel other than** those assessed primarily for rescue and firefighting […].

In determining the number of personnel required to provide for rescue and firefighting, a **Task and Resource Analysis** should be performed, taking into consideration the **types of aircraft** […], the available […] **vehicles and equipment** (consider: AMC3 ADR.OPS.B.010(a)(2)), and **other duties** required from RFFS personnel (GM2 ADR.OPS.B.010(a)(2)).

AMC6 ADR.OPS.B.010(a)(2) specifies that the aerodrome operator should ensure that:

- during flight operations […] **sufficient trained personnel** is detailed and readily available to **ride** […] **vehicles**, and to operate **the equipment** […];
- personnel is deployed […] considering also the **use of hand lines, ladders, and other rescue equipment** normally associated with aircraft rescue and firefighting operations; […] and
- any **other duties carried out** […] do not compromise the response […].

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How does the RFFS level of protection influence the minimum number of RFFS personnel?

Answer

The rescue and firefighting services (RFFS) level of protection reflects the size and capacity of aircraft normally using an aerodrome. Hence, it sets the overall frame when determining the

number of RFFS personnel. When aligning the number of personnel, it could either reflect the largest aircraft usually scheduled at the aerodrome or the largest type of aircraft within the published RFFS aerodrome category. Furthermore, the number of personnel usually available at an aerodrome should be sufficient to man the available vehicles associated with the RFFS level of protection and operate the equipment deemed to be required by the aerodrome operator at its maximum capacity (c.f. AMC3 ADR.OPS.B.010(a)(2) and AMC6 ADR.OPS.B.010(a)(2)).

In addition to the RFFS level of protection, the potential existence of difficult environments at or near the aerodrome may impact the number of RFFS personnel, as a response to such areas is to be initiated and the effective deployment of rescue equipment for such areas is to be considered.

To determine the minimum number of RFFS personnel, the aerodrome operator should develop a credible scenario in accordance with its published RRFS level(s) of protection.

Possible factors taken into account		**Example Scenario #1**	**Example Scenario #2**
Flight Phase	Landing / Take-Off / Taxiing / On Stand	Landing	On Stand
Prior Alert	Yes / No	No	Yes
Number of Aircraft / Vehicles involved	Aircraft / Ground Service Equipment / Regular Vehicle	1 Aircraft	1 Aircraft
Type of Aircraft	According to Airport RFFS Category or Reference Aircraft	RFFS Aerodrome Category	(Reference) Aircraft Type
Number of Persons on Board	According to Airport RFFS Category or Reference Aircraft	Maximum Capacity of Reference Aircraft	Actual Capacity of Reference Aircraft
Passengers with Reduced Mobility	Yes / No	No	Yes
Quantity of Fuel on Board	Low (e.g., on arrival) / Full (e.g., on departure) / Unknown	Low	Unknown
Dangerous Goods	Yes / No / Types and Quantities	No	No
Location of Accident	Runway / Before or After Threshold / Taxiway / Aprons	Runway	Taxiway
Conditions at Location	Paved / Unpaved / Water or swampy Area	Paved	Unpaved
Weather Conditions	Optimal / Impacting …	Optimal	Optimal

Aircraft Emergency State	Aircraft Accident / Full Emergency / Local Standby	Full Emergency	Aircraft Accident
Fuselage Integrity	OK / Damaged / In Several Parts	Damaged	OK
Access to Fuselage	Normal / Partial / Difficult	Partial	Normal
Emergency Evacuation	< 90 sec / < 5 min / Incomplete	< 5 min	Incomplete
External Emergency Services Arrival	< 10 min / X min / 30 min …	< 30 min	25 min

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What are the core tasks that should be taken into account when determining the number of personnel for rescue and firefighting?

Answer

The determination of the number of personnel should define and prioritise tasks required to save lives as indicated in GM1 ADR.OPS.B.010 and could include:

1. **Creating survivable conditions:**
    1. manning vehicles after the initial call;
    2. responding to the accident scene;
    3. assessing the accident; and
    4. controlling external fires (mainly by foam tender's turrets).
2. **Maintaining survivable conditions:**
    1. controlling external fires (supported by hand lines); and
    2. monitoring the evacuation process.
3. **Providing egress routes**
    1. assisting the evacuation; and
    2. creating access to fuselage (e.g. with ladders, ground handling stairs or rescue stairs).
4. **Initiating rescue of trapped occupants**
    1. Initiating the egress for occupants (e.g. ventilating or accessing the fuselage); and
    2. transporting of trapped occupants out of the 'hot zone'.

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How do available resources at an aerodrome influence the number of RFFS personnel?

Answer

The aerodrome operator should not only consider the deployment of available vehicles and equipment but also and foremost their specifications and requirements, in order to deploy the vehicles and equipment effectively. The following technical factors may increase or decrease the number of rescue and firefighting services (RFFS) personnel:

1. **number, types, and seat capacity of vehicles** (cf. AMC3 ADR.OPS.B.010);
2. **number and type of potential rescue equipment** for a response to difficult environments at or adjacent to the aerodrome;
3. **technical configuration and state-of-the-art features** of vehicles and other rescue equipment available at the aerodrome; and
4. human or infrastructural capability of **effective deployment** of required rescue equipment.

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What role does human performance play in the determination of the number of personnel?

Answer

Human factors and capabilities play a major role in the overall tactics, and have hence a major impact on the response to an incident. Therefore, the following may increase or decrease the number of personnel:

1. **training and proficiency of RFFS personnel** (e.g. voluntary, part-time, or full-time firefighters);
2. **tasks other than RFFS required by core RFFS personnel, resulting in fatigue** (e.g. domestic firefighting, ground handling, or aerodrome maintenance);

3. **responsibilities and tasks conducted by non-RFFS personnel** (e.g. cabin crew, security personnel, maintenance, or state authorities); and
4. **availability and response time of rescue staff other than the aerodrome's core RFFS personnel to support during an incident** (e.g. civil defence, medical services, or other external services).

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How could the total number of RFFS personnel be calculated based on an incident-related approach?

Answer

If the transparent and documented approach to determine the number of RFFS personnel was based on a scenario, the results could be used to conclude the total number of RFFS personnel by considering the following:

1. **aerodrome infrastructure** (e.g. provision of additional capacities depending on the aerodrome specifics and to intervene at any point of the aerodrome by meeting the response time(s)); however, there is no need to duplicate each position or equipment in such case);
2. **planned absence** (e.g. recurrent training, annual leave, shift factor or shift schemes); and
3. **contingency arrangements to cover unplanned absence** (e.g. sick leave, unplanned events, vehicle breakdown (cf. GM4 ADR.OPS.B.010(a)(e)).

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Is there any further supportive material that could be useful when determining the number of required RFFS personnel?

Answer

Further guidance or considerations to determine the number of required RFFS personnel may

be found in the following sources:

- ACI World: Managing Rescue and Firefighting Services at Airports — Handbook
- ICAO: Airport Services Manual, Part 1 — Rescue and Firefighting (Doc 9137)
- adapted procedures from structural firefighting or civil defense;
- contact or consultation with members of the working group for knowledge exchange; and
- any other international or national guidance material on the subject matter.

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AMC5 ADR.OPS.B.010(a)(2), point (a) refers to a response time not exceeding three minutes, and to an operational objective not exceeding two minutes. How should the operational objective be considered in relation to the response time?

Answer

The response time not exceeding three minutes should be considered as a time frame that should be met under optimum visibility and surface conditions.

The operational objective should be considered as a desired target under ideal conditions and understood “as low as reasonably possible and feasible” (considering saving lives as primary objective as well as relevant financial, organisational, technological, and human factors).

Getting as close as possible to the operational objective encompasses the set-up of a continuous improvement process (e.g. training, vehicle management, fire station(s) location and design, guidance, access roads, procedural amendment(s)).

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What should be understood as expeditiously as possible, should a response time be defined?

Answer

It is acknowledged that a response time should not be set to respond to an emergency in swampy or water areas, as it largely depends on varying local situations and environments. However, guidelines should be provided on the need for rescue entities to ensure timely response, taking into account:

- the local situation;
- specific conditions regarding survivability (e.g. survival in cold water is approximately 10 minutes maximum); and

the importance of providing adequate deployment of appropriate equipment in coordination among these entities.

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https://www.easa.europa.eu/en/faq/140169

AMC5 ADR.OPS.B010(a)(2), point (a) refers to the time of the initial call to the rescue and firefighting services. How should the term ‘initial call’ be understood?

Answer

- ‘Initial call’ means the first sound of the siren in the fire station, the pager’s alarm or any other means of alert notified by air traffic services (ATS) or any other party [or person], indicating an aircraft incident to the rescue and firefighting services.
- Assessment of the response time should take into account the various significant milestones, and in particular any delay in communicating the incident’s location.

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https://www.easa.europa.eu/en/faq/140170

AMC5 ADR.OPS.B010(a)(2), point (a) refers to the ‘position to apply foam’. How should the term ‘position to apply foam’ be understood?

Answer

As the capabilities of vehicles (e.g, moving and discharge or stop and discharge) and the

procedures (e.g. one or two persons) in place at aerodromes vary widely, in such a context:

- To be in a ‘position to apply foam’ means the moment whenever the vehicle(s) is capable to effectively apply at least 50 % of the required discharge rate as per the reported incident’s category.
- The requirement may be considered to be fulfilled as soon as the vehicle(s) reach(es) a location where fire monitors of the vehicle(s) are within the range of where the incident occurred and is/are in a position to effectively apply the extinguishing agents at the specified discharge rate.
- The capabilities of vehicles and procedures in place should be taken into consideration when calculating the response time.

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AMC5 ADR.OPS.B010(a)(2), point (a) defines that the response time is subject to optimum visibility and surface conditions. What circumstances should be considered as optimum visibility and surface conditions?

Answer

‘Optimum visibility’ includes daytime and good visibility that is not being interfered by any environmental impacts impairing the driver’s view (e.g. precipitation such as rain, snow, or fog).

‘Optimum surface conditions’ means that the normal response route (i.e. the predefined route that is normally available unless there is a temporary maintenance) can be accessed without delay and is free of any:

- environmental contamination (e.g. no precipitation, water, ice, or snow); or
- unusual or unpredictable obstacles affecting safety and effective response time (e.g. foreign object debris (FOD), traffic obstructing RFFS routing, etc.).

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AMC5 ADR.OPS.B.010(a)(2), points (a) and (b) define that the response time should be achieved to any point of each operational runway and calculated

to any part of the movement area. How many measurements/calculations should be conducted to meet the requirement of ‘any point’ or ‘any part’?

Answer

Usually, the response time should be achieved from the fire station(s) to the furthest point of the runway/s. However, if there are objective reasons why another point of the runway/s might be reached earlier or later (e.g. in case of more turns slowing down the vehicle speed), the response time should also be achieved to this point(s).

The same approach based on calculations should apply to any other parts of the movement area than the runway/s. However, as the complexity of the movement area might usually be more diverse, in many cases, more than one calculation might be considered.

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AMC5 ADR.OPS.B.010(a)(2), point (d) refers to guidance material that should be provided to meet the operational objective as nearly as possible in less than optimum visibility. To which response time(s) does that refer to?

Answer

AMC5 ADR.OPS.B.010(a)(2), point (d) aims to ensure an as quick as possible response to an incident and in less than optimum visibility, as orientation might be difficult. Hence, it refers to the response time of three minutes to any point of each operational runway/s, as per point (a) of the AMC, as well as to the response time to be calculated for any other part of the movement area, as per point (b) of the AMC.

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Should the term near’ be understood as a distance of 1 000 meters, as identified in AMC1 ADR.OPS.B.005(b)?

Answer

The term ‘near’ used in AMC3 ADR.OPS.B.010(a)(2) should be understood as including at least the 1 000 m referred to in AMC1 ADR.OPS.B.005(b), up to the 8 km referred to in AMC2 ADR.OPS.B.005(b), considering the published approach and departure procedures and the preferential flight routes.

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How should the aerodrome operator deduct these areas?

Answer

AMC1 ADR.OPS.B.005 aims that the aerodrome operator should ensure that assessment of the approach and departure areas is carried out which includes also cases when the aerodrome is located near a water/swampy area, or other difficult environment, or a significant portion of the approach/departure operations takes over these areas.

Within the 1 000 m, these areas should be defined considering the ‘obstacle limitation surfaces’ calculated according to the figures of ‘Divergence (each side)’ in CS ADR-DSN.J.480, Table J-1. ‘Dimensions and slopes of obstacle limitation surfaces — Approach runways’, adopting a trapezoidal shape with a 15-% angle for an instrument runway or a 10-% angle for a non-instrument runway.

For a portion of approach or departure operations up to 8 km, these areas should be defined considering the protection envelopes of a published approach or departure procedure.

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What width should be considered to define these areas?

Answer

AMC1 ADR.OPS.B.005 aims that the aerodrome operator should ensure that assessment of the approach and departure areas is carried out which includes also cases when the

aerodrome is located near a water/swampy area, or other difficult environment, or a significant portion of the approach/departure operations takes over these areas.

These areas should be defined considering, whenever possible and depending on the type of approach or departure procedure, the width of the runway strip and the published procedures envelope.

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What should be understood as the largest aeroplane normally using the aerodrome?

Answer

Based on AMC2 ADR.OPS.B010(a)(2), the aerodrome operator should consider for providing the minimum of the RFF service, that it needs sufficient equipment taking into account the longest aircraft (or group of aircraft) and their fuselage width based on which the level of protection of the aerodrome has been defined.

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In case off water/swampy areas, what should be considered to ensure an effective or adequate response to an emergency at the distances mentioned in AMC1 ADR.OPS.B.005(b) and AMC2 ADR.OPS.B.005(b)?

Answer

With regard to the 1000-m area from the runway thresholds, the aerodrome operator is required to assess and ensure the intervention capability of dedicated aerodrome services. If needed, according to the local environment, and through the establishment of appropriate cooperation protocols taking due account of national or local legislation, the institutional set-up and entities mission statement, the intervention capability could be ensured by relevant support entities.

With regard to the 8-km grid map and its relevant areas concerning published flight procedures,

the aerodrome operator, taking due account of the the national or local situation in terms of the institutional set-up of responsibility for managing and responding to an emergency, should conduct, with the support of relevant national or local entities, an assessment of the area to map entities available in case of an emergency, to identify intervention capability.

Such capability, with the aim to clarify how intervention would be implemented and the available means (i.e. responsibilities considering national or local legislation; type and quantity of equipment and personnel available; dispatch/activation time; other alternatives when response capacity is exhausted or in case there is no immediate response), should be documented and included in the National or Local Emergency Plans (GM1 ADR.OPS.B.005(a)), as well as in the Aerodrome Emergency Plan.

Such assessment should consider the safety management system requirement to coordinate the aerodrome emergency response plan. In that respect, coordination of the aerodrome emergency response plan with the emergency response plans of those organisations it must interface with during the provision of aerodrome services and with the relevant external organisations who have the responsibility to respond to an emergency occurring at an aerodrome or in its surroundings (ADR.OR.D.005) should be ensured.

The assessment of intervention capability should be periodically reviewed, tested, and discussed with all organisations that bear some responsibility in case of an emergency.

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What considerations for assessing difficult environments are already given in the EU regulatory framework?

Answer

Although the Regulation (EU) No 139/2014 does not contain specific considerations on the assessment of difficult environments at or near an aerodrome as the response to such areas, the existing EU regulatory framework contains aspects that could be used to assess difficult environments and plan the response to such areas in a transparent way:

1. **definition of the area's size** (e.g. AMC1 ADR.OPS.B.005(b), AMC2 ADR.OPS.B.005(b), GM1 ADR.OPS.B.010(a)(1));
2. **availability of support within the area**;
3. **resource management** (e.g. GM3 ADR.OPS.B.010(a)(2), AMC3 ADR.OPS.B.010(a)(2);

and

4. **verification**.

For more information, please refer to the following acceptable means of compliance (AMC) and guidance material (GM):

- GM1 ADR.OPS.B.010(a)(1).
- AMC3 ADR.OPS.B.010(a)(2), which states that ‘If the aerodrome is located near a **water/swampy area**, or **other difficult environment**, or a significant portion of the approach/departure operations takes over these areas, the aerodrome operator should **coordinate** the availability of suitable rescue equipment’.
- GM3 ADR.OPS.B.010(a)(2), which states that ‘Special fire fighting equipment **may not be provided** for water areas; this does not prevent the **provision of such equipment if it would be of practical use**, such as when the areas concerned include reefs or islands. The objective should be to **plan and deploy** the necessary life-saving flotation equipment, as expeditiously as possible, in a number commensurate with the largest aeroplane normally using the aerodrome’.
- AMC1 ADR.OPS.B.005(b), which states that ‘The aerodrome operator should ensure that an assessment of the approach and departure areas within 1000 m of the runway threshold is carried out to determine the options available for intervention’.
- AMC2 ADR.OPS.B.005(b), which states that ‘A grid map of the aerodrome and its immediate surroundings, approximately at a distance of 8km from the centre of the aerodrome’.

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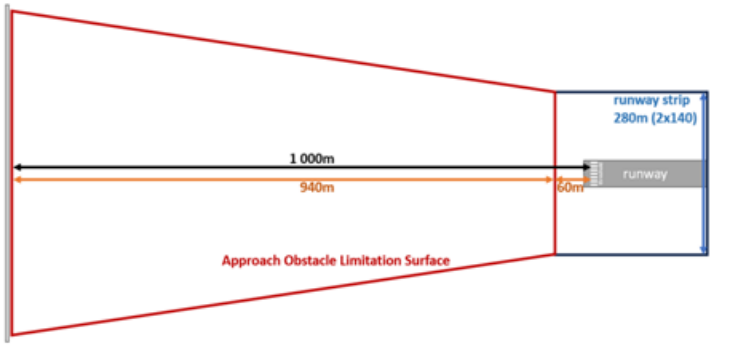
https://www.easa.europa.eu/en/faq/140179

What area should be considered when assessing difficult environments?

Answer

The assessment of potential difficult environments at or near an aerodrome should consider the immediate surroundings of an aerodrome and the established standard flight procedures.

In accordance with point (b) of ADR.OPS.B.005, the assessment of the area at an aerodrome should consider the width of the runway strip and then follow the actual approach obstacle limitation surface up to a distance of 1 000 m beyond the runway’s threshold (or, if there is no threshold, the runway end).



In accordance with point (e) of AMC2 ADR.OPS.B.005(b), the assessment near an aerodrome should consider significant portions underneath the standard approach and departure routes within a 8-km radius from the aerodrome reference point.



To determine the size of the area, please refer to the following:

- Table 1 of CS ADR-DSN.A.005 for the aerodrome reference code;
- CS ADR-DSN.A.002 for the runway;
- CS ADR-DSN.A.002 and CS ADR-DSN.B.160 for the runway strip; and
- CS ADR-DSN.A.002 and CS ADR-DSN.H.405 for the obstacle limitation surfaces.

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What response to difficult environments is expected by the aerodrome operator in those areas that are considered as difficult environments?

Answer

Within the 1 000 m area, the aerodrome operator should normally provide intervention capacities and respond to an incident (however, those responsibilities may be limited by local or national legislation defining other responsibilities). Therefore, the aerodrome operator should

determine the options available for intervention based on the capacity of its dedicated means or the established intervention protocols with third-party entities in charge. Additionally, activation and engagement procedures in accordance with needs and capacities considering the actual environment should be established.

For other difficult environments within the 8-km radius from the aerodrome reference point, the responsibility to respond remains with the local authorities or entities in charge within the local legal framework of the district where the incident occurred. Although there is no response expected by the aerodrome operator, the aerodrome operator should actively participate in the coordination of resources. This should include:

- the mapping of further entities' location and intervention capacities considering the safety management system requirements; and
- the counselling other responsible entities located in the area in the establishment of protocols

to allow for the effective organisation of resources for a rapid intervention.

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What resources could be considered when establishing intervention protocols?

Answer

Resources that could be considered to respond to incidents in difficult environments do not need to be limited to aerodrome-owned or RFFS resources. They could rather include any type of aerodrome service that can offer or ensure acceptable level of safety within the defined areas. Other such resources include third-party arrangements with external partners or organisations that can support or facilitate any response, whenever necessary, through knowledge, personnel, or equipment.

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How could the presence of difficult environments and the response capabilities to difficult environments be verified?

Answer

The presence of difficult environments should be reassessed upon infrastructural changes at or near the aerodrome. The intervention capabilities should be verified during training sessions, familiarisation with difficult environments, or exercises. Any third-party arrangements should be reviewed and updated periodically to ensure high-level of safety.

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Do firefighters need specific training when using fluorine-free foam?

Answer

Considering the characteristics of Fluorine-Free Foams, it is recommended that aerodrome operators and RFFS identify and implement actions to familiarize firefighters with Fluorine-Free Foam properties and tactics. Special attention should be given to foam application conditions and on ensuring isolation from heat and flames to break the combustion chain reaction.

These actions may include information dissemination or various levels of training. It is advantageous to carry out training with live fire & foam drills, as real practice offers greater responsiveness and adequacy of procedures.

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Are European airports required to replace current foams (AFFF) with fluorine-free foams (F3)?

Answer

At this stage, the replacement of AFFF foams with fluorine-free foams is not mandatory under the regulatory framework in the domain of civil aviation rules by EU-EASA and European current regulations.

However, due to European environmental regulation, the use of some AFFF is banned and considering future deadlines and the European objective of a complete ban of PFAS

in firefighting foams, airports should proactively plan the transition to fluorine-free foams.

The transition from AFFF foams to fluorine-free foams is driven by a phased ban - due to health and environmental concerns - on the production and use of certain fluorinated substances (PFAS) that are used in AFFF historically used by Aircraft Rescue and Fire Fighting Services at airports.

At this point, in accordance with the international Stockholm Convention, the European Regulation (EU) 2019/1021 “POPs" (Persistent Organic Polluants) bans on production and use the fluorinated foams containing PFOS (since 2009 and PFOA (since 2020) with some exemptions until end of 2022 and July 2025 for operational uses, depending on if discharges of foamed water are collected.

Additionally, the European Regulation (EC) 1907/2006 "REACH” **bans the production and use of additional PFAS in firefighting foams, including PFHxA**, to be banned before April 10, 2026, for regular firefighting uses and **before October 10, 2029, for civil aviation firefighting** (including airports)

Additional bans on any PFAS in firefighting foams are currently under discussion in the EU, leading many foam manufacturers to plan for discontinuing all PFAS-containing products.

As a result, depending on their chemical composition, some AFFF foams are now already banned or will be in future years:

- **"C8 foams", containing ‘long-chain” (more than 8 carbons) PFAS, are banned since 01/2023 at airports, where collecting foamed water is not ensured.**
- **Most of "C6 foams” (more recent generation of AFFF) will be banned in UE, with a specific 5-year delay (10/2029) for ARFF operations at airports.**

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What are the differences between AFFFs (Aqueous Film-Forming Foams) and the F3s (Fluorine-Free Foams)?

Answer

The main differences between the Aqueous Film-Forming Foams (AFFFs) and Fluorine-Free Foams (F3s) are chemical composition, firefighting performances and operational application

methods.

AFFFs (Aqueous Film-Forming Foams) contain PFAS, that are responsible for these foams' ability to form an aqueous film which helps to quickly suppress fires and provides higher resistance to re-ignition, even when foam has been degraded due to time or weather conditions.

F3s (Fluorine-Free Foams) have in common to be designed to be free of intentional fluorinated chemicals. Without fluor surfactants and film forming abilities, **their firefighting efficiency mainly relies on the quality of the foam blanket applied in operation**.

Accordingly, level of performance highly depends on the initial **quality of the foam produced by nozzle**, the **quality of the foam blanket created by firefighters** and **maintaining this quality despite degradation by time, physical or weather conditions**.

F3 Foam concentrate also presents various compositions, e.g. various physical properties, such as a different viscosity, that may impact quality of foam produced with firefighting equipment.

As a result, whatever the foam fire performance level, the compatibility with firefighting equipment and the training and operational tactics are more important criteria when using F3 than AFFF.

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https://www.easa.europa.eu/en/faq/142304

What are the main challenges for transition to Fluorine-Free Foam?

Answer

As for any change of foam, ensuring that the selected foam has demonstrated an appropriate and expected level of performance is fundamental.

However, considering general characteristics of Fluorine Free Foams, and considering the various products, the main challenges are, for an aerodrome operator, to ensure, with selecting and testing arrangements that:

- Selected foam suits with existing RFFS vehicles i.e.;
- Proportioning system vs. Viscosity of foam concentrate;
- Monitors and nozzles characteristics vs. Minimum quality of foam;
- Firefighting tactics are adjusted to F3;
- Firefighters are familiarized with the new foam;

- Handling or storage conditions assessment at the airport;
- Review and improve arrangements and criteria for initial and periodic testing of foam or vehicles.

In addition, aerodrome operators must plan transition to F3 considering:

- If or how existing vehicles are available for a future exploitation with F3 depending on:
  - Compatibility between vehicles and F3;
  - Impact of residual contamination with PFAS and environmental regulation.
- Already planned new vehicles, as it is advisable to limit contamination with PFAS;
- Existing stockpiles of AFFF, as far as it is usable foam considering PFAS regulation.

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What are the standards about performance level of fluorine-free foams at airports?

Answer

Although it is not clearly specified in AMC4 ADR.OPS.B.010(a)(2), it is commonly considered that the minimum level of performance A, B or C expected for extinguishing foams refers to performance levels defined by ICAO in Annex 14 and to information about fire performance test described in ICAO Airport Services Manual (Doc 9137), Part 1 (Rescue and Fire Fighting Services), Chapter 8.

As of today, there is no specific testing protocol defined for Fluorine Free Foam in the Airport Services Manual.

The current protocol allows measuring the minimum application rate whatever the tested Foam (Aqueous Film Forming (AFFF) or Fluorine Free (F3)).

As for AFFF, Aerodrome operators should refer to these information and the Airport Services Manual when requiring a minimum level of performances.

Selecting arrangements should include additional information such as expected conditions of certification or qualification of foam (fire performance test, foam production acceptance test with vehicles) and considerations about specifications of RFFS vehicles in use.

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Does the use of F3s change the quantities of extinguishing agent (water & foam) required?

Answer

The quantities and flow rates required by the Aerodrome regulation have been determined according to the length and width of the aircraft to be protected, as well as the foam application rate, which depends on the performance level (A, B, or C) achieved by the foam used as the primary extinguishing agent.

At this stage, once the foam, whether F3s or AFFF, has demonstrated its performance level on kerosene Jet-A1, the required quantities will be the same, regardless of whether AFFF or F3 is used.

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Is it required to considers transition to F3s as a change that need to be approved by Authority?

Answer

A change of foam, even when changing from AFFF to F3, does not directly affect the RFFS level of protection to be ensured by the airport operator. As such, the change is not identified as one requiring prior approval by Competent Authority (see AMC1 ADR.0O.B.040 (a);(b).

However, using a new type of foam could have a potential impact on the efficiency and organization of RFFS due to the different performances or application procedures as well as the challenges of such transition on the capacity to maintain an appropriate operational level of protection.

Therefore, it would be advisable for an airport operator to consider initiating and documenting a safety assessment – potentially supported by testing – before transitioning from AFFF to F3.

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Does fluorine-free foam offer equivalent performance and effectiveness on hydrocarbon fires?

Answer

Fluorine-free foams have generally demonstrated a different level of performance with regard to AFFF.

The lack of aqueous film-forming capability makes achieving initial fire suppression more difficult and affects resistance to re-ignition. This performance difference also depends on the type of flammable liquid or hydrocarbons to be extinguished.

However, many fluorine-free foams have demonstrated fire performance levels and effectiveness on kerosene that meet the minimum standards used to assess AFFF foams.

In practice, when using fluorine-free foam, **the ability to achieve quick**, **complete** and **lasting suppression largely depends on the firefighters' capacity to create and maintain a uniform foam blanket**.

In contrast, AFFF foams, with their aqueous film-forming properties, maintain better effectiveness even when the foam blanket is imperfect or degrades during the operation.

As a result, foam **application methods and firefighter training are to be considered as critical** when using fluorine-free foam than when using AFFF foam.

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Can a Fluorine Free Foam be used in conjunction with AFFF (Aqueous Film-Forming Foam)?

Answer

Due to their distinct chemical compositions, F3 and AFFF exhibit different mechanisms in fire suppression, particularly due to the lack of a floating aqueous film in F3.

AFFF and F3 concentrates must never be mixed into tank or mixing systems of vehicles.

However, using these two types of foam simultaneously from separate vehicles during an intervention, in the event of an aircraft accident, may not have any significant impact on the firefighting performance of the individual foams as far as respective application conditions are taken into account.

Moreover, it is suggested to minimize the duration of the period using both foams for transition purposes and to consult the manufacturers of the respective products for detailed technical guidance.

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Do airports need to change their firefighting vehicles or systems to use Fluorine Free Foam?

Answer

No, not necessarily. However, to ensure effectiveness of the new foam, the following aspects should be considered:

1. the compatibility of specifications of the intended foam concentrate with each firefighting vehicle and its firefighting systems;
2. sufficient cleaning of firefighting systems to avoid chemical interactions between previous foam (AFFF or F3) and new fluorine free foam.

Compatibility of F3s with vehicles depends on both the specifications of the vehicles and the on-board equipment, such as the foam proportioning system and nozzles, as well as the physical properties of the selected fluorine-free foam (e.g., viscosity or expansion rates), which could impact its performance with existing firefighting systems.

Depending on the chosen foam concentrate, **airports may need to adjust or replace foam proportioning systems or nozzles to ensure compatibility**. In some cases, if adjustments or replacements are not feasible, it may be necessary to **consider changing firefighting**

vehicles or, if possible, selecting a foam product with more suitable physical properties.

Therefore, it is recommended (including by vehicles manufacturers) to check the compatibility of the vehicles with the intended product:

- Prior to the order and delivery of the product, through a verification of the declared specifications and consultation with the manufacturers (of the vehicle and of the foam). At this point, results obtained previously on similar vehicles can be useful and valuable;
- Then, before F3 is officially put into service, (in-site) measurements and tests, to ensure that foam production by the airport's RFF vehicle is of an acceptable and expected standard considering proportioning system, foam quality and jet range (see ICAO Airport Service Manual "§ 8.1.6 "Foam performance acceptance test").

Considering sufficient cleaning of vehicle and firefighting systems, as it was usually recommended for any change of AFFF, a simple water rinse of the entire system (from tank to external equipment) may be considered as sufficient to prevent chemical interactions between new F3 and previous used foam.

However, it should also be noted that additional cleaning or vehicle replacement may be necessary to meet environmental requirements, due to the potential residual contamination of firefighting equipment with PFAS.

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What are foam production performance tests?

Answer

Whatever is the fire performance level of a selected foam, according to ICAO fire testing protocols, foam production by the airport's RFFS vehicles should be acceptable, considering fire testing conditions and expected performance of foam according to the foam manufacturer.

Foam production performance tests are measurements conducted with the airport's ARFF vehicles to verify:

- Performances of the proportioning system of the vehicle;
- Quality of foam (expansion ratio and 25% drainage time) produced with turret monitor and all other foam-making devices;
- Jet range of the main monitor.

Results of these tests, compared with expected performances, help to assess the compatibility

of foam and vehicles in the foam acceptance process. Initial results may be also used as reference for periodic in-service tests to ensure the ongoing performances of foam and foam production equipment. Considering that with Fluorine Free Foams, the quality of produced foam is more critical, performances of the main turret, in particular non-aspirated nozzle, should be assessed with care.

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Do intervention protocols need to be changed with the use of fluorine-free foam?

Answer

Considering differences between AFFF and F3s, which do not guarantee the production of an aqueous film on the burning or spilled liquid, aerodrome operators with their RFFS team should assess and review, in coordination with the foam manufacturer, whether their firefighting techniques and tactics are still appropriate or need to be adapted.

In particular:

- Foam application techniques;
- Consideration on adverse conditions impacting the quality of the foam blanket during operation;
- Monitoring and regeneration of foam blanket.

Furthermore, changes in intervention protocols should be taken into account in the Tasks and Resource Analysis as changes in techniques and tactics could affect the required number of firefighting personnel.

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What are the applicable safety regulatory requirements when changing foam?

Answer

ADR.OPS.B.010 requires that aerodrome operators ensure that adequate fire extinguishing agents are available. For this purpose, AMC4 ADR.OPS.B.010(a)(2) defines that:

(b) The foam (used as principal extinguishing agent) is meeting a minimum level of performance A, B or C;

(d)Minimum usable amounts of water are available for foam production (see table 1);

(j) A reserve supply of foam concentrate (200%) is maintained on the aerodrome (…);

(p) Arrangements are in place to manage extinguishing agents in terms of selection, storage, maintenance and testing.

As with any change of AFFF foam, the airport operator should ensure compliance with these provisions paying particular attention to those concerning the performance level.

In addition, it would be advisable to ensure that arrangements previously in place for selection, storage, maintenance and testing of AFFF are adapted to the characteristics and performance of new types of foam such as Fluorine-free foams, also with regard to the specifications of RFFS vehicles in use.

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Is on-site Fire performance testing necessary to evaluate the effectiveness of an extinguishing agent at an airport?

Answer

The legal provisions set in the Aerodrome regulation or in ICAO documents neither require nor recommend conducting on-site fire performance tests under airport condition (to be distinguished from on-site tests for verifying the compatibility of foam concentrate with the vehicles).

However, when selecting a foam concentrate, best practices should be adopted to ensure that the conditions under which the foam's performance was previously assessed (such as dosage, foam quality, and testing temperatures) match the conditions encountered at the airport or provide an acceptable level of performance.

If needed, especially when operating in temperatures that differ significantly from those experienced during the tests, it is recommended to consult the foam manufacturer for more information about the impact of temperatures on the foam performance.

Additional tests at a testing center may also be considered, or, ultimately, on-site tests if replicating the airport's specific conditions elsewhere proves too difficult.

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