



European and North  
Atlantic Office

*EUR Doc 019,*

*NAT Doc 006, Part II*

# **VOLCANIC ASH CONTINGENCY PLAN**

—

## **EUROPEAN AND NORTH ATLANTIC REGIONS**

***EUR/NAT VACP***

***Edition 2.0.0 — July 2016***

THIS DOCUMENT IS ISSUED BY THE EUR/NAT OFFICE OF ICAO  
UNDER THE AUTHORITY OF THE EANPG AND THE NAT SPG

---

**EUROPEAN AND NORTH ATLANTIC OFFICE OF ICAO**

**International Civil Aviation Organization (ICAO)**

European and North Atlantic (EUR/NAT) Office

3 bis, Villa Emile Bergerat

92522, Neuilly-sur-Seine CEDEX

FRANCE

e-mail : [icaoeurnat@paris.icao.int](mailto:icaoeurnat@paris.icao.int)  
Tel : +33 1 46 41 85 85  
Fax : +33 1 46 41 85 00  
Web : <http://www.icao.int/EURNAT/>

## TABLE OF CONTENTS

Table of Contents.....	i
Record of Amendments .....	v
Foreword.....	6
<i>Structure of the Document</i> .....	8
<i>Document Configuration Management</i> .....	9
<b>1. Dealing with the Hazard .....</b>	<b>10</b>
<b>2. Regional Preparation .....</b>	<b>12</b>
2.1 International Airways Volcano Watch (IAVW) .....	12
2.2 Information Flow .....	13
2.3 Information Control .....	13
2.4 Airspace Measures .....	13
2.5 air traffic Flow Management – ATFM.....	14
2.6 Crisis Management Arrangements .....	14
2.7 Training and Exercising .....	15
2.8 Regulations, Means of Compliance and guidance material .....	15
2.9 Operators from outside the Region .....	15
<b>3. Response to a Volcanic Ash Event .....</b>	<b>16</b>
3.0 Phases of an Event .....	16
3.1 Pre-Eruption Phase.....	16
<i>General</i> .....	16
<i>Originating ACC/FIC Actions (eruption expected in its own FIR)</i> .....	17
<i>Adjacent ACC/FIC actions</i> .....	18
<i>ATFM Unit actions</i> .....	18
3.2 Start of eruption phase .....	18
<i>General</i> .....	18
<i>Originating ACC/FIC actions (eruption in its own FIR)</i> .....	19
<i>Adjacent ACC/FIC actions</i> .....	20
<i>ATFM Unit actions</i> .....	20
3.3 On-Going Eruption Phase .....	20
<i>General</i> .....	20
<i>ACC/FIC Actions</i> .....	21
<i>ATFM Unit actions</i> .....	21
3.4 Recovery Phase .....	21
<b>List of Appendices and Attachments .....</b>	<b>23</b>
List of Appendices .....	23
List of Attachments.....	23
<b>Appendix 1 — Anticipated Flight Crew Issues when Encountering Volcanic Ash     (Information for ATS Personnel).....</b>	<b>24</b>
Ash detection by flight crew .....	24
Flight crew and volcanic ash encounter.....	24

Flight crew expectations from ATC .....	25
<b>Appendix 2 — Pilot Reports.....</b>	<b>26</b>
Introduction.....	26
VAAC requirements .....	27
Format and Routing instructions.....	27
Examples.....	27
<b>Appendix 3 — State Checklist.....</b>	<b>29</b>
Preparatory Activities (see also ICAO Doc 9766, section 4.1) .....	29
Crisis Management Activities.....	30
<b>Appendix 4 — VAAC Checklist.....</b>	<b>31</b>
VAAC Procedures .....	31
<b>Appendix 5 — ANSP Checklist.....</b>	<b>32</b>
Local instructions.....	32
Personnel Training and Exercises.....	32
Communication links .....	32
ATFM and Crisis Management .....	32
Dealing with the media.....	32
<b>Appendix 6 — Airspace User (Operator) Checklist.....</b>	<b>33</b>
SOPs .....	33
Sources of information.....	33
Procedures.....	33
Volcano Eruption Required information for dispatchers and flight crews .....	33
Dedicated team .....	34
Training.....	34
Participation in volcanic contingency exercises (e.g. VOLCEX, VOLKAM) .....	34
<b>Appendix 7 — MWO Checklist .....</b>	<b>35</b>
Action taken by MWO in the event of a volcanic eruption: .....	35
<b>Attachment X1 — Regional Monitoring Capabilities of volcanic activities and arrangements ...</b>	<b>36</b>
Common to EUR and NAT Regions .....	36
<i>Volcano Observatories and Volcanoes monitored</i> .....	36
<i>Satellites</i> .....	36
<i>LIDAR Networks</i> .....	36
<i>In-situ airborne monitoring</i> .....	36
<i>Aircraft Sensors</i> .....	36
<b>Attachment X2 — Regional Information Flow Arrangements and Model Templates     (according to global standards; supplemented by Regional requirements).....</b>	<b>37</b>
EUR Region – Eastern Part .....	37
<i>Information Flow schema</i> .....	37
VAAC .....	38
<i>Volcano Observatories (VO)</i> .....	39
MWO.....	40

<i>NOTAM office</i> .....	40
EUR Region – Western Part .....	41
<i>Information Flow schema</i> .....	41
VAAC .....	41
<i>Volcanic Ash Supplementary information</i> .....	43
EUROCONTROL.....	44
<i>Volcano Observatories (VO)</i> .....	44
MWO.....	45
<i>NOTAM office</i> .....	45
NAT Region.....	46
<i>Information Flow schema</i> .....	46
VAAC .....	47
<i>Volcano Observatories (VO)</i> .....	48
MWO.....	49
<i>NOTAM office</i> .....	49
<b>Attachment X3 — Description of Selected VA Products.....</b>	<b>51</b>
EUR Region – Eastern Part .....	51
<i>Use of Volcanic Ash VAA/VAG, SIGMET and NOTAM</i> .....	51
<i>ICAO Volcanic Ash Advisory (VAA) and VAG (Volcanic Ash Graphic)</i> .....	52
EUR Region – Western Part .....	52
<i>Use of Volcanic Ash VAA/VAG, SIGMET, NOTAM and ASHTAM</i> .....	52
<i>ICAO Volcanic Ash Advisory (VAA) and VAG (Volcanic Ash Graphic)</i> .....	53
<i>Supplementary Volcanic Ash Charts provided by the London and Toulouse VAACs</i> .....	54
<i>Annotated Satellite Image</i> .....	55
<i>Data Files</i> .....	56
NAT Region.....	57
<i>Use of Volcanic Ash VAA/VAG, SIGMET, NOTAM and ASHTAM</i> .....	57
<i>ICAO Volcanic Ash Advisory (VAA) and VAG (Volcanic Ash Graphic)</i> .....	58
<i>Annotated Satellite Image</i> .....	58
<i>Data Files</i> .....	59
<b>Attachment X4 — Guidance on the Establishment, Amendment and Withdrawal of Danger Areas.....</b>	<b>61</b>
EUR Region – Eastern Part .....	61
<i>Use of Danger Areas</i> .....	61
EUR Region – Western Part .....	61
<i>Use of Danger Areas</i> .....	61
<i>Size and dimensions of Danger Areas:</i> .....	61
NAT Region.....	62
<i>Use of Danger Areas</i> .....	62
<i>Size and dimensions of Danger Areas:</i> .....	62
<b>Attachment X5 — Air Traffic Flow Management arrangements.....</b>	<b>63</b>
EUR Region – Eastern Part .....	63
EUR Region – Western Part .....	63
<i>EUROCONTROL/Network Manager</i> .....	63
NAT Region.....	63
<i>NAT Organised Track System (OTS) and oceanic clearance arrangements:</i> .....	63
<b>Attachment X6 — Crisis Management Arrangements .....</b>	<b>65</b>

EUR Region – Eastern Part .....	65
EUR Region – Western Part .....	65
<i>EUROCONTROL/Network Manager</i> .....	65
<i>EACCC:</i> .....	65
<i>NOP Portal</i> .....	65
<i>Teleconferences</i> .....	66
<i>European crisis Visualisation Interactive Tool for ATFCM (EVITA)</i> .....	66
NAT Region.....	66
<b>Attachment X7 — VOLCEX Arrangements (GM in Doc 9766)</b> .....	<b>67</b>
Common to both EUR and NAT Regions .....	67
<i>European and North Atlantic Volcanic Ash Exercises Steering Group (EUR/NAT VOLCEX/SG)</i> .....	67
<i>Volcanic Ash Exercises Steering Group for the (far) Eastern part of the EUR Region (EUR (EAST) VOLCEX/SG)</i> .....	67
<b>Attachment X8 — Regional Regulations, Means of Compliance and Guidance Material (References)</b> .....	<b>68</b>
EUR Region – Eastern Part .....	68
EUR Region – Western Part .....	68
<i>EU Regulations, Directives, AMC, GM, etc</i> .....	68
<i>Additional National Regulations</i> .....	69
<i>SRA application in the EUR region</i> .....	69
NAT Region.....	70
<b>Terminology, Definitions and Acronyms</b> .....	<b>a</b>
<b>Terminology</b> .....	<b>a</b>
<b>Definitions</b> .....	<b>a</b>
<b>Acronyms</b> .....	<b>a</b>
<b>Referenced Documents</b> .....	<b>c</b>
<b>SARPs</b> .....	<b>c</b>
<b>Guidance</b> .....	<b>c</b>

## RECORD OF AMENDMENTS

The *Volcanic Ash Contingency Plan – European and North Atlantic Regions* (EUR/NAT VACP, EUR Doc 019, NAT Doc 006, Part II) –Edition 2.0.0 resumes the practice of a VACP common to both European and North Atlantic ICAO Regions.

Subsequent to an update to the *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444) section 15.8 taking effect in November 2014, which transferred the responsibility for Volcanic Ash (VA) avoidance or the decision to fly or not to fly into an area of known or forecast VA contamination from Air Traffic Management (ATM) to Aircraft Operators (AO), there was a period when each of the EUR and NAT Region had its own VACP. Edition 2 of this document covers both EUR and NAT Regions, as was the case before November 2014 and the aforementioned change to the PANS-ATM (Doc 4444).

Proposal for amendments to the EUR/NAT VACP are processed according to the principles set forth in the *Document Configuration Management* sub-section in the foreword, at page 9 (paragraphs 0.0.21 and 0.0.22 refer). The space below is provided to keep a record of amendments to this document.

---

## FOREWORD

0.0.1 Within and adjacent to the European (EUR) and North Atlantic (NAT) Regions there are areas of volcanic activity which are likely to affect flight in the NAT and EUR Regions. This plan sets out standardised guidelines for the coordination of information and the alerting of aircraft before and during a volcanic eruption and procedures to be followed.

0.0.2 Volcanic ash is a hazard to flight operations. It is important to note that other contaminants are also associated with volcanic activity.

0.0.3 To mitigate the hazards of volcanic contamination aircraft operators need to obtain information and support from many different sources including Air Traffic Management (ATM<sup>1</sup>). The management of air traffic will be impacted proportionally to the extent and nature of the contamination. The issue cannot be resolved by individual stakeholders in isolation but needs collaborative decision making (CDM) involving all entities concerned.

0.0.4 Contingency planning for major service disruptions, such as that caused by volcanic ash, needs to encompass the whole ATM Community<sup>2</sup> as defined in ICAO's *Global Air Traffic Management Operational Concept* (Doc 9854). While general provisions exist for ATM Contingency Planning in Annex 11 [*Air Traffic Services*] and in the *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444), and some aspects are addressed in the *Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds* (Doc 9691) and in the *Handbook on the International Airways Volcano Watch* (IAVW Handbook, Doc 9766), ICAO's International Volcanic Ash Task Force (IVATF) developed comprehensive Guidance Material for ATM Volcanic Ash Contingency Planning in the form of a template.

0.0.5 This document is based on all of these sources and the needs and experience of the members of the ATM community in the EUR and NAT Regions of ICAO. While it focuses on the provision of ATM related services to airspace users within the frameworks of International Airways Volcano Watch (IAVW) and EUR Crisis Management, it also establishes the connection to all relevant interfaces, such as the International Airways Volcano Watch, Meteorological Services, Flight Operations and Aerodromes. Wherever possible, duplication of text from other ICAO and industry documents is avoided by reference to the source.

0.0.6 This common EUR/NAT Volcanic Ash Contingency Plan (VACP) is based on the following principles that are rooted in the Standards of various ICAO Annexes. States have the responsibility to establish and supervise the requirements on flight operations and the provision of the necessary services.

0.0.7 The airspace users have (full and final) responsibility for the safety of flight operations in accordance with their Safety Risk Assessment (SRA) as accepted by their State's authority. This includes the decision about operation in airspace where volcanic ash is present or forecast (Annexes 6

---

<sup>1</sup> ATM is defined in PANS-ATM (Doc 4444) as “The dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions.”

<sup>2</sup> ATM Community is defined in Doc 9854 as “The aggregate of organizations, agencies or entities that may participate, collaborate and cooperate in the planning, development, use, regulation, operation and maintenance of the ATM system.”



[*Operation of Aircraft*], and 19 [*Safety Management*]; *Manual on Flight Safety and Volcanic Ash* (Doc 9974) refer).

0.0.8 The Air Navigation Service Providers (ANSP) act to achieve the objectives of the *Air Traffic Services* (Annex 11), which are (inter alia) to:

- prevent collisions between aircraft;
- expedite and maintain an orderly flow of air traffic;
- provide advice and information useful for the safe and efficient conduct of flights.

0.0.9 States are furthermore obliged to ensure, inter alia, appropriate *Meteorological Services for International Air Navigation* (Annex 3) and *Aeronautical Information Services* (Annex 15).

0.0.10 Further principles of this contingency plan are that a cautious approach in case of limited information is adopted; and responses are scaled proportionally to the prevailing conditions.

0.0.11 When limited information is available, the initial procedures are conservative. With increasing amount of and confidence in the information the constraints on flight operations can be relaxed based on appropriate risk management.

0.0.12 Small eruptions might only need a local response, while significant or major eruptions are likely to trigger national, sub-regional, Regional or even inter-Regional activities.

0.0.13 The contingency plan aims to ensure the highest level of service possible, to support safe and efficient flight operations in adverse conditions.

0.0.14 This contingency plan is written to give sufficient background information and guidance to operational personnel, describing the end-to-end processes and information flows and referencing relevant Standard and Recommended Practices (SARPs) and Guidance Material.

0.0.15 While it is firmly rooted in the ICAO SARPs, this contingency plan is intended to provide the enabling support structure to implement best practices that serve the needs of the ATM Community.

0.0.16 Desired developments (e.g. an action plan on arrangements that still need to be implemented) may be listed as an attachment to support the planning of amendments and improvements.

0.0.17 The guidelines provided in this document assume that the operators follow the ICAO requirements regarding Safety Management Systems (SMS). Detailed guidance on Safety Risk Assessments (SRAs) for flight operations with regard to volcanic ash contamination can be found in the *Manual on Flight Safety and Volcanic Ash* (ICAO Doc 9974) and in Attachment X8 [*Regional Regulations, Means of Compliance and Guidance Material*].

0.0.18 Volcanic ash can also affect the operation of aircraft at aerodromes. Volcanic ash deposition at an aerodrome, even in small amounts, can result in the closure of the aerodrome until all the deposited ash has been removed. In extreme cases, the aerodrome may no longer be available for operation at all, resulting in repercussions on the ATM system, e.g. diversions, revised traffic flows, etc.

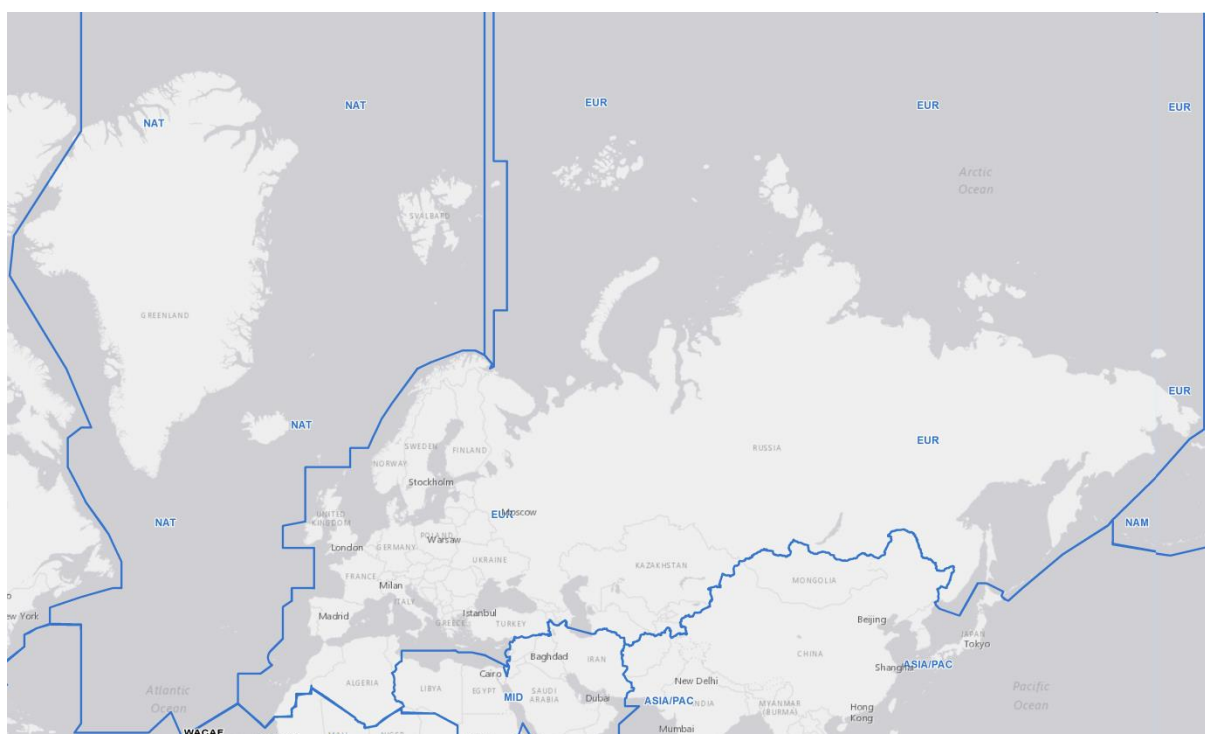
0.0.19 This document is organised in three levels:

- i) A main body, common to both Regions;
- ii) Appendices; and
- iii) Attachments

0.0.20 Consistent with ICAO practice,

- **Appendices** to the document comprise material grouped separately for convenience but forming part of the main body of the document: information in VACP Appendices complement the main body text, and is therefore applicable to both Regions.
- **Attachments** to the document comprise material supplementary to the main body of the document, or included as a guide to the application of the provisions in the document: information contained in the VACP Attachments is applicable to individual Regions or sub-Regions, and may contain variations from the main body text. To this end, most of the attachments are therefore organised in three (3) sections, namely: EUR Region – Eastern Part, EUR Region – Western Part, and NAT.

Figure 1: European and North Atlantic Regions of ICAO



### *Document Configuration Management*

0.0.21 Because this document is common to the ICAO EUR and NAT Regions, special care is to be taken when amending it, to avoid that an amendment proposed by one Region introduce modification disrupting for the other Region. Therefore, amendments to the EUR/NAT VACP will abide to the following principles:

- a) Each Proposal for amendments (PfA) to the common EUR/NAT VACP is to be channelled through the appropriate working body in the EANPG or the NAT SPG working structure, as seen fit, for initial assessment before further processing;
- b) Each PfA to an Attachment is to be endorsed by either the COG or the NAT IMG, as appropriate, once assured that the impact to the resulting document was under control and limited to the content specific to the endorsing Region;
  - the COG and NAT IMG, as appropriate, shall be informed about the existence of amendment(s) endorsed only by the other group due to the amendment(s) having an impact limited to only one ICAO Region (EUR or NAT); and
  - PfAs to Attachments do not need to be approved (by the EANPG and NAT SPG);
- c) Each PfA to an Appendix or to the document main body is to be endorsed by both the COG and the NAT IMG, once assured that the impact to the resulting document was under control and all the modifications to the document fully developed in the PfA;
  - PfA to Appendices do not need to be approved by the EANPG and NAT SPG;
- d) PfA to the document main body shall be approved by both the NAT SPG and EANPG, once endorsed by the NAT IMG and COG;

0.0.22 If appropriate<sup>3</sup>, a common date of applicability for the amended common EUR/NAT VACP should be determined for both NAT and EUR Regions, coordinated between the NAT IMG and COG. Approval by correspondence would be sought when time is critical.

---

<sup>3</sup> A common date of applicability would not be required for a new version of the common EUR/NAT VACP subsequent to amendments having an impact limited to only one of the EUR or NAT Region.

## 1. DEALING WITH THE HAZARD

1.0.1 During an eruption volcanic ash can reach and exceed the cruising altitudes of turbine-powered aeroplanes within minutes and spread over vast geographical areas within a few days. Encounters with volcanic ash may result in one or more of the following and other problems:

- malfunction, or failure, of one or more engines leading not only to reduction, or complete loss, of thrust but also to failures of electrical, pneumatic and hydraulic systems;
- blockage of pitot and static sensors resulting in unreliable airspeed indications and erroneous warnings;
- windscreens rendered partially or completely opaque;
- smoke, dust and/or toxic chemical contamination of cabin air requiring crew use of oxygen masks, thus impacting communications; electronic systems may also be affected;
- erosion of external and internal aircraft components;
- reduced electronic cooling efficiency leading to a wide range of aircraft system failures;
- aircraft need to be manoeuvred in a manner that conflicts with other aircraft;
- deposits of volcanic ash on a runway degrading braking performance, most significantly if the ash is wet; in extreme cases, this can lead to runway closure.

1.0.2 This list is not exhaustive and other unusual occurrences may develop.

1.0.3 In this context it should be noted that some aircraft types or engine technologies are more vulnerable to volcanic contaminants; any specific measures to be applied by the regulatory authorities for flight operations, would therefore need to take into account these differences.

1.0.4 Considering that a turbine-engine aircraft travels about 150 km (80 NM) in 10 minutes and that volcanic ash can rise to flight levels commonly used by these aircraft in half that time, a timely response to volcanic eruptions and volcanic ash in the atmosphere is essential. It is therefore imperative that information on the volcanic activity is disseminated as soon as possible.

1.0.5 In order to ensure the smooth implementation and effectiveness of the contingency plan in case of an actual volcanic eruption, volcanic ash training and exercising should be conducted (Section 2.7 [*Training and Exercising*] refers).

1.0.6 ICAO has set up the International Airways Volcano Watch (IAVW) to provide near-real-time information on the largest possible number of volcanic events that affect aviation. State volcano observatories (VO) shall monitor active or potentially active volcanoes and shall provide information to Area Control Centres (ACC), Meteorological Watch Offices (MWO) and Volcanic Ash Advisory Centres (VAAC). It should be noted that currently not all active or potentially active volcanoes are actually monitored. VAACs detect the existence and extent of discernible volcanic ash in the atmosphere in their area of responsibility and issue advisory information regarding the extent and forecast movement of the volcanic ash cloud.

1.0.7 Special air-reports on volcanic activity (prescribed in PANS-ATM – Doc 4444) and the information collected by the IAVW (detailed in IAVW Handbook – Doc 9766) in accordance with

SARPs of ICAO Annex 3 are elements of the input for the generation of volcanic ash advisories in alphanumeric (VAA) and graphic (VAG) forms. VAAs/VAGs are used by

- MWOs to derive Significant Meteorological information (SIGMET)
- airspace users for flight planning
- Air Traffic Service (ATS) units for contingency planning

1.0.8 The complexity of ATM operations in the EUR and NAT Regions requires well-coordinated and controlled actions to deal effectively and efficiently with volcanic ash in the airspace.

1.0.9 The Flight Information Centre (FIC)/ACC unit serves during a volcanic eruption as the critical communication link between affected aircraft in flight and the information providers. Commercial operators will coordinate actions with their flight crews en-route and affected air traffic services units. As this all results in increased workload for the ATS personnel involved, local procedures should address how this situation should be handled.

1.0.10 Due to the density of EUR and NAT traffic permanent ATS system capacity and air traffic flow management<sup>4</sup> (ATFM) arrangements<sup>5</sup> are in place in some parts of the Regions. The contingency plan details the (additional) arrangements in case of volcanic ash affecting the airspace.

1.0.11 The provisions of Annexes 3 [*Meteorological Services for International Air Navigation*], 15 [*Aeronautical Information Services*] (AIS), and related documents are the basis of the detailed instructions contained in this contingency plan. Airspace users need as much advance notification as possible on the status of a volcano and/or volcanic ash airspace contamination and/or volcanic ash deposition at airports for strategic planning and the execution of flights to ensure the safety of the flying public.

1.0.12 This contingency plan provides Regional guidance on airspace management measures that might be taken by competent authorities (e.g. the establishment and withdrawal of Danger Areas); and the creation and dissemination of Notices to Airmen (NOTAM)/ASHTAM and special air-reports on volcanic activity.

1.0.13 The contingency plan, including its Appendices<sup>6</sup> and Attachments<sup>7</sup>, contains the organisation of the information flow as per Annex 3 [*Meteorological Services for International Air Navigation*] and the information flow relating to supplementary information.

---

<sup>4</sup> *The Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM, ICAO Doc 4444), Air Traffic Flow Management (ATFM): A service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate ATS authority.*

<sup>5</sup> *Manual on Collaborative Air Traffic Flow Management (ICAO Doc 9971) refers.*

<sup>6</sup> *Appendices, according to ICAO Practice, comprise material grouped separately for convenience but forming part of the main body of the document.*

<sup>7</sup> *Attachments, according to ICAO Practice, comprise material supplementary to the main body of the document, or included as a guide to the application of the provisions in the document. Information contained in an Attachment is applicable to individual Regions or sub-Regions, and may contain variations from the main body text.*

## 2. REGIONAL PREPARATION

2.0.1 The successful operation of air traffic in case of a volcanic ash event depends on coordinated arrangements. This section lists those issues which are common to both Regions. Attachments to the Contingency Plan contain the current details and arrangements agreed in the respective Region.

### 2.1 INTERNATIONAL AIRWAYS VOLCANO WATCH (IAVW)

2.1.1 Annex 3 [*Meteorological Services for International Air Navigation*], Chapter 3 obliges States to arrange the monitoring of active and potentially active volcanoes by selected State volcano observatories.

2.1.2 The IAVW Handbook (Doc 9766) details the responsibilities of volcano observatories.

2.1.3 In areas where volcanoes are not adequately monitored by volcano observatories, remote sensing technologies, such as observation by satellites, and pilot reports serve as the main sources of information about eruptions and volcanic ash. Annex 3 [*Meteorological Services for International Air Navigation*], paragraphs 4.8, 5.5 and 5.9 refer.

2.1.4 Flight crews are required to report observations of volcanic activity by means of a special air-report. Arrangements should be put in place to ensure that such information is transferred without delay to the appropriate agencies. Instructions for air reporting of volcanic activity and the special air-report of volcanic activity form (Model VAR) can be found in Appendix 1 of PANS-ATM (Doc 4444).

2.1.5 Special air-reports on volcanic activity are necessary to improve the knowledge base of the VAACs. The communication and dissemination of pilot reports on volcanic activity is described in Appendix 2 [*Pilot Reports*].

2.1.6 Volcanic Ash Advisory Centres (VAAC) are established in the UK (London VAAC) and in France (Toulouse VAAC) serving the eastern part of the NAT and most of Europe; and in Montreal and Washington for the western part of the NAT; the far eastern part of the EUR Region is served by VAAC Tokyo and VAAC Anchorage. Their area of responsibility and cooperation with other VAACs is described in Doc 9766 (Handbook on the IAVW). The VAACs follow a best practices approach agreed among them, that aims to achieve global harmonisation of their services.

2.1.7 VAACs provide approved and recognised information as defined in Annex 3 [*Meteorological Services for International Air Navigation*] that supports the SRA methodology applied by airspace users. Additionally, MET Offices collocated with VAACs London and Toulouse provide supplementary information<sup>8</sup>. Attachment X3 [*Description of Selected VA Products*] contains explanatory information about both Annex 3 [*Meteorological Services for International Air Navigation*], VA products, and supplementary information; this enables airspace users to understand the limitations of the products, and sources of information, when developing their SRAs and operational planning (Appendix 4 [*VAAC Checklist*] refers).

2.1.8 To keep information about affected airspace as accurate as possible, so that restrictions to flight operations can be limited as much as possible, the VAACs should have

---

<sup>8</sup> In this document “supplementary information” means additional information on volcanic activity available beyond that prescribed by ICAO SARPs (Attachment X3 [*Description of Selected VA Products*] refers).

arrangements with those States having suitable infrastructure (LIDAR networks, aircraft to provide in-situ measurements, etc) to allow the use of relevant data for the verification of actual volcanic ash (horizontal and vertical extent).

2.1.9 VAAC products should be amended as appropriate once information on observed volcanic ash has been verified.

2.1.10 Attachment X1 contains the Regional monitoring capabilities and arrangements.

## 2.2 INFORMATION FLOW

2.2.1 Information on areas of observed and/or forecast volcanic ash shall be disseminated in accordance with Annex 3 [*Meteorological Services for International Air Navigation*] and Annex 15 [*Aeronautical Information Services*].

2.2.2 The details of all communication channels need to be established in advance and be available in local contingency arrangements. Telephone numbers, e-mail addresses, URLs of websites etc should be kept up-to-date and saved on electronic systems for easy use (e.g. electronic phone book, internet browser bookmarks).

Templates for required messages and all relevant information for their completion shall be available locally.

2.2.3 Regional arrangements and example templates are available, as appropriate, in Attachment X2 [*Regional Information Flow Arrangements and Model Templates*] (e.g. EVITA<sup>9</sup>, EACCC<sup>10</sup>, teleconference procedures).

## 2.3 INFORMATION CONTROL

2.3.1 While the availability of required information is crucial for planning and execution of ATM operations and flight operations, recent events have shown that information overload can result from the inappropriate application of communication requirements.

2.3.2 Regional arrangements should be made to ensure availability of the necessary information in accordance with Annexes 3 [*Meteorological Services for International Air Navigation*] and 15 [*Aeronautical Information Services*].

2.3.3 States are encouraged to ensure the availability of guidance and procedures, on the range of information that may be used for the planning and execution of operations in their airspace (Appendix 3 [*State Checklist*]. and Appendix 5 [*ANSP Checklist*] refer).

2.3.4 Attachment X3 contains current Regional arrangements and agreements for information service provisions.

## 2.4 AIRSPACE MEASURES

The Chicago Convention reserves each contracting State the right, in the interest of public safety, temporarily to restrict or prohibit flying over the whole or any part of its territory.<sup>11</sup>

---

<sup>9</sup> EVITA: *European Crisis Visualization Interactive Tool for ATFCM (Air Traffic Flow and Capacity Management)*

<sup>10</sup> EACCC: *European Aviation Crisis Coordination Cell*

2.4.1 Annexes 11 [*Air Traffic Services*] and 15 [*Aeronautical Information Services*] define Restricted, Prohibited and Danger Areas and specify requirements for their identification and promulgation. Neither the Convention, nor any of the Annexes provide detailed guidance on the conditions that would necessitate the establishment of such areas, nor on specific procedures for their use. By inference of Article 12 of the Convention, over the High Seas only Danger Areas can be established. This is based on the United Nations Convention on the Law of the Sea (Montego Bay 1982).

2.4.2 In a volcanic ash scenario the State should ensure that the authority which is responsible for determining the need for and extent of Danger, Prohibited or Restricted Areas should have the appropriate competencies, including on flight operations. The facility should be available permanently.

2.4.3 Whereas Danger Areas traditionally were absolutely avoided by aircraft, current safety management practices might allow the operation of (certain) aircraft in accordance with an appropriate Safety Risk Assessment (SRA). Although ATM normally expects aircraft to avoid Danger Areas established in connection to a volcanic ash event, the final decision regarding the route to be flown, whether it will be to avoid or proceed through an area of volcanic ash or activity, is the flight crew's responsibility.

2.4.4 Attachment X4 [*Guidance on the Establishment, Amendment and Withdrawal of Danger Areas*] describes the procedures for the use of Danger Areas.

## 2.5 AIR TRAFFIC FLOW MANAGEMENT – ATFM

2.5.1 Annex 11 [*Air Traffic Services*] paragraph 3.7.5 states that Air Traffic Flow Management shall be implemented for airspace where air traffic demand at times exceeds, or is expected to exceed, the declared capacity of the air traffic control services concerned.

2.5.2 Volcanic ash in airspace may result in a significant number of aircraft being re-routed into adjacent, non-affected areas. Regional arrangements should aim to provide sufficient capacity to safely and efficiently accommodate the revised traffic flow.

2.5.3 Regional ATFM units should be the ideal information pools and communication nodes for contingency situations and could be set up to support collaborative decision making (CDM) between ANSPs, Civil Aviation Authorities (CAA), VAACs, Meteorological Watch Offices (MWO) and airspace users.

2.5.4 Where permanent ATFM arrangements do not exist or cannot cope with the consequences of disruption caused by volcanic ash, contingency measures should be developed and agreed between the ANSPs and the airspace users. Attachment X5 [*Air Traffic Flow Management arrangements*] contains some existing Regional and sub-regional ATFM arrangements.

## 2.6 CRISIS MANAGEMENT ARRANGEMENTS

2.6.1 The nature of extraordinary contingency situations might require decision-making on a higher level than that of normal operations and beyond ATM. Arrangements should be in place to share information with national, Regional and sub-regional disaster management services that may have been implemented to address the crisis. These measures are to assure the delivery of essential goods through alternative means of transport in case of prolonged non-availability of airspace or airports, or the evacuation of humans from hazardous areas.

---

<sup>11</sup> *Chicago Convention (ICAO Doc 7300), Article 9 refers.*



2.6.2 Regional and/or sub-regional crisis management arrangements are detailed in Attachment X6 [*Crisis Management Arrangements*].

## 2.7 TRAINING AND EXERCISING

2.7.1 It is important to appropriately train personnel that may be involved in volcanic ash contingency operations, so that they have the necessary competency<sup>12</sup> of their own area of responsibility, and have awareness of the information needs and the impact on stakeholders.

2.7.2 System-wide response to volcanic ash events shall be tested by the conduct of regular exercises. Doc 9766 Appendix F contains *Guidance for conducting volcanic ash exercises in ICAO Regions*. The collection and documentation of relevant data on system performance is a key objective of exercising. Subsequent analysis of exercises and actual events should be used to develop improvements to the Regional and global volcanic ash contingency procedures.

2.7.3 Attachment X7 [*VOLCEX Arrangements*] contains information on the Regional and/or sub-regional volcanic ash exercise arrangements.

## 2.8 REGULATIONS, MEANS OF COMPLIANCE AND GUIDANCE MATERIAL

2.8.1 States determine which Regulations and Directives they need to implement to ensure compliance with the global and Regional requirements.

2.8.2 Attachment X8 [*Regional Regulations, Means of Compliance and Guidance Material*] contains references to relevant Regional and sub-regional (non-ICAO) regulations and guidance material.

## 2.9 OPERATORS FROM OUTSIDE THE REGION

2.9.1 Regional contingency planning should be transparent to all users, and take account, as far as practical, of operators from outside the Region to ensure that they are familiar with the Regional operations.

---

<sup>12</sup> **Competency.** A combination of skills, knowledge and attitudes required to perform a task to the prescribed standard.

### 3. RESPONSE TO A VOLCANIC ASH EVENT

#### 3.0 PHASES OF AN EVENT

3.0.1 The response to a volcanic event that impacts air traffic has been divided into four distinct phases in this document — a Pre-Eruption Phase, a Start of Eruption Phase, an On-going Eruption Phase, and a Recovery Phase — as follows:

**PRE-ERUPTION PHASE** (when applicable): The initial response, “raising the alert”, commences when a volcanic eruption is expected. It should be noted that sometimes volcanoes erupt unexpectedly without any alert being raised; hence the pre-eruption phase may be omitted.

**START OF ERUPTION PHASE** (when applicable): The start of eruption phase commences when information about the outbreak of a volcanic eruption becomes available.

**ON-GOING ERUPTION PHASE:** The on-going eruption phase commences with the issuance of the first complete volcanic ash advisory (VAA) containing information on the extent and forecast movement of the volcanic ash cloud.

**RECOVERY PHASE:** The recovery phase commences with the issuance of the first VAA containing the statement “NO VA EXP” (i.e. “no volcanic ash expected”) which normally occurs when it is determined that no volcanic ash is expected in the atmosphere and the volcanic activity has reverted to its non-eruptive state.

3.0.2 The Handbook on the International Airways Volcano Watch (Doc 9766) does not differentiate consistently between these different phases, which are functionally quite different. The Regional VA Contingency Plan lists the appropriate actions in the respective sections.

3.0.3 Although the four distinct phases herein describe actions to be undertaken during an actual volcanic event, they are based on a theoretical scenario. Actual eruptions may not always be distinct with respect to ATM actions to be undertaken. Similarly, an eruption may occur without any pre-eruptive activity, or may cease and restart more than once. Hence, the first observation may be the presence of an ash cloud, which is already some distance away from the volcano. It is essential that the contingency planning prepares the ATM system for an appropriate response depending on the actual conditions.

#### 3.1 PRE-ERUPTION PHASE

##### *General*

3.1.1 Emphasis in this phase is placed on raising awareness of the potential hazard and to protect aircraft in flight. The actions shall be based on well-prepared, well-exercised contingency plans and standard operating procedures.

3.1.2 This phase is frequently characterised by a very limited availability of information on the potential extent and severity of the impending eruption. Notwithstanding the potentially limited extent of information available, the pre-eruption phase actions described below should be carried out for every expected eruption.

3.1.3 Volcano observatories shall provide the information on the state of the volcano showing pre-eruptive activity and notify their associated ACC, MWO and VAAC in form of the Volcano Observatory Notice for Aviation (VONA), as described in Appendix E of ICAO Doc 9766 (IAVW Handbook); Annex 3 [*Meteorological Services for International Air Navigation*], Appendix 2 para 4.1 refers.

3.1.4 If volcano observatories, VAACs or MWOs suspect volcanic activity in an area, they could request the appropriate ATS unit(s) to solicit Special air-reports on volcanic ash from suitable aircraft (route and altitude) at appropriate time intervals (e.g. every half hour).

3.1.5 Initial awareness of the event may be provided by means of a Special AIREP, VONA, satellite data, as well as other remote sensors. This information may lead to the production of the initial SIGMET, VAA/VAG, NOTAM as per the On-Going Eruption Phase. States should ensure that alerting information is distributed expeditiously by the most appropriate means to allow for the early warning of aircraft in flight.

3.1.6 VAACs should consider whether the information warrants the issuance of an initial Volcanic Ash Advisory (VAA).

3.1.7 Air operators and flight crews are expected to consider the potential effect of an eruption based on the operator's Safety Risk Assessment and standard operating procedures or to avoid the affected area.

*Originating ACC/FIC Actions (eruption expected in its own FIR)*

3.1.8 In the event of pre-eruption volcanic activity, which could pose a hazard to aviation, an area ACC or FIC when appropriate, on receiving information of such an occurrence, should carry out the following:

- a) ensure that appropriate AIS messages are originated in accordance with Annex 15 [*Aeronautical Information Services*]. These must provide as precise information as is available regarding the activity of the volcano. It is imperative that this information is issued by the international NOTAM office and disseminated as soon as possible in accordance with the provisions of Annex 15;
- b) when so required by the State, define an initial, precautionary danger area in accordance with established local procedures. The size of the danger area should encompass a volume of airspace around the volcano in accordance with the information available, aiming to avoid undue disruption of flight operations;
  - i) if no such local procedures have been established, the danger area should be defined as a circle with a radius of 110 km (60 NM). The circle should be centred on the estimated or known location of the volcanic activity; in case of wind speeds exceeding 30 kts the danger area should be extended downwind by maximum half an hour of wind influence;
  - ii) ATC would not normally initiate a clearance through a danger area, it will inform aircraft about the potential hazard and continue to provide normal services. It is the responsibility of the pilot-in-command to determine the safest course of action.
- c) advise the associated MWO and MET service provider(s) in accordance with national/Regional arrangements (unless the initial notification originated from such provider(s)), who will then inform the associated Volcanic Ash Advisory Center (VAAC);
- d) alert flights already within the area concerned and offer assistance to enable aircraft to exit the area in the most expeditious and appropriate manner. Flight crews should be provided with all necessary information required to make safe and efficient decisions in dealing with the hazards in the defined area. Aircraft that are close to the area should be offered assistance to remain clear of the area;
- e) immediately notify other affected ACCs/FICs of the event and the location and dimensions of the area concerned. The ACC should provide information on potential

implications on traffic flow and its capability to handle the expected traffic. Adjacent ACCs may be asked to reroute flights not yet coordinated to keep them clear of the area. It should be noted that flight crews make the decision whether or not to completely avoid the area based on, for example, visual observations;

- f) review the local contingency plan;
- g) advise the appropriate ATFM unit(s) and coordinate and implement ATFM measures if necessary to maintain the required level of safety; and
- h) relax airspace restrictions when possible to facilitate efficient traffic flow.

*In order to assist staff in expediting the process of composing the AIS messages, a series of templates should be available for this stage of the volcanic activity.*

3.1.9 In addition to sending the relevant AIS messages to the normal distribution list, they will be sent to the relevant MWO(s), all VAACs, SADIS and the WIFS gateway (Appendix 2 [*Pilot Reports*] refers).

#### *Adjacent ACC/FIC actions*

3.1.10 During the pre-eruption phase, ATS units will inform aircraft about the potential hazard and continue to provide normal services. Adjacent ACCs/FICs should take the following action to assist:

- i) gain and maintain awareness of the affected area and inform pilots that will or might be affected;
- j) when requested by pilots of aircraft advised that they will be affected by the area, re-clear flights to which control services are being provided after coordination with other affected ACCs; and
- k) unless otherwise instructed, continue normal operations and;
- l) if future traffic is affected by the area, consider the potential impact and the necessity for ATFM measures.

#### *ATFM Unit actions*

3.1.11 Where an ATFM unit is established, it should, upon receipt of preliminary information on volcanic activity from an ACC or the lead VAAC, initiate actions in accordance with its procedures to ensure exchange of information in order to support CDM between air navigation service providers (ANSPs), meteorological watch offices (MWOs), VAACs and aircraft operators concerned.

## 3.2 START OF ERUPTION PHASE

### *General*

3.2.1 This phase commences when information about the outbreak of a volcanic eruption becomes available, with volcanic ash being ejected into the atmosphere. The focus of the processes in this phase is to protect aircraft in flight and at aerodromes from the hazards associated with the eruption through the collection and dissemination of information.

*When an eruption does not impact the airspace above and around the volcano (e.g. lava flow) the processes described in the pre-eruption phase may be applicable.*

3.2.2 Volcano observatories should assess the information on the state of the volcano showing eruptive activity and provide notification to their associated ACC, MWO and VAAC in form

of the *Volcano Observatory Notice for Aviation* (VONA), as described in Appendix E of the IAVW Handbook (Doc 9766) (Annex 3 [*Meteorological Services for International Air Navigation*], Appendix 2 para 4.1 refers).

3.2.3 VAACs should collect all relevant information and act in accordance with paragraph 4.5 of the IAVW Handbook (Doc 9766).

3.2.4 Major activities of the start of eruption phase are: issuance of relevant AIS and MET messages in accordance with Annexes 15 [*Aeronautical Information Services*] and 3 [*Meteorological Services for International Air Navigation*], respectively (as detailed in the IAVW Handbook (Doc 9766), paragraphs 4.3 and 4.4); as well as provision of information and assistance to airborne traffic.

3.2.5 As appropriate, danger areas may be declared by the authority which is responsible for determining the need for and extent of Danger, Prohibited or Restricted Areas, and published via NOTAM (in accordance with the “*Airspace Measures*” section of this contingency plan).

*Originating ACC/FIC actions (eruption in its own FIR)*

3.2.6 The ACC/FIC providing services in the FIR within which the volcanic eruption takes place should act in accordance with the ATS contingency procedures contained in the PANS–ATM (Doc 4444), paragraph 15.8 and the guidance in paragraph 4.2 of the IAVW Handbook (Doc 9766) and inform flights about the existence, extent and forecast movement of volcanic ash and provide information useful for the safe and efficient conduct of flights.

3.2.7 If necessary, rerouting of traffic should commence immediately or may be in progress if the alerting time has been sufficient to activate the pre-eruption phase. The ACC should assist in rerouting aircraft around the affected and/or danger area as expeditiously as possible. Adjacent ACCs should also take the affected and/or danger area into account and give similar assistance to aircraft as early as possible.

3.2.8 During the start of eruption phase, although ATC will not normally initiate a clearance through a danger area, it will inform aircraft about the hazard and will continue to provide normal services. It is expected that aircraft will attempt to remain clear of the danger area; however, it is the responsibility of the pilot-in-command to determine the safest course of action.

3.2.9 During the start of eruption phase the ACC/FIC should:

- a) ensure that a NOTAM is originated to define a Danger Area delineated cautiously so as to encompass a volume of airspace in accordance with the limited information available. Until reliable information on the extent of the eruption is available, the guidance for precautionary Danger Areas should be followed. In determining the area, information on upper winds should be taken into account. The purpose is to ensure safety of flight in the absence of any prediction from a competent authority on the extent of volcanic ash in the airspace;
- b) maintain close liaison with MWOs and, where appropriate, VAACs, who should issue appropriate MET messages in accordance with Annex 3 [*Meteorological Services for International Air Navigation*];
- c) solicit as far as practicable special air-reports on volcanic activity from aircraft in the area concerned to enlarge the knowledge about volcanic ash in the airspace; and

- d) devise, implement and update ATFM measures when necessary to ensure safe and efficient flight operations, based on MET observations and forecasts in cooperation with aircraft operators and the adjacent ACCs using the CDM process;
- e) ensure that reported differences between published information and observations (pilot reports, airborne measurements, etc.) are forwarded as soon as possible to the appropriate authorities to ensure revision of incorrect information and its dissemination to all concerned;
- f) begin planning for the on-going eruption phase in conjunction with the aircraft operators, the appropriate ATFM unit and ACCs concerned; and
- g) initiate appropriate AIS messages in accordance with Annex 15 [*Aeronautical Information Services*] and the IAVW Handbook (Doc 9766), should significant reductions in intensity of volcanic activity take place during this phase and evidence confirms that the airspace is no longer contaminated by volcanic ash. Otherwise, begin CDM planning for the on-going eruption phase in conjunction with aircraft operators, the appropriate ATFM unit and the affected ACCs.

#### *Adjacent ACC/FIC actions*

3.2.10 During the start of eruption phase, adjacent ACCs/FICs should take the following actions:

- gain and maintain awareness of the affected area and inform flights that will or might be affected; and
- maintain a close liaison with the appropriate ATFM unit, aircraft operators and the originating ACC/FIC to devise, implement and update ATFM measures (including relaxation of airspace restrictions) which will enable safe and efficient flight operations; and
- begin planning for the on-going eruption phase in conjunction with the aircraft operators, the appropriate ATFM unit and ACCs/FICs concerned.

#### *ATFM Unit actions*

3.2.11 During the start of eruption phase, depending on the impact and/or extent of the volcanic ash cloud, the appropriate ATFM unit should organise the exchange of latest information on the developments with the associated VAACs, ANSPs, MWOs and operators concerned in order to support CDM.

3.2.12 The ATFM unit will apply ATFM measures on request of the ANSPs concerned. The measures should be reviewed and updated in accordance with latest information. Airspace measures should be relaxed as soon as the situation allows.

### 3.3 ON-GOING ERUPTION PHASE

#### *General*

3.3.1 The on-going eruption phase commences with the issuance of the first complete (i.e. including forecasts) volcanic ash advisory (VAA) by the responsible VAAC that contains information on the extent and expected movement of the volcanic ash cloud in accordance with Annex 3 [*Meteorological Services for International Air Navigation*] provisions. It may take up to 3 hours after start of eruption to issue this first complete VAA.

*Volcanic ash advisory information in graphical format (VAG) should also be issued by the VAAC, containing the same information as its text-based VAA equivalent. (Doc 9766, paragraph 4.5.1).*

3.3.2 The VAA/VAG should be used to:

- prepare appropriate AIS and MET messages in accordance with Annex 15 [*Aeronautical Information Services*] and Annex 3 [*Meteorological Services for International Air Navigation*] provisions, respectively; and
- plan the provision of air traffic services, including the application of appropriate ATFM measures.

#### *ACC/FIC Actions*

3.3.3 Volcanic ash may affect any combination of airspace; therefore it is not possible to prescribe measures to be taken for all situations. The following guidance therefore may prove useful during the on-going eruption phase, but should not be considered mandatory or exhaustive:

- The ACC/FIC will continue to act in accordance with the ATS Contingency Procedures contained in PANS-ATM (Doc 4444) Chapter 15.8 ;
- ACCs/FICs affected by the movement of the volcanic ash shall ensure that appropriate AIS messages are originated in accordance with Annex 15 [*Aeronautical Information Services*]. ACCs/FICs concerned and the appropriate ATFM unit should continue to publish details on measures taken to ensure dissemination to all concerned;
- the ACC/FIC should solicit special air-reports on volcanic activity if so requested by the appropriate VAAC;
- ACCs/FICs and ATFM units should be aware that for the purposes of flight planning and execution, operators could treat the horizontal and vertical extent of the volcanic ash contaminated area to be over-flown as if it were mountainous terrain; and
- any reported differences between published information and observations (pilot reports, airborne measurements, etc.) should be forwarded as soon as possible to the appropriate authorities to ensure revision of any incorrect information and its dissemination to all concerned.

#### *ATFM Unit actions*

3.3.4 The ATFM units will continue to apply ATFM measures on request of the ANSPs concerned. The measures should be reviewed and updated (including relaxation of airspace measures) in accordance with latest information. Depending on the impact and/or extent of the volcanic ash, the appropriate ATFM unit may take the initiative to organize teleconferences to exchange the latest information on the developments, in order to support CDM, with the VAACs, ANSPs and MWOs and operators concerned.

### 3.4 RECOVERY PHASE

3.4.1 The recovery phase commences with the issuance of the first VAA/VAG containing the statement “NO VA EXP” (i.e. “no volcanic ash expected”) — which normally occurs when it is determined that the volcanic activity has reverted to its non-eruptive state and the airspace is no longer affected by volcanic ash. Consequently, appropriate MET and AIS messages should be issued in

accordance with Annex 3 [*Meteorological Services for International Air Navigation*] and Annex 15 [*Aeronautical Information Services*], respectively.

3.4.2 ACCs/FICs and ATFM units should revert to normal operations as soon as practical.



## LIST OF APPENDICES AND ATTACHMENTS

### List of Appendices

*Appendices to the document comprise material grouped separately for convenience but forming part of the main body of the document: information in VACP Appendices complement the main body text, and is therefore applicable to both Regions.*

Appendix 1 — Anticipated Flight Crew Issues when Encountering Volcanic Ash (Information for ATS Personnel)

Appendix 2 — Pilot Reports

Appendix 3 — State Checklist

Appendix 4 — VAAC Checklist

Appendix 5 — ANSP Checklist

Appendix 6 — Airspace User (Operator) Checklist

Appendix 7 — MWO Checklist

### List of Attachments

*Attachments to the document comprise material supplementary to the main body of the document, or included as a guide to the application of the provisions in the document: information contained in the VACP Attachments is applicable to individual Regions or sub-Regions, and may contain variations from the main body text. To this end, most of the attachments are therefore organised in three (3) sections, namely: EUR Region – Eastern Part, EUR Region – Western Part, and NAT.*

Attachment X1 — Regional Monitoring Capabilities of volcanic activities and arrangements

Attachment X2 — Regional Information Flow Arrangements and Model Templates (according to global standards; supplemented by Regional requirements)

Attachment X3 — Description of Selected VA Products

Attachment X4 — Guidance on the Establishment, Amendment and Withdrawal of Danger Areas

Attachment X5 — Air Traffic Flow Management arrangements

Attachment X6 — Crisis Management Arrangements

Attachment X7 — VOLCEX Arrangements (GM in Doc 9766)

Attachment X8 — Regional Regulations, Means of Compliance and Guidance Material (References)

## APPENDIX 1

### ANTICIPATED FLIGHT CREW ISSUES WHEN ENCOUNTERING VOLCANIC ASH (INFORMATION FOR ATS PERSONNEL)

1. General issues concerning airborne observation of volcanic ash and the effect of volcanic ash on aircraft are contained in ICAO Doc 9691 (*Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds*). Specific instructions for pilots should be based on the recommendations of the original equipment manufacturers (OEM) and shall be contained in the operations manual.

#### *Ash detection by flight crew*

2. ATS personnel should be aware that flight crews may detect the presence of volcanic ash by the following means:

- a) If VMC, visually
- b) Reports from aircraft ahead
- c) smoke or dust appearing in the cockpit
- d) acrid odour similar to electrical smoke;
- e) Increase in engine EGT<sup>13</sup>, changing engine conditions;
- f) at night,
  - i. St. Elmo's fire/static discharges may be observed around the windshield, accompanied by a bright glow in the engine inlet(s);
  - ii. sharp distinct shadows cast by landing lights as compared to the diffused shadows observed in clouds.

#### *Flight crew and volcanic ash encounter*

3. Once volcanic ash is encountered flight crew may have to deal with the following issues depending on the severity of the encounter:

- a) smoke, fumes or dust appearing in the cockpit which may prompt the flight crew to don oxygen masks (this interferes with the clarity of voice communications);
- b) multiple engine malfunctions, such as stalls, overtemperature (EGT), and thrust loss or complete failure of one or more engines. Engines may have to be shut down and restarted.
- c) because of the abrasive effects of volcanic ash on windshields and landing lights, visibility for approach and landing may be markedly reduced or even be lost completely.
- d) Should pitot tubes become blocked, airspeed indications may become unreliable. The pilots will probably disconnect the autopilot, set engine thrust to an appropriate value and maintain the aircraft's pitch attitude manually. This will keep the aircraft at a safe speed, but will probably result in difficulty to maintain the assigned altitude. Increased separation is required (above and below).
- e) ATS personnel should be aware that a volcanic ash encounter may create extreme workload for pilots.

---

<sup>13</sup> EGT = Exhaust Gas Temperature (this is a major parameter for determining operating limits of turbine engines).

*Appendix 1 (page 2 of 2)*

— Anticipated Flight Crew Issues when Encountering Volcanic Ash —

4. Depending on the severity of the encounter, the reaction of the flight crew will be as follows:
- a) Carry out the emergency drill for a volcanic ash encounter. This generally has the following elements:
    - i. Reduce thrust to idle if possible. *By reducing thrust, the temperature in the combustion section will be lower and less ash will deposit in the engine. Also lower thrust requires lower airflow (and ash) through the engine. To maintain a safe speed, the aircraft will have to descend. The resulting descent rate will be less than during an emergency descent due to pressurisation failure.*
    - ii. Execute a descending 180 degree turn. A turnback is usually the quickest route out of an ash cloud.
    - iii. Don oxygen masks if required. This may make communication on the flight deck and with ATC difficult.
    - iv. declaration of an emergency (MAYDAY MAYDAY MAYDAY) or request for an immediate reclearance possibly accompanied by an urgency signal (PAN PAN; PAN PAN; PAN PAN). **Note:** the manoeuvre above may commence prior to an emergency or urgency being declared.
    - v. Carry out various emergency/non-normal drills as required, such as engine relight, unreliable airspeed, system failure drills.
    - vi. Communication with Cabin crew and passengers.
  - b) Diversion to the nearest suitable aerodrome.
  - c) If an aerodrome is contaminated with ash, the deceleration will be less than usual despite the use of maximum braking, resulting in a longer ground run. This may be aggravated by limited use of reverse thrust to avoid blowing up ash from the runway surface. If reverse thrust is necessary to bring the aircraft to a stop, a dust cloud may be raised.

***Flight crew expectations from ATC***

5. What the flight crew may require from ATC:
- a) An immediate reclearance, laterally and/or vertically.
  - b) If carrying out the escape manoeuvre, ensuring other traffic is kept clear.
  - c) vectors to an area clear of ash if possible.
  - d) Information on the nearest suitable aerodrome and its weather and condition, including braking action. An aerodrome with a long runway.
  - e) vectors to an alternate and a priority landing.
  - f) If the windscreen is obscured, an autoland.
  - g) Emergency services for landing and provision of medical assistance for passengers and crew.

***Note:*** While carrying out an escape manoeuvre, and associated emergency/non-normal drills, the flight crew workload and the priority to control the aircraft may limit the ability of the crew to communicate to ATC and comply with ATC instructions.

## APPENDIX 2

### PILOT REPORTS

#### *Introduction*

1. ICAO Annex 3 [*Meteorological Services for International Air Navigation*], paragraph 5.5, g) and h), prescribes that volcanic ash clouds, volcanic eruptions and pre-eruption volcanic activity, when observed, shall be reported by all aircraft. The ICAO *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444) contain detailed provisions on this special air report requirement in paragraphs 4.12.3 and 4.12.5, and the Volcanic Activity Report form in its Appendix 1.
2. In order to improve the rate of reporting and the sharing of information on volcanic ash encounters and observations in accordance with the above mentioned provisions (in-flight, via Special Air-Reports and post-flight via Volcanic Activity Report) the following procedures have been agreed for the EUR and NAT Regions. A high level of global harmonization is essential to achieve the desired level of implementation and consistency of the information.
3. The purposes of volcanic ash reporting and data collection; and the responsibilities and roles of the participants in the reporting process are described in detail in Appendix C of the Volcanic Ash ATM Contingency Plan Template (VAACPT), that can be found on the ICAO Portal under group EEVOLCEXSG.
4. With reference to the format of special air-report on volcanic ash, the EANPG/56 recognized the existence of various formats provided in the provisions (Annex 3 [*Meteorological Services for International Air Navigation*] and PANS-ATM [Doc 4444] refer). Consequently, the EANPG/56 agreed to Conclusion 56/13 that requests the appropriate ICAO working structure at the global level to consider harmonizing the format of special air-report on volcanic ash in Annex 3 and PANS-ATM (Doc 4444). As this task may take some time (years) to be completed, the various formats are used in examples below based on the current provisions and to whom they apply. In this context it is noted that the European Aviation Safety Agency (EASA) requires operators under their jurisdiction to report to EASA (report@easa.europa.eu) any encounter with volcanic ash or any other relevant maintenance and airworthiness related findings. The form referenced in EASA Safety Information Bulletin EASA\_SIB\_2010-17R6 contains the same basic information as the ICAO VAR form. Therefore it might be useful to consider the development of a single reporting form that addresses the need of all stakeholders.
5. Pilots should be aware that reporting *no volcanic ash* is important to verify information about airspace contamination from various sources that could lead to less airspace restrictions. Doc 9766, paragraph 4.7 requires that in the event of an eruption, operators should request their pilots to report, when appropriate, any observation related to a volcanic ash cloud including the absence of visible ash and all other relevant information such as observational conditions. The operator should then forward this information to the association VAAC in a timely manner. The best way to do so is to send this information by e-mail. The operational e-mail addresses of the VAACs are listed in Table 4-2 of Doc 9766.
6. “NO VISIBLE ASH OBSERVED” or “NO ASH VISIBLE” shall be reported in the “Other” plain text field of item 8 of the Special air-report of volcanic activity or VAR Form.

*Appendix 2 (page 2 of 3)*  
— Pilot Reports —

7. When a flight is observing volcanic activity or contamination over a prolonged period during flight, a series of special air-reports on volcanic ash shall be made, so that a four-dimensional representation of the situation is created.

8. Pilots should be trained for airborne observations of volcanic activity/contamination to avoid an erosion of the credibility of special air-reports on volcanic ash. Improved instructions on the use of the Volcanic Activity Report Form are required to achieve high quality of information for the VAR users.

### ***VAAC requirements***

9. VAACs Montréal, Washington, London and Toulouse serve the NAT Region; VAACs London, Toulouse, Anchorage and Tokyo serve the EUR Region. Their requirements for receiving Special Air-Reports of Volcanic Activity are listed in Appendix-04.

### ***Format and Routing instructions***

10. For in-flight Special Air-Reports on Volcanic Activity and post-flight Volcanic Activity Reports, the form provided in PANS-ATM (Doc 4444) Appendix 1, section 2 shall be used.

### ***Examples***

#### *Pilots:*

11. Example referencing PANS-ATM (Doc 4444) Appendix 1, Part 1-Reporting instructions sections 1-4 and 9 is provided:

“AIREP SPECIAL UNITED AIRLINES TREE TOO TOO POSITION FIVE FIVE ZERO  
TREE NORTH WUN SEVEN ZERO TOO ZERO EAST FLIGHT LEVEL TREE ZERO  
ZERO CLIMBING TO FLIGHT LEVEL TREE FIVE ZERO VOLCANIC ASH CLOUD”

#### *ATS unit:*

12. The format used for forwarding of meteorological information received by voice communications to the associated meteorological watch office (MWO) is provided in subtitle 3 of Appendix 1 of PANS-ATM. An example is provided based on the information given by the pilot.

ARS UAL322 5503N17020E 0105 F300 ASC F350 VA CLD=

#### *MWO:*

13. Example referencing Annex 3 [*Meteorological Services for International Air Navigation*], Appendix 6, Table A6-1 is provided based on information given by the ATS unit:

ARS UA322 VA CLD FL300/350 OBS AT 0105Z N5503E17020=  
The MWO should send this message in accordance with regional dissemination schema such as RODEX in EUR region, and to:

Appropriate Regional OPMET Data Bank  
Appropriate Volcanic Ash Advisory Centre

*Appendix 2 (page 3 of 3)*  
— Pilot Reports —

*Example:*

MWO Yelizovo sends this information using the World Organization Abbreviated Header Line (WMO AHL) of UARA71 RUPK to:

Appropriate ROC – in this case, ROC Vienna at AFTN address LOWMMMXX which will then route to SADIS (EGZZWPXX) and WIFS (KWBCYMYX), according to the regional OPMET exchange schema.

Appropriate VAAC – in this case, VAAC Tokyo (fax: +81 (3) 3212 6446; email [vac@eqvol2.kishou.go.jp](mailto:vac@eqvol2.kishou.go.jp); AFTN address RJTDYMYX)

When the volcanic crisis is announced by EACCC EVITA will receive Special Air-Reports and VARs through the information upload on the protected part of the EUROCONTROL NOP portal ([https://www.nm.eurocontrol.int/PORTAL\\_EVITA\\_portlet](https://www.nm.eurocontrol.int/PORTAL_EVITA_portlet)). Only those professionally engaged in Air Traffic Management and Aircraft Operations who have applied for access, signed an Agreement and received the necessary rights, and therefore bound to EUROCONTROL NM [Terms and Conditions](#) may login and upload reports or access the NM Protected Applications to obtain the information.

To get the access, organizations professionally engaged in Air Traffic Management and Aircraft Operations, have to submit their request via the procedure described in the following link <http://www.eurocontrol.int/network-operations/nm-operational-services-and-products>. Technical requirements and instructions how to access or upload the volcanic observation can be found in the EVITA User's Guide available via the link at the bottom right hand side of the NOP Portal.

*Tools and media for presenting and sharing the volcanic ash information*

14. To report, transmit and disseminate information about visible or discernible ash, the following tools are used in the EUR and NAT Regions

- a) VAA/VAG ('Info Source' and 'Remark' sections)
- b) Radiotelephony and Data link Communications (Special Air Report)
- c) VAR
- d) NOTAM is issued for change in volcanic eruption status and is therefore possible that a special air-report could contribute to the evidence that would warrant a change in volcanic eruption status
- e) SIGMET is issued by the MWO when volcanic ash is observed by aircraft, volcano observatory, ground-based radars, lidars or ceilometers or discernible on satellite.
- f) Central data repository e.g. Network Manager(NM) Network Operations Portal (NOP)
- g) EVITA: <http://www.eurocontrol.int/services/evita-european-crisis-visualisation-interactive-tool-atfcm>
- h) Teleconferences
- i) Periodic Bulletins with the set of information defined by the data providers and data users; e.g. Smithsonian Institution Weekly Bulletin.
- j) Summaries containing general information and lessons learned from previous experience may be found on SKYbrary: <http://www.skybrary.aero/>

### APPENDIX 3

#### STATE CHECKLIST

1. States need to ensure that they have robust arrangements in place that can be activated when there is volcanic contamination in their airspace. These arrangements should be in line with global and regional provisions. The aim should be to create cooperation of all entities involved, including those from non-aviation sectors, as appropriate. Contingency arrangements shall ensure safe and efficient flight operations for most circumstances. Crisis management should be available to assist in situations resulting in major loss of network capacity.

2. The following checklist provides a list of areas that might need to be covered, but is not necessarily exhaustive.

3. It is envisaged the following organisations in a State will be required to provide information to their stakeholders during a volcanic eruption, when volcanic contaminants are present or expected in the airspace or on airports. Their activities need to be coordinated by those operating the State Crisis Management Plan (if available).

- a) Department/Ministry for Transport;
- b) National Supervisory Authority (Regulator);
- c) ANSPs (En Route and Terminal);
- d) Meteorological Office;
- e) NOTAM Office;
- f) Airlines and other airspace users;
- g) Airports; and
- h) Department/Ministry of Defence.

#### ***Preparatory Activities (see also ICAO Doc 9766, section 4.1)***

4. States having active or potentially active volcanos in their territory should establish:

- a) one or more Volcano Observatories; and
- b) a routine process for monitoring messages produced by Volcano Observatories;

5. Each State should:

- a) consider the use of available infrastructure or the implementation of new assets for the observation of volcanic contaminants; and review routinely their status
- b) mobile radar, gas and seismological sensors, GPS stations, etc. for use at or near volcanos;
- c) LIDAR networks and high-performance ceilometer networks; and
- d) aircraft that can provide in-situ measurements.
- e) implement and routinely review a State Volcanic Contamination policy and guidance (in particular also for VA Danger Areas);
- f) establish and routinely review VA contingency plans, procedures, communication channels and message templates for all Stakeholders;

<i>Appendix 3 (page 2 of 2)</i> — State Checklist —
--

- g) establish and routinely update Staff Training activities (State and all stakeholders);
- h) establish and routinely review Crisis management provisions (ideally taking into account non-aviation sectors);
- i) establish a regular review and acceptance of new SRAs for State based operators (according to ICAO Doc 9974; or GM2 ORO.GEN.200(a)(3) to EU Regulation 965/2012 if applicable); and
- j) participate in State and ICAO Regional VA exercises.

### ***Crisis Management Activities***

6. All States shall:
  - a) ensure that all those involved in crisis management are briefed in due time when exceedance of the capacity of contingency arrangements has to be expected;
  - b) activate State Crisis Management Plan (if appropriate);
  - c) activate State volcanic ash NOTAM / SIGMET process as an addition to the VACP process;
  - d) convene regular meetings of State Crisis Management Teams until situation returns to non-crisis circumstances;
  - e) take part in Regional / sub-Regional (e.g. EUROCONTROL / EACCC) Crisis Management teleconferences;
  - f) take part in regular teleconferences with airspace users (in particular airlines) operating in State FIR;
  - g) check VAAC guidance ahead of the provision of SIGMETs by MWOs; and
  - h) share volcanic contamination information from in situ sensors (e.g. LIDAR, Optical Particle Counter (OPC) and Aircraft) with other States and the responsible VAACs.



## APPENDIX 4

### VAAC CHECKLIST

1. VAACs and Volcano Observatories are elements of the *Air Navigation Plan* (ANP) Vol I  
***VAAC Procedures***
2. Detailed VAAC responsibilities and procedures are contained in Annex 3 [*Meteorological Services for International Air Navigation*] to the convention on International Civil Aviation.
3. Standards and Recommended Practices (Annex 3 chapter 3.5)
  - a) Technical specifications (Annex 3 Appendix 2.3)
  - b) Volcanic Ash Advisory Example (Annex 3 Appendix 2 Example A2-1)
  - c) Volcanic Ash Advisory Template (Annex 3 Appendix 2 Table A2-1)
4. Operational procedures and contact lists are documented in the *Handbook on the International Airways Volcano Watch* (IAVW Handbook, Doc 9766)
  - a) MWOs and ACCs to which information is to be sent: refer to Doc 9766 Part5 (International airways volcano watch contact)
  - b) VAAC Websites (by alphabetical order):
    - i. VAAC Anchorage: <http://vaac.arh.noaa.gov/>
    - ii. VAAC Montreal: <http://weather.gc.ca/eer/vaac/>
    - iii. VAAC London: <http://www.metoffice.gov.uk/aviation/vaac/>
    - iv. VAAC Tokyo: <http://ds.data.jma.go.jp/svd/vaac/data/>
    - v. VAAC Toulouse: <http://www.meteo.fr/vaac/>
    - vi. VAAC Washington: <http://www.ssd.noaa.gov/VAAC/messages.html>
  - c) Actions to be taken by VAACs in the event of a volcanic eruption: refer to Doc 9766 chapter 4.6.
  - d) Collaborative Decision Analysis and Forecasting guidelines and procedures between VAACs for VAAs: refer to Doc 9766 chap 4.10.
  - e) Guidance for Volcanic Ash Exercises: refer to Attachment X7 [*VOLCEX Arrangements*]
  - f) VAAC Contact Numbers: refer to Doc 9766 Table 4-2.
  - g) VAA Bulletin Headers: refer to Doc 9766 Table 4-3.
  - h) Co-ordination and handover procedures between VAACs: refer to Doc 9766 Appendix C.
  - i) Back-up arrangements between VAACs London and Toulouse: refer to Doc 9766 Appendix D.

## APPENDIX 5

### ANSP CHECKLIST

#### *Local instructions*

1. Air Navigation Service Providers (ANSP) will ensure that suitable local instructions are in place at ATC facilities to enable staff at all levels of the organisation to manage a volcanic contamination contingency event safely and efficiently. These instructions be in accordance with the appropriate Volcanic Contamination Contingency Plan and will detail procedures necessary to deal with the ATC aspect of the contingency and also the interfaces with external agencies. These will include at a minimum, State regulators, adjacent ANSPs, Met Offices and the central ATFM unit (if any). These instructions may also detail the interface with the VAAC if appropriate.
2. Air Traffic Control provides services in a normal manner, including issuing reroute, flight level change and speed change clearances, to aircraft operating or planning to operate inside areas contaminated with volcanic ash when required due to traffic. It is the responsibility of the pilot-in-command to determine if such clearances can be safely accepted or not.

#### *Personnel Training and Exercises*

3. ANSPs will establish a training and exercise plan to ensure staff at all levels within the organisation involved in a volcanic contamination contingency can execute the procedures detailed in local instructions. Continuation training will be provided to ensure that staff maintain a level of proficiency which allows them to safely and efficiently manage a volcanic contamination contingency situation at any time.
4. In the EUR/NAT Region ANSPs will participate in regular volcanic ash exercises organised within the framework of the ICAO VOLCEX Steering Group which includes wide participation by ANSPs, AOs, VAACs, Met providers, state regulators and Network and Crisis Management units.

#### *Communication links*

5. ANSPs will have in place effective communication links with at least their state regulator, adjacent ANSPs, Met Offices and their central ATFM unit (if any). Communication links with the VAAC may also be established where appropriate.

#### *ATFM and Crisis Management*

6. Central ATFM units (if any) will facilitate information exchange among existing crisis management structures.

#### *Dealing with the media*

7. During a volcanic contamination contingency event ANSPs can expect a level of interest from the media. ANSPs will have in place as process for addressing any requests for information.

## APPENDIX 6

### AIRSPACE USER (OPERATOR) CHECKLIST

1. **SRA** (according to ICAO Doc 9974) within SMS (Annex 19 [*Safety Management*]; Doc 9859).

All following should be according to the Operator's SRA:

#### *SOPs*

2. Standard Operating Procedures (SOP) should be included in different Operations (OPS) Manual Parts (General & Definitions, Aircraft Specifics, Training) for both phases:
  - FLIGHT EXECUTION
  - FLIGHT PLANNING

#### *Sources of information*

3. To avoid information overload, the Operator should identify, prioritize & select the sources of information according to areas flown and as approved by its regulator, including Private Weather Service Provider, VAA, VAGs, European Concentration Charts, SIGMETs (OBS or FCST), Special AIREPs, NOTAMs & Surface weather METARs.

#### *Procedures.*

4. The Operator should establish acceptable areas within which it may fly: above, below or with or without a margin of a predicted contaminated area.

#### *Volcano Eruption Required information for dispatchers and flight crews*

5. FLIGHT EXECUTION :
  - a) Alert Flight Crews (ACARS, VHF, HF or SatCom...), FOC & Engineers/Maintenance.
  - b) Provide Volcano name & location, ash direction, Entry & Exit points of expected contaminated areas.
  - c) If possible & when distance permits: create an exclusion zone, establish wind direction to circumnavigate area.
  - d) Review Destination, alternate, ETOPS & Depressurisation aerodromes availability.
  - e) Review & provide ETPs & escape routes.
  - f) Specific instructions for Flight Crews & Operational Control in case of volcanic contamination are described in Ops Manual Part related to Aircraft Specifics.
  - g) Monitor updated information.
  - h) When available, pilot participation via pre-formatted ACARS messages (Special AIREPS): Visible Ash Yes/No.
  - i) FOC/Dispatch to Relay Special AIREPs to the European Network Manager (subregional procedure).

<i>Appendix 6 (page 2 of 2)</i> — Airspace User (Operator) Checklist —
---

## 6. FLIGHT PLANNING :

- a) Identify areas to be avoided.
- b) Flight plan avoiding identified areas.
- c) Establish Company Fuel policy (RCF, Contingency, ...).
- d) Avoid selecting ETOPS alternates & escape routes that are within predicted contaminated area.
- e) Consider Depressurisation (O<sub>2</sub>) time limits.
- f) Provide related text and graphic in weather/flight brief.

***Dedicated team***

7. It is recommended to nominate a temporary team dedicated to monitor, disseminate & centralize updated information & participate in teleconferences & crisis contingency plans.

***Training***

- 8. Crew: OPS Manual (General & Definitions, Aircraft Specifics, Training)
- 9. Dispatch: Ops Manual (General & Definitions, Training)
- 10. Engineers/Maintenance: Ops Manual (Aircraft Specifics, Training)
- 11. Contents:
  - a) volcanic contamination hazards
    - general
    - aircraft specific
  - b) safety management principles
  - c) operator SMS and SRA
  - d) ATM contingency planning
  - e) planning of operations
  - f) executing of operations
  - g) handling of differences to planned operating conditions in flight
  - h) communications

***Participation in volcanic contingency exercises (e.g. VOLCEX, VOLKAM)***

## APPENDIX 7

### MWO CHECKLIST

The MWO role is crucial during a volcanic ash contingency. MWO's are responsible for producing VA SIGMET for their FIRs making use of information from VAACs and any other locally available information. These SIGMETs may subsequently be used in NOTAM production. The accuracy and timeliness of VA SIGMET production is very important for the effectiveness of mitigation actions and the safety and efficiency of air traffic.

#### *Action taken by MWO in the event of a volcanic eruption:*

- Pay attention to VAA/VAG produced by the appropriate VAAC (Montréal and Washington for western part of NAT; Toulouse and London for the eastern part of the NAT and the EUR Region west of 90°E; Tokyo and Anchorage for the EUR Region east of 90°E) as well as supplementary products provided by the MET offices co-located with VAACs Toulouse and London;
- Monitor information from volcano observatories in their area of responsibility;
- Immediately after the reception of any of those advisories, check within their area of responsibility for VA contaminated areas and;
- Issue SIGMET according to VAAC advisory information, special air-reports on volcanic ash and any other relevant information and/or measurements available;
- Assure that VA SIGMET format is compliant with provisions and SIGMET template of ICAO Annex 3 [*Meteorological Services for International Air Navigation*]; templates available in local instructions might help to achieve this;
- Advise ACC and VAAC whether or not the volcanic ash is identifiable from satellite images/data, ground based or airborne measurements or other relevant sources.
- Report differences between aircraft observations (e.g. ash encounters) or any other qualified source and the information published in VAA/VAG, SIGMET or NOTAM/ASHTAM to appropriate VAACs and MWO. The information should be passed immediately to adjacent MWO(s) downstream of the moving ash cloud;
- On reception, forward special air-reports on volcanic ash to appropriate VAACs, appropriate Regional OPMET Centre by AFTN which would then route to SADIS (EGZZWPXX) and WIFS (KWBCYMYX); Referencing Annex 3, Appendix 6, the format of a special air-report on volcanic ash is illustrated by the following example:

ARS UA322 VA CLD FL300/350 OBS AT 0105Z N5503E17020=

- Coordinate as far as practicable with ACCs, adjacent MWOs and the VAAC concerned to ensure as much as possible consistency in VA analysis and forecast.
- Provide as far as practicable regular volcanic briefings, based on the latest available ash observations and forecasts, to ACCs, ATFM units, airport operators and aircraft operators concerned;
- Ensure that local instructions address VA contingency procedures;
- Ensure that all relevant staff are trained regularly to apply the VA contingency procedures;
- Participate in volcanic ash exercises.

## ATTACHMENT X1

### REGIONAL MONITORING CAPABILITIES OF VOLCANIC ACTIVITIES AND ARRANGEMENTS

#### *Common to EUR and NAT Regions*

Information sources are listed below:

#### *Volcano Observatories and Volcanoes monitored*

- Azores: <http://www.cvarg.azores.gov.pt/Paginas/home-cvarg.aspx>
- Canary Islands: <http://www.ign.es/ign/layout/volcaVolcanologia.do>
- Iceland: <http://en.vedur.is/>
- Italy: <http://www.ingv.it/it/>
- Eastern Russian Federation: <http://www.kscnet.ru/ivs/kvert/van/>

#### *Satellites*

- MSG: <http://oiswww.eumetsat.org/IPPS/html/MSG/RGB/DUST/>

#### *LIDAR Networks*

- France LIDAR network (webpage available early 2016)
- Germany DWD Ceilomap: <http://www.dwd.de/ceilomap>
- United Kingdom MO LIDARNET: <http://www.metoffice.gov.uk/public/lidarnet/lcbr-network.html>

EARLINET - <http://earlinet.org/>

TOPROF - [http://www.cost.eu/COST\\_Actions/essem/Actions/ES1303](http://www.cost.eu/COST_Actions/essem/Actions/ES1303)

E-PROFILE- <http://eumetnet.eu/e-profile>

#### *In-situ airborne monitoring*

- France: <http://www.safire.fr/web/index.php>
- Germany: <http://www.deutscher-wetterdienst.de/gsb/emergency/>  
(for username/password, email to: luftfahrt@dwd.de)
- United Kingdom:  
[http://www.metoffice.gov.uk/publicsector/emergencies/civil\\_contingency\\_aircraft](http://www.metoffice.gov.uk/publicsector/emergencies/civil_contingency_aircraft)

#### *Aircraft Sensors*

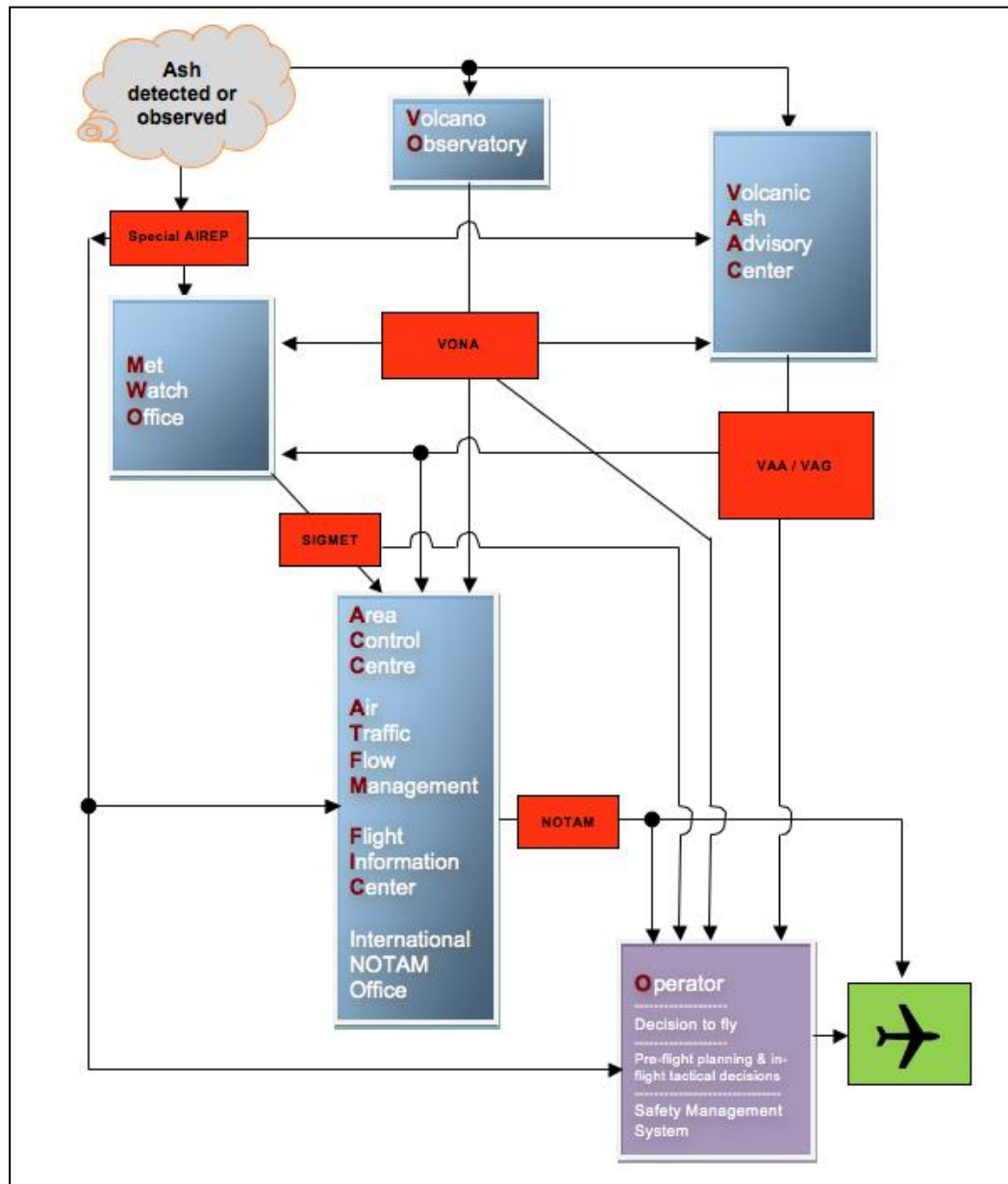
- AVOID: <http://www.nilu.no/Nyhetsarkiv/tabid/74/language/en-GB/NewsId/261/AVOID-volcanic-ash-detection-technology-tested-on-Airbus-aircraft.aspx>
- ZEUS: <http://www.metoffice.gov.uk/news/releases/archive/2014/zeus>

## ATTACHMENT X2

**REGIONAL INFORMATION FLOW ARRANGEMENTS AND MODEL TEMPLATES**  
**(ACCORDING TO GLOBAL STANDARDS; SUPPLEMENTED BY REGIONAL REQUIREMENTS)**

*EUR Region – Eastern Part*

*Information Flow schema*



## Attachment X2 (page 2 of 14)

## — Regional Information Flow Arrangements and Model Templates —

## VAAC

## 1. VAAC contact details:

- They can be found in ICAO Doc 9766 table 4-2 [VAAC Contact numbers]. Hyperlink: [Doc 9766 VAAC contact points](#)

## 2. VAAs (Volcanic Ash Advisory) and VAGs (Volcanic Ash Graphics)

The VAA template is described in Annex 3 [*Meteorological Services for International Air Navigation*], in Appendix 2, Table A2-1 [*template for advisory message for volcanic Ash*].

## VAA examples:

```

VA ADVISORY
DTG: 20100101/0605Z
VAAC: TOULOUSE
VOLCANO: ETNA 211060
PSN: N3744 E01500
AREA: ITALY
SUMMIT ELEV: 3330M
ADVISORY NR: 2015/12
INFO SOURCE: INGV, WEBCAM
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: ERUPTION STARTED AT 0600Z
OBS VA DTG: 02/0600Z
OBS VA CLD: SFC/FL130 N3750 E01500 - N3800 E01550 - N3735 E01550 -
N3750 E01500 MOV E 45KT
FCST VA CLD +6HR: 02/1200Z SFC/FL130 N3750 E01505 - N3840 E01950 -
N3710 E01945 - N3750 E01505
FCST VA CLD +12HR: 02/1800Z NOT PROVIDED
FCST VA CLD +18HR: 03/0000Z NOT PROVIDED
RMK: PLEASE CHECK SIGMET FOR CURRENT WARNINGS.
NXT ADVISORY: NO LATER THAN 20150202/1200Z=

VA ADVISORY
DTG: 20100101/1500Z
VAAC: LONDON
VOLCANO: ORAEFAJOKULL 374010
PSN: N6400 W01639
AREA: ICELAND
SUMMIT ELEV: 2119M
ADVISORY NR: 2010/002
INFO SOURCE: IMO
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: OBS ASH PLUME, EST 12KM FROM RADAR.
OBS VA DTG: 10/1500Z
OBS VA CLD: NO VA EXP
FCST VA CLD +6HR: 10/2100Z SFC/FL200 N6329 W01651 - N6517
W01614 - N6849 E00351 - N6742 E01549 - N6329 W01651
FL200/350 N6327 W01656 - N6600 W01444 - N6750 W00307 - N6854 E01550 -
N6718 E01833 - N6327 W01656
FL350/550 N6325 W01635 - N6450 W01625 - N6812 W00004 - N6841 E01441 -
N6726 E01653 - N6325 W01635
FCST VA CLD +12HR: 11/0300Z SFC/FL200 N6334 W01640 - N6526 W01629 -
N6945 E00502 - N6658 E03036 - N6327 E03908 - N6629 E00931 - N6334
W01640
FL200/350 N6329 W01701 - N6556 W01624 - N7009 E00806 - N6431 E04310 -
N6026 E04358 - N6709 E00854 - N6329 W01701
FL350/550 N6334 W01650 - N6551 W01547 - N6931 E01235 - N6439 E03929 -
N6128 E04027 - N6634 E01013 - N6334 W01650
FCST VA CLD +18HR: 11/0900Z SFC/FL200 N6327 W01717 - N6517 W01706 -
N6905 E00017 - N6949 E02107 - N6024 E05301 - N5804 E05147 - N6630
E01612 - N6327 W01717 FL200/350 N6327 W01645 - N6556 W01613 - N7054

```



*Attachment X2 (page 3 of 14)*

## — Regional Information Flow Arrangements and Model Templates —

E01405 - N5925 E05658 - N5421 E04829 - N6717 E01018 - N6327 W01645  
 FL350/550 N6327 W01634 - N6634 W01510 - N7012 E01458 - N5953 E05349 -  
 N5558 E04930 - N6630 E01405 - N6327 W01634  
 RMK: ASH PLUME NOW OBS, ESTIMATED HEIGHT 12KM FROM RADAR. INCREASING  
 SEISMIC ACTIVITY.  
 NXT ADVISORY: WILL BE ISSUED BY 20150210/1800Z =

## 3. VAA and VAG dissemination:

- a) VAA are sent by the VAACs to the MWOs and ACC/FICs following ICAO Doc 9766 Part 2 (hyperlink: [ICAO Doc 9766 Part 2](#) on ICAO website).
- b) The VAAs are to be sent onto AFTN.
- c) They can be retrieved as the VAGs in the VAACs Websites
  - VAAC London: [VAAs & VAGs](#)
  - VAAC Toulouse: [VAAs & VAGs](#)
  - VAAC Tokyo: [VAAs & VAGs](#)
  - VAAC Montréal: [VAAs & VAGs](#)
  - VAAC Washington: [VAAs & VAGs](#)
- d) They can be retrieved as well in the secure SADIS FTP site (hyperlink: [SADIS](#)) and WIFS https service (hyperlink: [WIFS](#)).

*Volcano Observatories (VO)*

## 4. VONA (Volcano Observatory Notice to Aviation)

VONA is a recommended practice (Annex 3). The VONA template can be found in ICAO Doc 9766 Appendix E.

## 5. VONA example:

*(1) VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)*

- |  |   |
|--|---|
| (2) Issued:                            | (20150202/0559Z)  |
| (3) Volcano:                           | Etna 211060   |
| (4) Current Color Code:                | <b>RED</b>  |
| (5) Previous Color Code:               | ORANGE  |
| (6) Source:                            | Etna Volcano Observatory  |
| (7) Notice Number:                     | 2015/0011/03E11   |
| (8) Volcano Location:                  | 3744N 01500E  |
| (9) Area:                              | Italy   |
| (10) Summit Elevation:                 | 3300 m  |
| (11) Volcanic Activity Summary:        | EXPLOSIVE ACTIVITY AT NEW SE CRATER (NSEC)<br>SUMMIT VENT - SIGNIFICANT ASH EMISSION OCCURS |
| (12) Volcanic cloud height:            | UNKNOWN   |
| (13) Other volcanic cloud information: | dark ash cloud at low elevation due to strong wind  |
| (14) Remarks:                          | THE PHENOMENON IS DETECTED BY<br>VIDEOSURVEILLANCE CAMERAS FROM 0558Z                       |

## Attachment X2 (page 4 of 14)

## — Regional Information Flow Arrangements and Model Templates —

## (1) VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)

- (15) Contacts: 24/7 OE Control Room operator  
 turnista@ct.ingv.it [+39 095 7165800](tel:+390957165800)  
 Eugenio Privitera (OE Director)  
 direttore.oe@ingv.it [+39 095 7165800](tel:+390957165800)
- (16) Next Notice: A new VONA will be issued if conditions change significantly or the colour code is changes.

## MWO

## 6. Volcanic Ash SIGMETs

- a) The VA SIGMET template is described in Annex 3 [*Meteorological Services for International Air Navigation*], Appendix 6 [*Template for SIGMET and AIRMET messages*].

## b) VA SIGMET examples:

```
LFMM SIGMET 1 VALID 020800/021200 LFPW-
LFMM MARSEILLE FIR/UIR VA ERUPTION MT STROMBOLI
LOC N3848 E01511 VA CLD FCST E OF E00900 SFC/FL200 MOV NW 40KT
FCST 1200Z N4415 E00700 - N4400 E00700 - N4315 E00945 - N4115 E00945 -
N4115 E00800 - N4045 E00800 - N4215 E00545 - N4345 E00545=
```

## 7. VA SIGMET dissemination

Appropriate Regional OPMET Centre – in this case, ROC Vienna at AFTN address LOWMMMXX, which would then route to SADIS (EGZZWPXX) and WIFS (KWBCYMYX) and be available to all stakeholders with a SADIS or WIFS account.

Appropriate VAAC – example: VAAC Tokyo at RJTDYMYX

Appropriate ACC and ATFM – example: ACC Petropavlovsk-Kamchatsky at UHPPZRZX and MATMC at UUUWZDZX

## NOTAM office

## 8. NOTAMs (ASHTAMs)

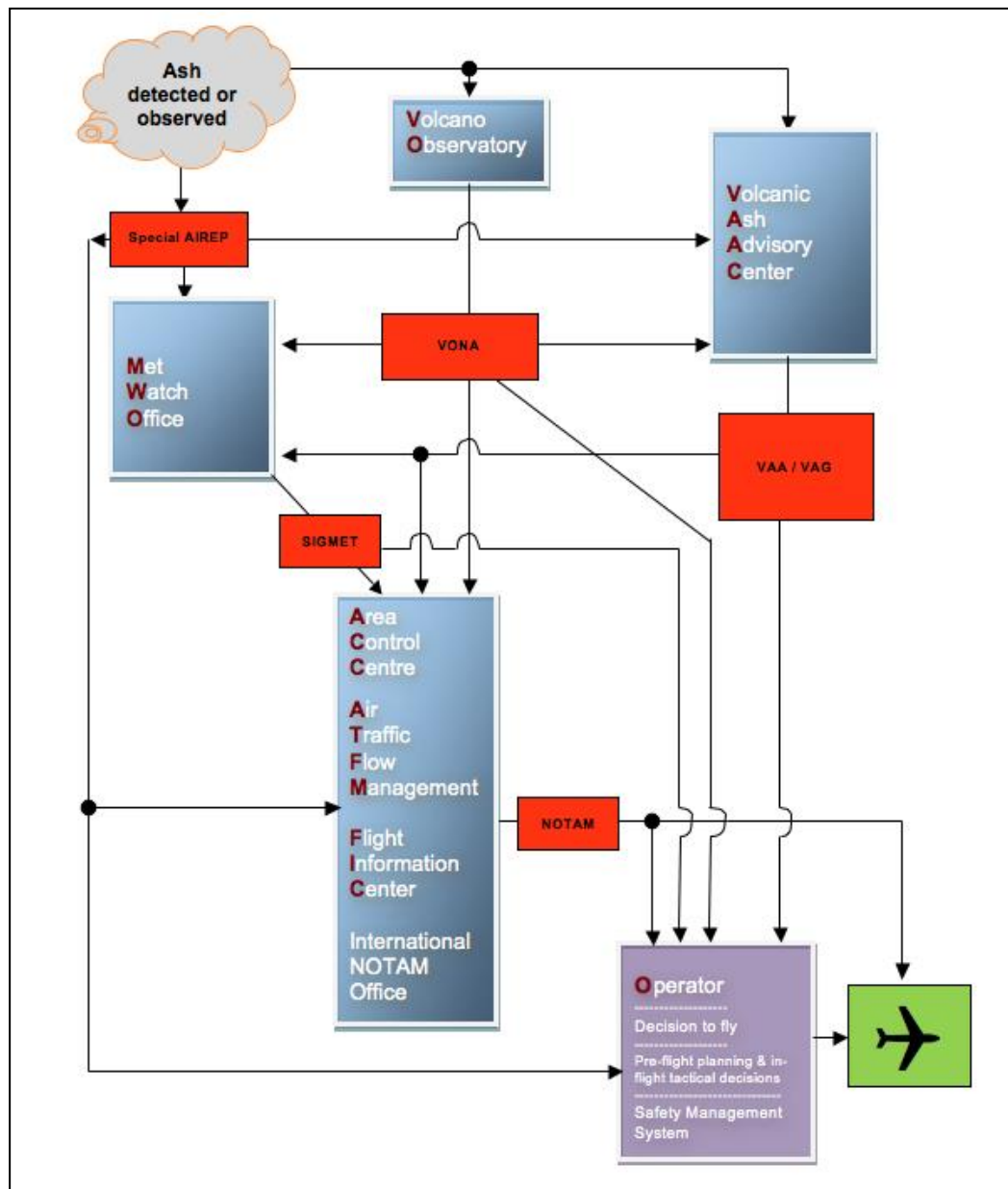
An example of NOTAM related to Volcanic Ash follows:

```
(W2867/15 NOTAMR W2866/15
Q) LIRR/QWWWX/IV/NBO/W/000/999/3759N01525E087
A) LIRR B) 1512090826 C) 1512101812EST
E) VOLCANO ETNA ID211060, PSN COORDINATES 374403N0150014E, ELEV
10922FT/3330M, EXPLOSIVE ACTIVITY IS INCREASED AT SE CRATER
SUMMIT VENT.
-SIGNIFICANT ASH EMISSION OCCURS.
GREY CLOUD OF ASH AND VAPOR GROWING ABOVE VOLCANO SUMMIT.
THE PHENOMENON IS OBSERVED BY VIDEOSURVEILLANCE CAMERAS.
ICAO LEVEL OF ALERT COLOUR: RED.
RMK: PILOTS SHALL WATCH OUT FOR RELEVANT SIGMET AND VOLCANIC
ADVISORY PRODUCTS PROVIDED BY TOULOUSE VOLCANIC ASH ADVISOR
CENTER (VAAC) IF AVBL THROUGH WEB SITE.
HTTP://WWW.METEO.FR/VAAC/EVAA.HTML (LOWER CASE).
REF AIP ENR 5.3.3-1
F) GND
G) UNL) =
```

## Attachment X2 (page 5 of 14)

## — Regional Information Flow Arrangements and Model Templates —

9. Messages dissemination  
SADIS/WIFS Gateway at EGZZVANW

**EUR Region – Western Part***Information Flow schema*

## VAAC

1. VAAC contact details:
- They can be found in ICAO Doc 9766 table 4-2 [VAAC Contact numbers]. Hyperlink: [Doc 9766 VAAC contact points](#)

## Attachment X2 (page 6 of 14)

## — Regional Information Flow Arrangements and Model Templates —

## 2. VAAs (Volcanic Ash Advisory) and VAGs (Volcanic Ash Graphics)

The VAA template is described in Annex 3 [*Meteorological Services for International Air Navigation*], Appendix 2, Table A2-1 [*template for advisory message for volcanic ash*].

## VAA examples:

```

VA ADVISORY
DTG: 20100101/0605Z
VAAC: TOULOUSE
VOLCANO: ETNA 211060
PSN: N3744 E01500
AREA: ITALY
SUMMIT ELEV: 3330M
ADVISORY NR: 2015/12
INFO SOURCE: INGV, WEBCAM
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: ERUPTION STARTED AT 0600Z
OBS VA DTG: 02/0600Z
OBS VA CLD: SFC/FL130 N3750 E01500 - N3800 E01550 - N3735 E01550 -
N3750 E01500 MOV E 45KT
FCST VA CLD +6HR: 02/1200Z SFC/FL130 N3750 E01505 - N3840 E01950 -
N3710 E01945 - N3750 E01505
FCST VA CLD +12HR: 02/1800Z NOT PROVIDED
FCST VA CLD +18HR: 03/0000Z NOT PROVIDED
RMK: PLEASE CHECK SIGMET FOR CURRENT WARNINGS.
NXT ADVISORY: NO LATER THAN 20150202/1200Z=

VA ADVISORY
DTG: 20100101/1500Z
VAAC: LONDON
VOLCANO: ORAEFAJOKULL 374010
PSN: N6400 W01639
AREA: ICELAND
SUMMIT ELEV: 2119M
ADVISORY NR: 2010/002
INFO SOURCE: IMO
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: OBS ASH PLUME, EST 12KM FROM RADAR.
OBS VA DTG: 10/1500Z
OBS VA CLD: NO VA EXP
FCST VA CLD +6HR: 10/2100Z SFC/FL200 N6329 W01651 - N6517
W01614 - N6849 E00351 - N6742 E01549 - N6329 W01651
FL200/350 N6327 W01656 - N6600 W01444 - N6750 W00307 - N6854 E01550 -
N6718 E01833 - N6327 W01656
FL350/550 N6325 W01635 - N6450 W01625 - N6812 W00004 - N6841 E01441 -
N6726 E01653 - N6325 W01635
FCST VA CLD +12HR: 11/0300Z SFC/FL200 N6334 W01640 - N6526 W01629 -
N6945 E00502 - N6658 E03036 - N6327 E03908 - N6629 E00931 - N6334
W01640
FL200/350 N6329 W01701 - N6556 W01624 - N7009 E00806 - N6431 E04310 -
N6026 E04358 - N6709 E00854 - N6329 W01701
FL350/550 N6334 W01650 - N6551 W01547 - N6931 E01235 - N6439 E03929 -
N6128 E04027 - N6634 E01013 - N6334 W01650
FCST VA CLD +18HR: 11/0900Z SFC/FL200 N6327 W01717 - N6517 W01706 -
N6905 E00017 - N6949 E02107 - N6024 E05301 - N5804 E05147 - N6630
E01612 - N6327 W01717 FL200/350 N6327 W01645 - N6556 W01613 - N7054
E01405 - N5925 E05658 - N5421 E04829 - N6717 E01018 - N6327 W01645
FL350/550 N6327 W01634 - N6634 W01510 - N7012 E01458 - N5953 E05349 -
N5558 E04930 - N6630 E01405 - N6327 W01634
RMK: ASH PLUME NOW OBS, ESTIMATED HEIGHT 12KM FROM RADAR. INCREASING
SEISMIC ACTIVITY.
NXT ADVISORY: WILL BE ISSUED BY 20150210/1800Z =

```

*Attachment X2 (page 7 of 14)**— Regional Information Flow Arrangements and Model Templates —*

3. VAA and VAG dissemination:
- a) VAA are sent by the VAACs to the MWOs and ACC/FICs following ICAO Doc 9766 Part 2 (hyperlink: [ICAO Doc 9766 Part 2](#) on ICAO website).
  - b) The VAAs are to be sent onto AFTN.
  - c) They can be retrieved as the VAGs in the VAACs Websites
    - VAAC London: [VAAs & VAGs](#)
    - VAAC Toulouse: [VAAs & VAGs](#)
    - VAAC Tokyo: [VAAs & VAGs](#)
    - VAAC Montréal: [VAAs & VAGs](#)
    - VAAC Washington: [VAAs & VAGs](#)
  - d) They can be retrieved as well in the secure SADIS FTP site (hyperlink: [SADIS](#)) and WIFS https service (hyperlink: [WIFS](#)).

*Volcanic Ash Supplementary information*

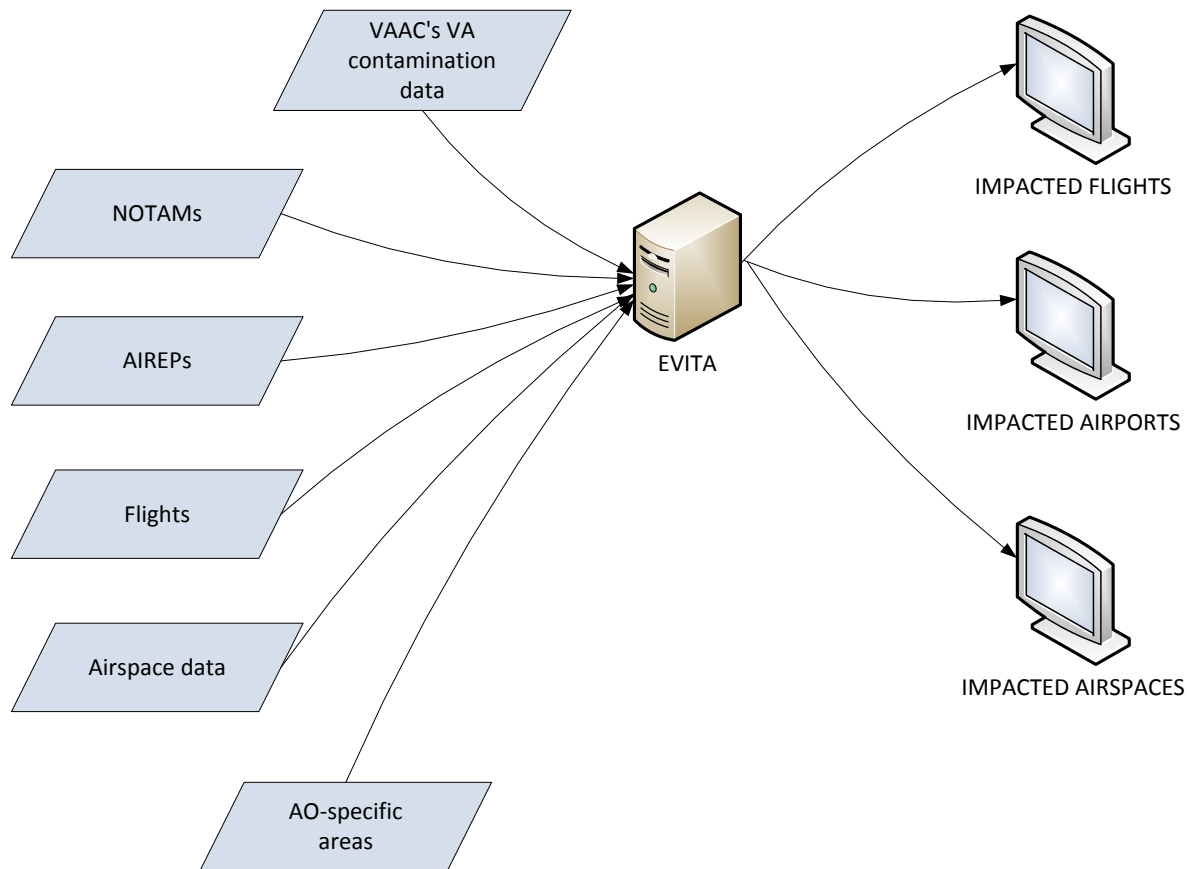
4. In the EUR region, some supplementary products are available in accordance with EASA Safety Information Bulletin SIB N° 2010-17R6.
5. These data or graphics, when produced, represent additional information on VA contaminated areas, such as Concentration charts and data.
6. They are available in the VAACs Websites (VAAC London: [VAAC London volcanic ash concentration charts](#) and VAAC Toulouse: [VAAC Toulouse volcanic ash concentration charts](#)).

## Attachment X2 (page 8 of 14)

## — Regional Information Flow Arrangements and Model Templates —

*EUROCONTROL*

## 7. EVITA



## 8. Teleconference procedures EUROCONTROL

Information and details about operational teleconferences called by the Network Manager will be published in the head line news of the NOP portal:  
<https://www.public.nm.eurocontrol.int/PUBPORTAL/>

*Volcano Observatories (VO)*

## 9. VONA (Volcano Observatory Notice to Aviation)

VONA is a recommended practice (Annex 3). The VONA template can be found in ICAO Doc 9766 Appendix E.

## 10. VONA example:

*(1) VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)*

- |                          |                          |
|--------------------------|--------------------------|
| (2) Issued:              | (20150202/0559Z)         |
| (3) Volcano:             | Etna 211060              |
| (4) Current Color Code:  | <b>RED</b>               |
| (5) Previous Color Code: | ORANGE                   |
| (6) Source:              | Etna Volcano Observatory |
| (7) Notice Number:       | 2015/0011/03E11          |

## Attachment X2 (page 9 of 14)

## — Regional Information Flow Arrangements and Model Templates —

## (1) VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)

- (8) Volcano Location: 3744N 01500E  
 (9) Area: Italy  
 (10) Summit Elevation: 3300 m  
 (11) Volcanic Activity: EXPLOSIVE ACTIVITY AT NEW SE CRATER (NSEC)  
 Summary: SUMMIT VENT - SIGNIFICANT ASH EMISSION OCCURS  
 (12) Volcanic cloud height: UNKNOWN  
 (13) Other volcanic cloud information: dark ash cloud at low elevation due to strong wind  
 (14) Remarks: THE PHENOMENON IS DETECTED BY VIDEOSURVEILLANCE CAMERAS FROM 0558Z  
 (15) Contacts: 24/7 OE Control Room operator  
 turnista@ct.ingv.it [+39 095 7165800](tel:+390957165800)  
 Eugenio Privitera (OE Director)  
 direttore.oe@ingv.it [+39 095 7165800](tel:+390957165800)  
 (16) Next Notice: A new VONA will be issued if conditions change significantly or the colour code is changes.

## MWO

## 11. Volcanic Ash SIGMETs

- a) The VA SIGMET template is described in Annex 3 [*Meteorological Services for International Air Navigation*], Appendix 6 [*Template for SIGMET and AIRMET messages*].
- b) VA SIGMET examples:
- ```
LFMM SIGMET 1 VALID 020800/021200 LFPW-
LFMM MARSEILLE FIR/UIR VA ERUPTION MT STROMBOLI
LOC N3848 E01511 VA CLD FCST E OF E00900 SFC/FL200 MOV NW 40KT
FCST 1200Z N4415 E00700 - N4400 E00700 - N4315 E00945 - N4115 E00945 -
N4115 E00800 - N4045 E00800 - N4215 E00545 - N4345 E00545=
```

## 12. VA SIGMET dissemination

In the EUR region, the VA SIGMET are sent onto AFTN following RODEX schema, i.e. the National OPMET Centers send the VA SIGMET from their MWO(s) to their Regional OPMET Center (ROC: London, Toulouse or Vienna, following the Area of responsibility) which will disseminate the VA SIGMET internationally.

## NOTAM office

## 13. NOTAMs (ASHTAMs)

An example of NOTAM related to Volcanic Ash follows:

```
(W1436/2016
Q)LIXX/QWWWX/IV/NBO /W /000/999/4339N01139E999
A)LIBB LIMM LIRR B)2016-06-14 15:58 C)2016-06-14 18:00 EST
VOLCANO ETNA ID 211060, PSN COORDINATES 374403N0150014E, ELEV
10922FT/3330M, EXPLOSIVE ACTIVITY IS STILL ONGOING FROM 1455Z NO
SIGNIFICANT ASH EMISSION OCCURED. ASH SI STILL DRIFTING IN ROME FIR,
BRINDISI FIR AND THE SOUTH PART OF LIMM FIR.
ICAO LEVEL OF ALERT COLOUR: ORANGE
RMK:
1. THE EXPLOSIVE ACTIVITY WAS DETECTED BY VIDEO SURVEILLANCE CAMERAS
```

*Attachment X2 (page 10 of 14)*

## — Regional Information Flow Arrangements and Model Templates —

AT 1455Z.

2. PILOTS SHALL WATCH OUT FROM RELEVANT SIGMET AND VOLCANIC ADVISORY PRODUCTS PROVIDED BY TOULOUSE VOLCANIC ASH ADVISOR CENTER (VAAC) IF AVAILABLE THROUGH WEB SITE

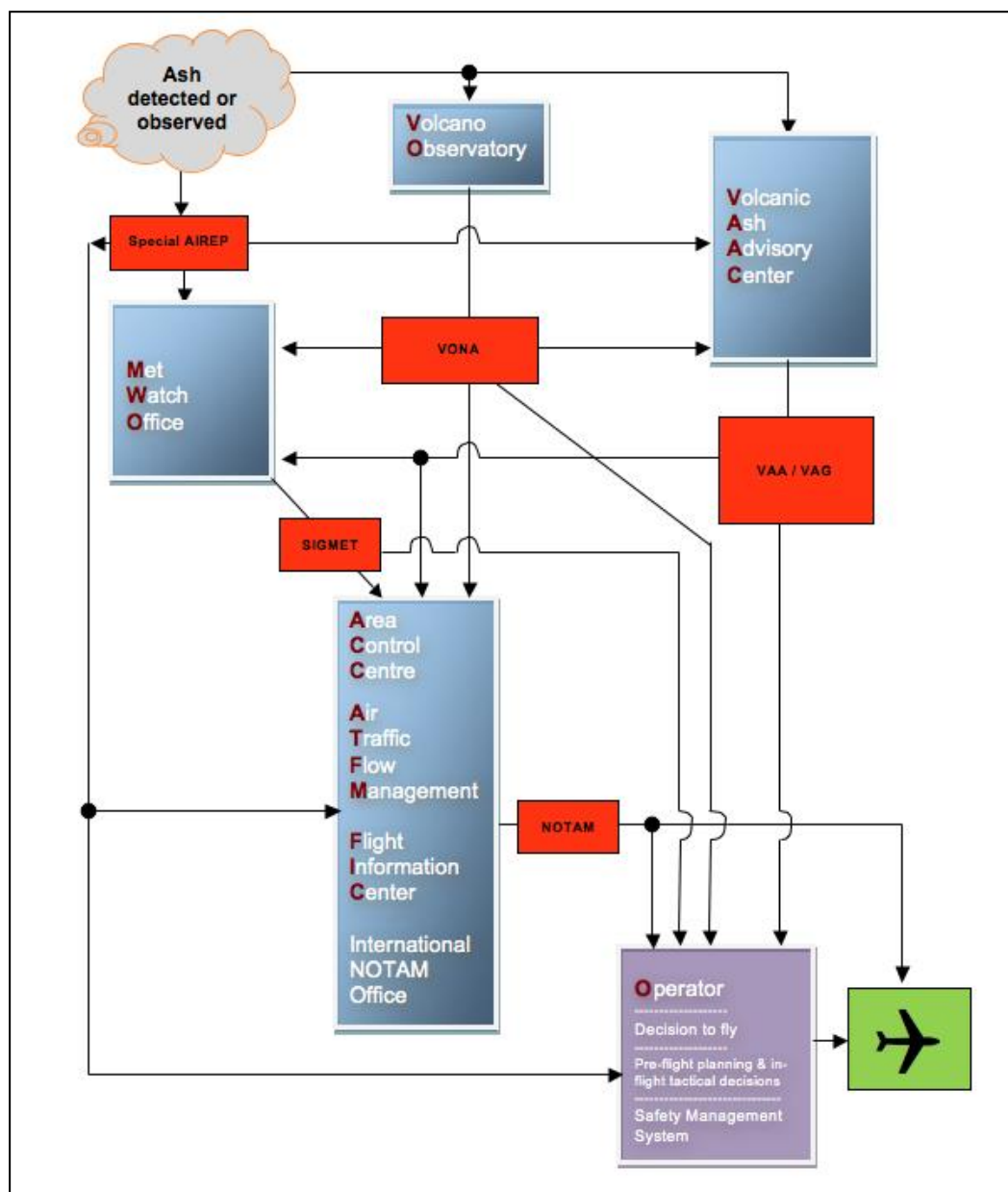
HTTP://WWW.METEO.FR/VAAC/EVAAHTML (LOWERCASE)

REF AIP ENR 5.3.3-1

F) SFC G) UNL) =

## 14. Messages dissemination

SADIS/WIFS Gateway at EGZZVANW

**NAT Region***Information Flow schema*



*Attachment X2 (page 11 of 14)*

## — Regional Information Flow Arrangements and Model Templates —

## VAAC

## 1. VAAC contact details:

- They can be found in ICAO Doc 9766 table 4-2 [VAAC Contact numbers]. Hyperlink: [Doc 9766 VAAC contact points](#)

## 2. VAAs (Volcanic Ash Advisory) and VAGs (Volcanic Ash Graphics)

The VAA template is described in Annex 3 [Meteorological Service for International Air navigation], in Appendix 2, Table A2-1 [template for advisory message for volcanic Ash].

## VAA examples:

```

VA ADVISORY
DTG: 20100101/0605Z
VAAC: TOULOUSE
VOLCANO: ETNA 211060
PSN: N3744 E01500
AREA: ITALY
SUMMIT ELEV: 3330M
ADVISORY NR: 2015/12
INFO SOURCE: INGV, WEBCAM
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: ERUPTION STARTED AT 0600Z
OBS VA DTG: 02/0600Z
OBS VA CLD: SFC/FL130 N3750 E01500 - N3800 E01550 - N3735 E01550 -
N3750 E01500 MOV E 45KT
FCST VA CLD +6HR: 02/1200Z SFC/FL130 N3750 E01505 - N3840 E01950 -
N3710 E01945 - N3750 E01505
FCST VA CLD +12HR: 02/1800Z NOT PROVIDED
FCST VA CLD +18HR: 03/0000Z NOT PROVIDED
RMK: PLEASE CHECK SIGMET FOR CURRENT WARNINGS.
NXT ADVISORY: NO LATER THAN 20150202/1200Z=

VA ADVISORY
DTG: 20100101/1500Z
VAAC: LONDON
VOLCANO: ORAEFAJOKULL 374010
PSN: N6400 W01639
AREA: ICELAND
SUMMIT ELEV: 2119M
ADVISORY NR: 2010/002
INFO SOURCE: IMO
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: OBS ASH PLUME, EST 12KM FROM RADAR.
OBS VA DTG: 10/1500Z
OBS VA CLD: NO VA EXP
FCST VA CLD +6HR: 10/2100Z SFC/FL200 N6329 W01651 - N6517
W01614 - N6849 E00351 - N6742 E01549 - N6329 W01651
FL200/350 N6327 W01656 - N6600 W01444 - N6750 W00307 - N6854 E01550 -
N6718 E01833 - N6327 W01656
FL350/550 N6325 W01635 - N6450 W01625 - N6812 W00004 - N6841 E01441 -
N6726 E01653 - N6325 W01635
FCST VA CLD +12HR: 11/0300Z SFC/FL200 N6334 W01640 - N6526 W01629 -
N6945 E00502 - N6658 E03036 - N6327 E03908 - N6629 E00931 - N6334
W01640
FL200/350 N6329 W01701 - N6556 W01624 - N7009 E00806 - N6431 E04310 -
N6026 E04358 - N6709 E00854 - N6329 W01701
FL350/550 N6334 W01650 - N6551 W01547 - N6931 E01235 - N6439 E03929 -
N6128 E04027 - N6634 E01013 - N6334 W01650
FCST VA CLD +18HR: 11/0900Z SFC/FL200 N6327 W01717 - N6517 W01706 -
N6905 E00017 - N6949 E02107 - N6024 E05301 - N5804 E05147 - N6630
E01612 - N6327 W01717 FL200/350 N6327 W01645 - N6556 W01613 - N7054

```

*Attachment X2 (page 12 of 14)*

## — Regional Information Flow Arrangements and Model Templates —

E01405 - N5925 E05658 - N5421 E04829 - N6717 E01018 - N6327 W01645  
 FL350/550 N6327 W01634 - N6634 W01510 - N7012 E01458 - N5953 E05349 -  
 N5558 E04930 - N6630 E01405 - N6327 W01634  
 RMK: ASH PLUME NOW OBS, ESTIMATED HEIGHT 12KM FROM RADAR. INCREASING  
 SEISMIC ACTIVITY.  
 NXT ADVISORY: WILL BE ISSUED BY 20150210/1800Z =

## 3. VAA and VAG dissemination:

- a) VAA are sent by the VAACs to the MWOs and ACC/FICs following ICAO Doc 9766 Part 2 (hyperlink: [ICAO Doc 9766 Part 2](#) on ICAO website).
- b) The VAAs are to be sent onto AFTN.
- c) They can be retrieved as the VAGs in the VAACs Websites
  - VAAC London: [VAAs & VAGs](#)
  - VAAC Toulouse: [VAAs & VAGs](#)
  - VAAC Tokyo: [VAAs & VAGs](#)
  - VAAC Montréal: [VAAs & VAGs](#)
  - VAAC Washington: [VAAs & VAGs](#)
- d) They can be retrieved as well in the secure SADIS FTP site (hyperlink: [SADIS](#)) and WIFS https service (hyperlink: [WIFS](#)).

*Volcano Observatories (VO)*

## 4. VONA (Volcano Observatory Notice to Aviation)

VONA is a recommended practice (Annex 3). The VONA template can be found in ICAO Doc 9766 Appendix E.

## 5. VONA example:

*(1) VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)*

- |                                        |                                                                                             |
|----------------------------------------|---------------------------------------------------------------------------------------------|
| (2) Issued:                            | (20150202/0559Z)                                                                            |
| (3) Volcano:                           | Etna 211060                                                                                 |
| (4) Current Color Code:                | <b>RED</b>                                                                                  |
| (5) Previous Color Code:               | ORANGE                                                                                      |
| (6) Source:                            | Etna Volcano Observatory                                                                    |
| (7) Notice Number:                     | 2015/0011/03E11                                                                             |
| (8) Volcano Location:                  | 3744N 01500E                                                                                |
| (9) Area:                              | Italy                                                                                       |
| (10) Summit Elevation:                 | 3300 m                                                                                      |
| (11) Volcanic Activity Summary:        | EXPLOSIVE ACTIVITY AT NEW SE CRATER (NSEC)<br>SUMMIT VENT - SIGNIFICANT ASH EMISSION OCCURS |
| (12) Volcanic cloud height:            | UNKNOWN                                                                                     |
| (13) Other volcanic cloud information: | dark ash cloud at low elevation due to strong wind                                          |
| (14) Remarks:                          | THE PHENOMENON IS DETECTED BY<br>VIDEOSURVEILLANCE CAMERAS FROM 0558Z                       |

## Attachment X2 (page 13 of 14)

## — Regional Information Flow Arrangements and Model Templates —

## (1) VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)

- (15) Contacts: 24/7 OE Control Room operator  
 turnista@ct.ingv.it [+39 095 7165800](tel:+390957165800)  
 Eugenio Privitera (OE Director)  
 direttore.oe@ingv.it [+39 095 7165800](tel:+390957165800)
- (16) Next Notice: A new VONA will be issued if conditions change significantly or the colour code is changes.

## MWO

## 6. Volcanic Ash SIGMETs

- a) The VA SIGMET template is described in Annex 3 [*Meteorological Services for International Air Navigation*], Appendix 6 [*Template for SIGMET and AIRMET messages*].

## b) VA SIGMET examples:

LFMM SIGMET 1 VALID 020800/021200 LFPW-  
 LFMM MARSEILLE FIR/UIR VA ERUPTION MT STROMBOLI  
 LOC N3848 E01511 VA CLD FCST E OF E00900 SFC/FL200 MOV NW 40KT  
 FCST 1200Z N4415 E00700 - N4400 E00700 - N4315 E00945 - N4115 E00945 -  
 N4115 E00800 - N4045 E00800 - N4215 E00545 - N4345 E00545=

## 7. VA SIGMET dissemination

Appropriate Regional OPMET Center (ROC: London, Toulouse or Washington, following the Area of responsibility) which will disseminate the VA SIGMET internationally.

## NOTAM office

## 8. NOTAMs (ASHTAMs)

An example of NOTAM related to Volcanic Ash follows:

(W2867/15 NOTAMR W2866/15  
 Q) LIRR/QWWWX/IV/NBO/W/000/999/3759N01525E087  
 A) LIRR B) 1512090826 C) 1512101812EST  
 E) VOLCANO ETNA ID211060, PSN COORDINATES 374403N0150014E, ELEV  
 10922FT/3330M, EXPLOSIVE ACTIVITY IS INCREASED AT SE CRATER  
 SUMMIT VENT.  
 -SIGNIFICANT ASH EMISSION OCCURS.  
 GREY CLOUD OF ASH AND VAPOR GROWING ABOVE VOLCANO SUMMIT.  
 THE PHENOMENON IS OBSERVED BY VIDEOSURVEILLANCE CAMERAS.  
 ICAO LEVEL OF ALERT COLOUR: RED.  
 RMK: PILOTS SHALL WATCH OUT FOR RELEVANT SIGMET AND VOLCANIC  
 ADVISORY PRODUCTS PROVIDED BY TOULOUSE VOLCANIC ASH ADVISOR  
 CENTER (VAAC) IF AVBL THROUGH WEB SITE.  
 HTTP://WWW.METEO.FR/VAAC/EVAA.HTML (LOWER CASE).  
 REF AIP ENR 5.3.3-1  
 F) GND  
 G) UNL)=

## 9. Messages dissemination

SADIS/WIFS Gateway at EGZZVANW

*Attachment X2 (page 14 of 14)*

## — Regional Information Flow Arrangements and Model Templates —

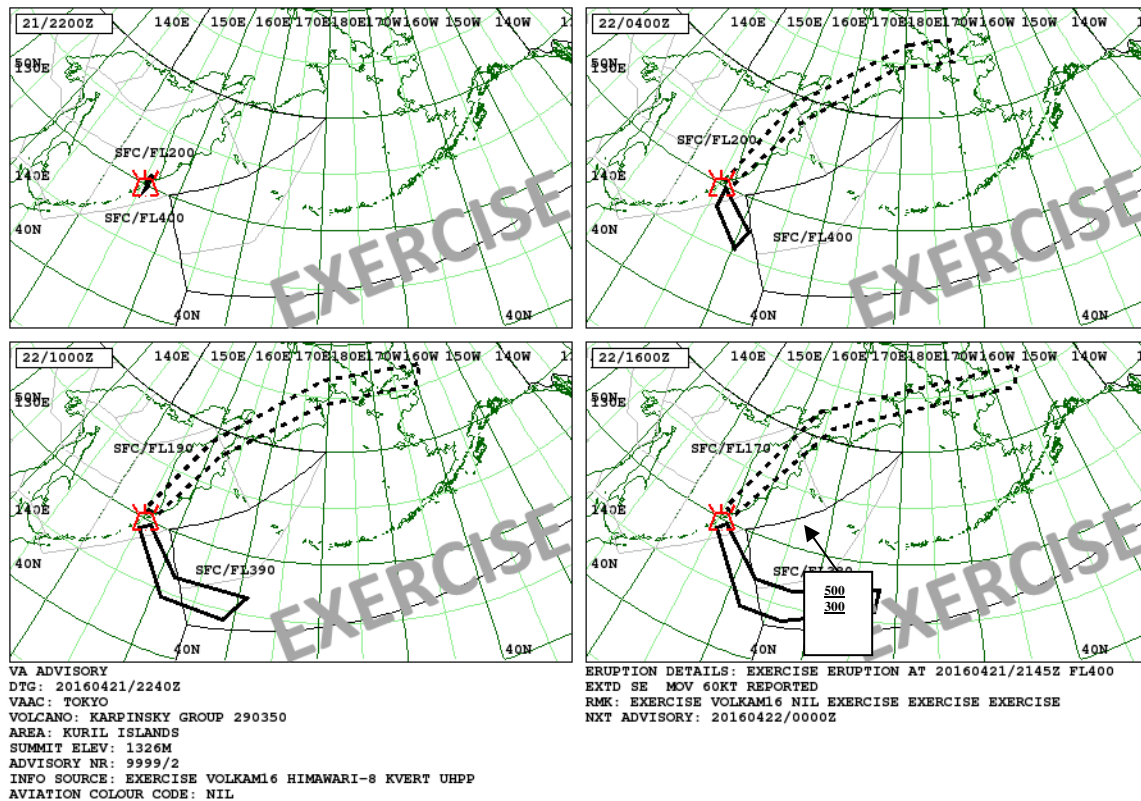
**ATTACHMENT X3****DESCRIPTION OF SELECTED VA PRODUCTS*****EUR Region – Eastern Part****Use of Volcanic Ash VAA/VAG, SIGMET and NOTAM*

1. There are a variety of methods by which volcanic ash information can be provided to users in a form that can be plotted on charts.
2. The VAA/VAG provided by the VAAC provides a regional view of the areas of ash contamination.
3. The VA SIGMET is issued by each MWO, who usually, unless they have additional information, take the VAA data and provide this for specific FIRs. SIGMETs are provided from the start of VA contamination of the corresponding FIR/UIR. They give information (based on a snapshot) for the beginning of the validity period and an outlook (also a snapshot) for the end of the validity period (which is a maximum of 6h later). The first SIGMET is generally shorter than 6h in order to have the following ones issued at synoptic hours (00, 06, 12 and 18z) and are mainly based on the VAAC's production (T+0 and T+6).
4. The VA NOTAM is issued by the NOTAM Office (NOF) and is usually supplied on the basis of information received from the MWO. In order to reduce information overload the NOTAMs, where provided, give information on significant changes of the status of the volcano eruption and references existing information such as VAA/VAG and SIGMET.

Attachment X3 (page 2 of 10)  
— Description of Selected VA Products —

*ICAO Volcanic Ash Advisory (VAA) and VAG (Volcanic Ash Graphic)*

5. In the event of an eruption, VAAC Tokyo or VAAC Anchorage will provide the ICAO Annex 3 [Meteorological Services for International Air Navigation] Volcanic Ash Advisory (VAA) and Volcanic Ash Graphic (VAG) as soon as practicable. Thereafter, VAA and VAG will be updated every 6 hours at 00, 06, 12 and 18 UTC for T+0, T+6, T+12, T+18 hours.



6. Both products are provided on the website detailed below, additionally the VAA is provided as an AFTN message.

- VAAC Tokyo Website <http://ds.data.jma.go.jp/svd/vaac/data/index.html>
- VAAC Anchorage Website <http://vaac.arh.noaa.gov/>

Although not currently a standard product, a T+24 VAG and/or VAA product is currently being trialled by VAAC Tokyo and VAAC Anchorage. This product is simply a standalone continuation of the standard VAG/VAA product showing the expected locations of plumes at the T+24 hour forecast stage.

**EUR Region – Western Part**

*Use of Volcanic Ash VAA/VAG, SIGMET, NOTAM and ASHTAM*

1. There are a variety of methods by which volcanic ash information can be provided to users in a form that can be plotted on charts.

*Attachment X3 (page 3 of 10)*  
— Description of Selected VA Products —

2. The VAA/VAG provided by the VAAC provides a regional view of the areas of ash contamination.

3. The VA SIGMET is issued by each MWO, who usually, unless they have additional information, take the VAA data and provide this for specific FIRs. Where a VAAC provides supplementary volcanic ash products [ the information provided on the SIGMET is consistent with the low contamination area ]. SIGMETs are provided from the start of VA contamination of the corresponding FIR/UIR. They give information (based on a snapshot) for the beginning of the validity period and an outlook (also a snapshot) for the end of the validity period (which is a maximum of 6h later). The first SIGMET is generally shorter than 6h in order to have the following ones issued at synoptic hours (00, 06, 12 and 18z) and are mainly based on the VAAC's production (T+0 and T+6).

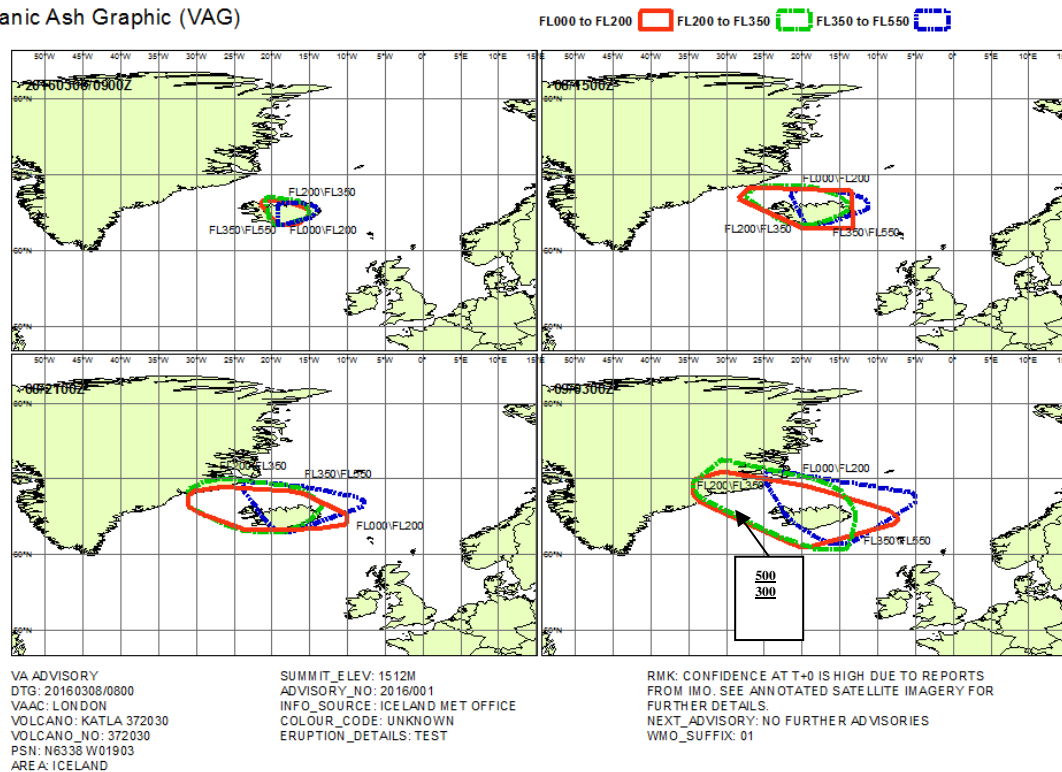
4. The VA NOTAM is issued by the NOTAM Office (NOF) and is usually supplied on the basis of information received from the MWO. In order to reduce information overload the NOTAMs, where provided, give information on significant changes of the status of the volcano eruption and references existing information such as VAA/VAG and SIGMET.

5. The ASHTAM is not widely used as a means of disseminating Volcanic Ash information and is not required where a State provides VA NOTAMs.

*ICAO Volcanic Ash Advisory (VAA) and VAG (Volcanic Ash Graphic)*

6. In the event of an eruption, VAAC London or VAAC Toulouse will provide the ICAO Annex 3 [Meteorological Services for International Air Navigation] Volcanic Ash Advisory (VAA) and Volcanic Ash Graphic (VAG) as soon as practicable. Thereafter, VAA and VAG will be updated every 6 hours at 00, 06, 12 and 18 UTC for T+0, T+6, T+12, T+18 hours.

Volcanic Ash Graphic (VAG)



*Attachment X3 (page 4 of 10)*  
— Description of Selected VA Products —

7. Both products are provided on the website detailed below, additionally the VAA is provided as an AFTN message.

- VAAC London Website [www.metoffice.gov.uk/aviation/vaac/](http://www.metoffice.gov.uk/aviation/vaac/)
- VAAC Toulouse Website [www.meteo.fr/vaac/](http://www.meteo.fr/vaac/)

8. Although not currently a standard product, a T+24 VAG and/or VAA product is currently being trialled by VAAC Toulouse and VAAC London. This product is simply a standalone continuation of the standard VAG/VAA product showing the expected locations of plumes at the T+24 hour forecast stage.

9. In addition to the ICAO products detailed above a range of supplementary products are provided. These are detailed below.

*Supplementary Volcanic Ash Charts provided by the London and Toulouse VAACs*

10. The EUR region is required to provide supplementary information on volcanic ash beyond a simple ash/no ash product to support the region's Safety Risk Assessment (SRA) based approach in case of a significant ash producing eruption. This means that multiple contamination levels will continue to underpin the EUR/NAT Volcanic Ash Contingency Plan (VACP).




11. Since the 2010 Eruption of Eyjafjallajökull, VAACs London and Toulouse have provided Volcanic Ash Concentration Charts in support of the VACP. These charts predict the location of a quantitative mass of ash per unit volume.

12. The Volcanic Ash Concentration Charts are provided for three contamination levels:-

- **Low contamination** Volcanic Ash Mass Concentration less than or equal to 2000 micrograms per cubic metre.
- **Medium contamination** Volcanic Ash Mass Concentration greater than 2000 micrograms per cubic metre and less than 4000 micrograms per cubic metre.
- **High contamination** Volcanic Ash Mass Concentration greater than or equal to 4000 micrograms per cubic metre

13. Volcanic Ash Mass Concentration charts are issued every 6 hours at 00, 06, 12 and 18 UTC for T+0, T+6, T+12, and T+18 hours ahead. It should be noted that the charts represent the actual or forecast location of ash over the 6-hour period up to the validity time.

14. The charts detail a number of polygons which will be divided into low, medium and high contamination areas.

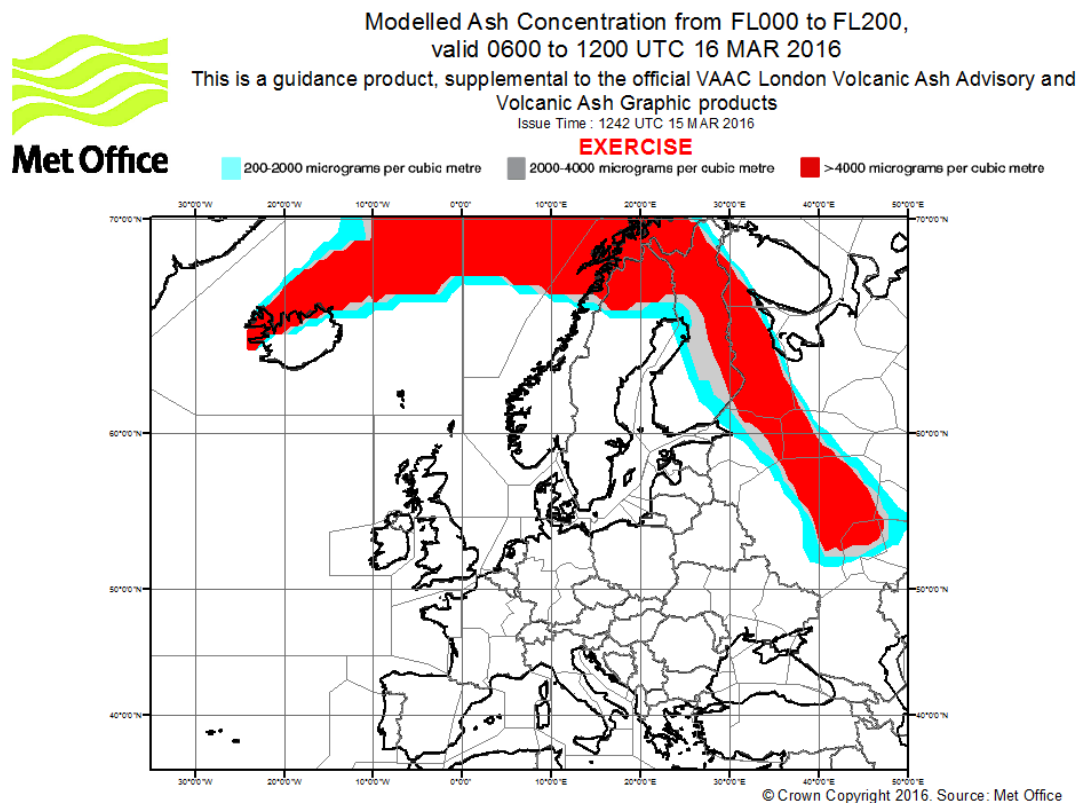
- Low Contamination:  $\leq 2000$  micrograms per cubic metre 
- Medium Contamination:  $> 2000 < 4000$  micrograms per cubic metre 
- High Contamination:  $\geq 4000$  micrograms per cubic metre 

15. Separate charts covering different Flight Level bands (FL000-200, FL200-350, FL350-550) are provided.



*Attachment X3 (page 5 of 10)*  
— Description of Selected VA Products —

16. Example VA concentration chart



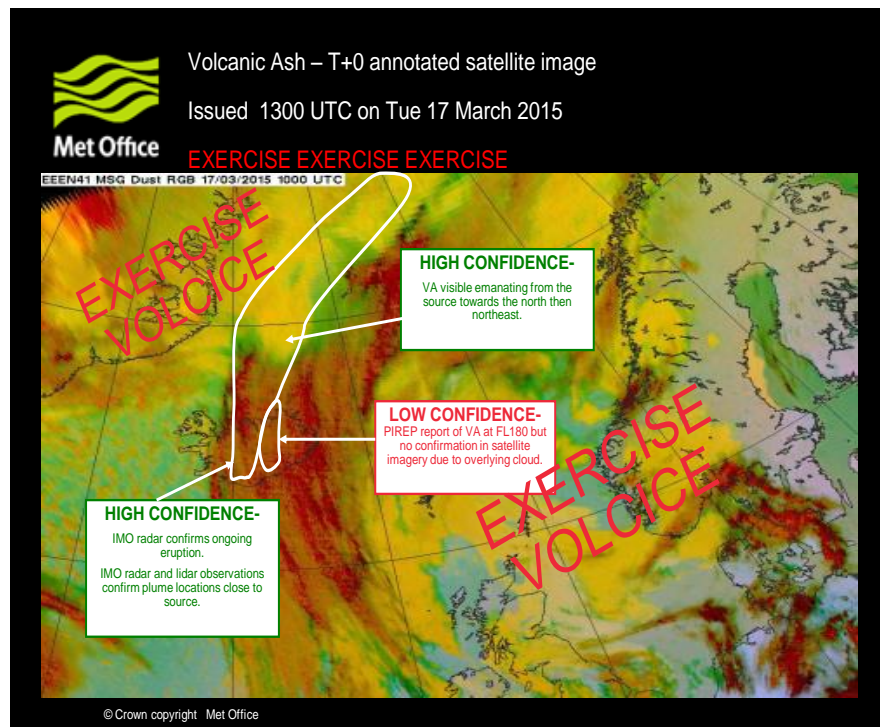
*Annotated Satellite Image*

17. At regular intervals (every 3 hours for VAAC London) VAAC Toulouse and VAAC London will produce a satellite image which is annotated with a variety of observational information related to volcanic ash including pilot reports, research aircraft reports, lidar information and other satellite information. This information assists users to understand how the VAAC forecasters are using this additional information that is being provided by indicating the confidence on which it is being evaluated.

18. These products will be issued every 3 hours at the following approximate times: 02, 05, 08, 11, 14, 17, 20, and 23 UTC.

*Attachment X3 (page 6 of 10)*  
— Description of Selected VA Products —

19. Example Annotated Satellite Image:



*Data Files*

20. Data files in csv format will be provided for contour co-ordinates of the CML charts in a similar format to those currently provided. Note, however, that some of the information contained in the header (the first 11 lines of the csv file) will differ from those currently issued. Consideration will be given to publishing an XML schema for ingestion of this data. This will facilitate more streamlined ingestion of the contour data into visualisation packages.

21. CSV Format – Current (as at 15.03.16) format – as provided to EUROCONTROL – other variants also exist

```
VOLCANO: KATLA 372030
PSN: N6338 W01903
VOLCANIC ASH CONCENTRATION: LOW 200 MICROGRAMS PER CUBIC METRE CONTOUR
LOW; 200 MICROGRAMS PER CUBIC METRE CONTOUR
ISSUE TYPE: TEST
MODEL RUN: 20160308/0900
ISSUE TIME: 20160308/0858
VALIDITY TIME: 20160308/2100
FLIGHT LEVEL: FL200/FL350
REMARKS: CONFIDENCE AT T+0 IS HIGH DUE TO REPORTS FROM IMO. SEE
ANNOTATED SATELLITE IMAGERY FOR FURTHER DETAILS.
ORIGINATOR: LONDON VAAC
POLY 1
N695414,W0245459
N693250,W0235049
N693215,W0220807
N684750,W0195437
N684648,W0191745
N682734,W0184723
N684737,W0174604
N684655,W0162922
N684025,W0161917
N680250,W0155101
```

*Attachment X3 (page 7 of 10)*

## — Description of Selected VA Products —

N680022,W0151806  
 N665056,W0133348  
 N664025,W0132621  
 N662733,W0132612  
 N644629,W0144126  
 N635947,W0155135  
 N633641,W0165949  
 N625250,W0180538  
 N624940,W0181647  
 N624943,W0210705  
 N631210,W0221637  
 N631258,W0240012  
 N640316,W0262425  
 N645526,W0270302  
 N660404,W0270440  
 N663440,W0272739  
 N663440,W0274707  
 N654942,W0300425  
 N655254,W0301659  
 N662254,W0305802  
 N682727,W0310052  
 N684454,W0305010  
 N690819,W0294126  
 N693143,W0290455  
 N693250,W0282753  
 N695456,W0272057  
 N695414,W0245459

***NAT Region****Use of Volcanic Ash VAA/VAG, SIGMET, NOTAM and ASHTAM*

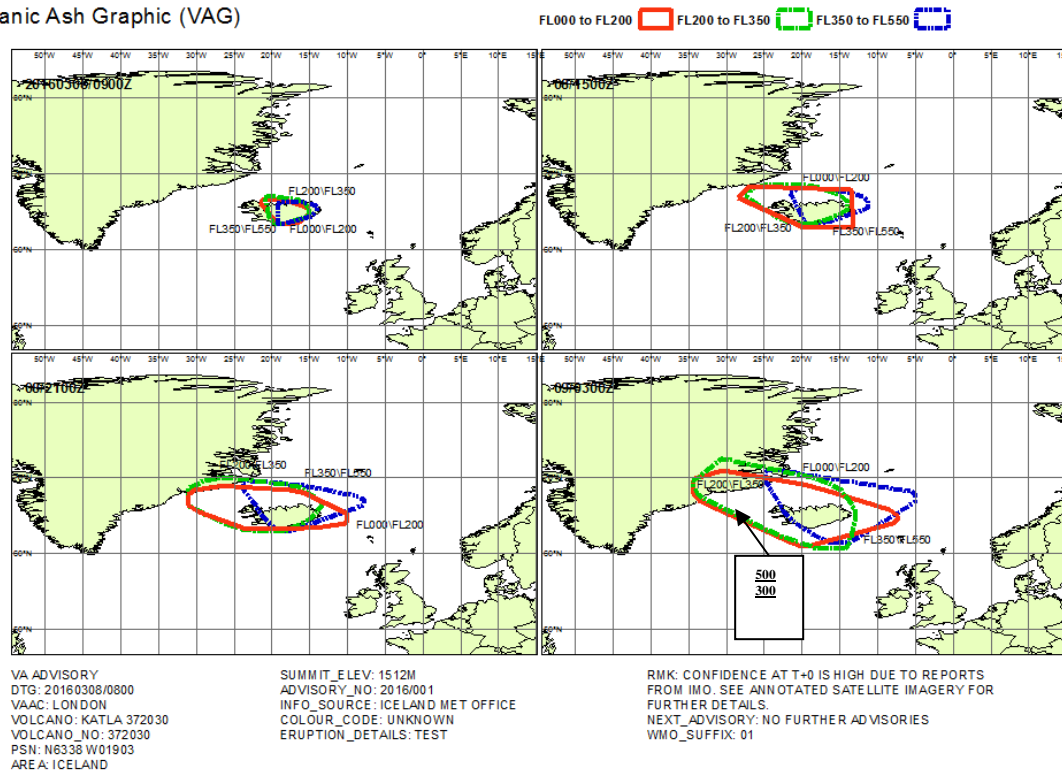
1. There are a variety of methods by which volcanic ash information can be provided to users in a form that can be plotted on charts.
2. The VAA/VAG provided by the VAAC provides a regional view of the areas of ash contamination.
3. The VA SIGMET is issued by each MWO, who usually, unless they have additional information, take the VAA data and provide this for specific FIRs. Where a VAAC provides supplementary volcanic ash products [ the information provided on the SIGMET is consistent with the low contamination area ]. SIGMETs are provided from the start of VA contamination of the corresponding FIR/UIR. They give information (based on a snapshot) for the beginning of the validity period and an outlook (also a snapshot) for the end of the validity period (which is a maximum of 6h later). The first SIGMET is generally shorter than 6h in order to have the following ones issued at synoptic hours (06, 12 and 18z) and are mainly based on the VAAC's production (T+0 and T+6).
4. The VA NOTAM is issued by the NOTAM Office (NOF) and is usually supplied on the basis of information received from the MWO. In order to reduce information overload the NOTAMs, where provided, give information on significant changes of the status of the volcano eruption and references existing information such as VAA/VAG and SIGMET.
5. The ASHTAM is not widely used as a means of disseminating Volcanic Ash information and is not required where a State provides VA NOTAMs.

Attachment X3 (page 8 of 10)  
— Description of Selected VA Products —

*ICAO Volcanic Ash Advisory (VAA) and VAG (Volcanic Ash Graphic)*

6. In the event of an eruption, VAAC London or VAAC Toulouse will provide the ICAO Annex 3 [Meteorological Services for International Air Navigation] Volcanic Ash Advisory (VAA) and Volcanic Ash Graphic (VAG) as soon as practicable. Thereafter, VAA and VAG will be updated every 6 hours at 00, 06, 12 and 18 UTC for T+0, T+6, T+12, T+18 hours.

Volcanic Ash Graphic (VAG)



7. Both products are provided on the website detailed below, additionally the VAA is provided as an AFTN message.

- VAAC London Website [www.metoffice.gov.uk/aviation/vaac/](http://www.metoffice.gov.uk/aviation/vaac/)
- VAAC Toulouse Website [www.meteo.fr/vaac/](http://www.meteo.fr/vaac/)

8. Although not currently a standard product, a T+24 VAG and/or VAA product is currently being trialled by VAAC Toulouse and VAAC London. This product is simply a standalone continuation of the standard VAG/VAA product showing the expected locations of plumes at the T+24 hour forecast stage.

9. In addition to the ICAO products detailed above a range of supplementary products are provided. These are detailed below.

*Annotated Satellite Image*

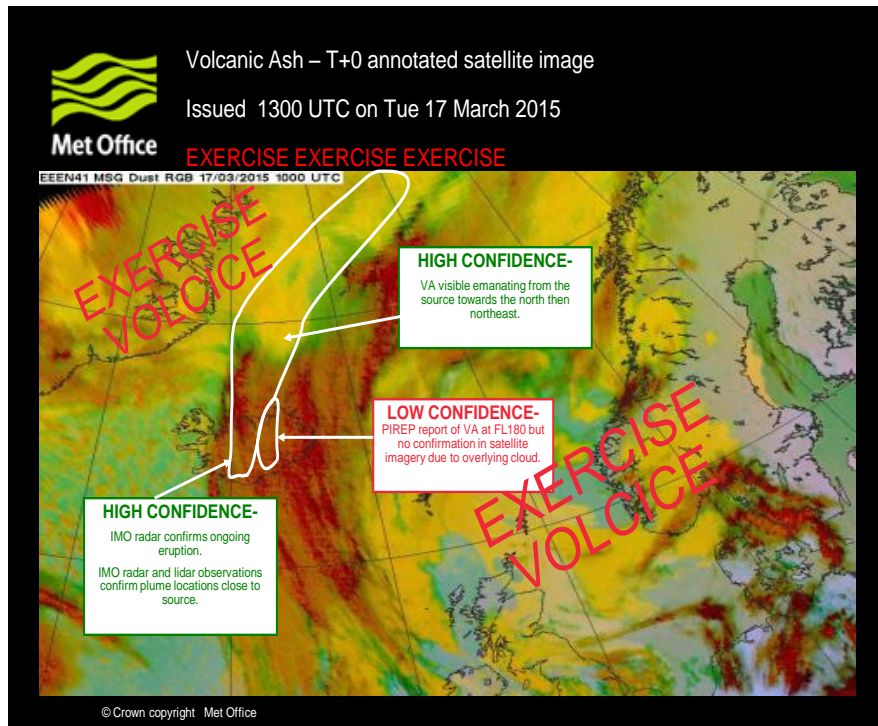
10. At regular intervals (every 3 hours for VAAC London) VAAC Toulouse and VAAC London will produce a satellite image which is annotated with a variety of observational information related to volcanic ash including pilot reports, research aircraft reports, lidar information and other satellite information. This information assists users to understand how the VAAC forecasters are using

*Attachment X3 (page 9 of 10)*  
— Description of Selected VA Products —

this additional information that is being provided by indicating the confidence on which it is being evaluated.

11. These products will be issued every 3 hours at the following approximate times: 02, 05, 08, 11, 14, 17, 20, and 23 UTC.

12. Example Annotated Satellite Image:



### Data Files

13. Data files in csv format will be provided for contour co-ordinates of the CML charts in a similar format to those currently provided. Note, however, that some of the information contained in the header (the first 11 lines of the csv file) will differ from those currently issued. Consideration will be given to publishing an XML schema for ingestion of this data. This will facilitate more streamlined ingestion of the contour data into visualisation packages.

14. CSV Format – Current (as at 15.03.16) format – as provided to EUROCONTROL – other variants also exist

```
VOLCANO: KATLA 372030
PSN: N6338 W01903
VOLCANIC ASH CONCENTRATION: LOW 200 MICROGRAMS PER CUBIC METRE CONTOUR
LOW; 200 MICROGRAMS PER CUBIC METRE CONTOUR
ISSUE TYPE: TEST
MODEL RUN: 20160308/0900
ISSUE TIME: 20160308/0858
VALIDITY TIME: 20160308/2100
FLIGHT LEVEL: FL200/FL350
REMARKS: CONFIDENCE AT T+0 IS HIGH DUE TO REPORTS FROM IMO. SEE
ANNOTATED SATELLITE IMAGERY FOR FURTHER DETAILS.
ORIGINATOR: LONDON VAAC
POLY 1
N695414,W0245459
N693250,W0235049
```

*Attachment X3 (page 10 of 10)*

## — Description of Selected VA Products —

N693215,W0220807  
N684750,W0195437  
N684648,W0191745  
N682734,W0184723  
N684737,W0174604  
N684655,W0162922  
N684025,W0161917  
N680250,W0155101  
N680022,W0151806  
N665056,W0133348  
N664025,W0132621  
N662733,W0132612  
N644629,W0144126  
N635947,W0155135  
N633641,W0165949  
N625250,W0180538  
N624940,W0181647  
N624943,W0210705  
N631210,W0221637  
N631258,W0240012  
N640316,W0262425  
N645526,W0270302  
N660404,W0270440  
N663440,W0272739  
N663440,W0274707  
N654942,W0300425  
N655254,W0301659  
N662254,W0305802  
N682727,W0310052  
N684454,W0305010  
N690819,W0294126  
N693143,W0290455  
N693250,W0282753  
N695456,W0272057  
N695414,W0245459

---

**ATTACHMENT X4****GUIDANCE ON THE ESTABLISHMENT, AMENDMENT AND WITHDRAWAL OF DANGER AREAS*****EUR Region – Eastern Part****Use of Danger Areas*

1. Danger area is not issued for en-route flight – reference NOTAM and SIGMET.

***EUR Region – Western Part***

1. This is a guidance to be used by Regional agencies as reference in the use of Danger Areas in regards to Volcanic Ash.

*Use of Danger Areas*

2. The use of precautionary Danger Areas over and in the proximity of a volcanic eruption has been considered appropriate. It should be noted that an initial Danger Area will always be a stationary circle around the volcano, it will not follow the ash cloud.
3. The competent authority for determining the need for and extent of Danger Areas is the one regulating flight operations. States should implement arrangements to ensure the timely declaration of Danger Area by an appropriate authority according to pre-defined conditions.
4. In the Pre-Eruption and Start of Eruption phases there is lack of available information and the focus should be on aircraft in flight in the vicinity and or heading towards the volcano. The most effective tool at that time period is a Danger Area and it should be determined by prevailing local wind speeds.
5. As more information is received the restrictions should be lifted appropriately.
6. Appropriate AIS and MET messages shall be issued in accordance with Annex 15 [*Aeronautical Information Services*] and Annex 3 [*Meteorological Services for International Air Navigation*], respectively.
7. When respective VAAC or local Met Office issues the first area of forecasted ash, Danger Areas should normally be deactivated.

*Size and dimensions of Danger Areas:*

- the area will be centered on the estimated or known position of the volcanic activity;
- the size of the Danger Area should not exceed 60NM in the EUR Region;
- in case of strong wind speeds the danger area should be extended downwind, not exceeding half the size of the area but will not follow the wind further;
- the Danger Area should be promulgated via NOTAM.

*Attachment X4 (page 2 of 2)*

## — Guidance on the Establishment, Amendment and Withdrawal of Danger Areas —

***NAT Region***

1. This is a guidance to be used by Regional agencies as reference in the use of Danger Areas in regards to Volcanic Ash.

*Use of Danger Areas*

2. The use of precautionary Danger Areas over and in the proximity of a volcanic eruption has been considered appropriate. It should be noted that an initial Danger Area will always be a stationary circle around the volcano, it will not follow the ash cloud.

3. The competent authority for determining the need for and extent of Danger Areas is the one regulating flight operations. States should implement arrangements to ensure the timely declaration of Danger Area by an appropriate authority according to pre-defined conditions.

4. In the Pre-Eruption and Start of Eruption phases there is lack of available information and the focus should be on aircraft in flight in the vicinity and or heading towards the volcano. The most effective tool at that time period is a Danger Area and it should be determined by prevailing local wind speeds.

5. As more information is received the restrictions should be lifted appropriately.

6. Appropriate AIS and MET messages shall be issued in accordance with Annex 15 [*Aeronautical Information Services*] and Annex 3 [*Meteorological Services for International Air Navigation*], respectively.

7. When respective VAAC or local Met Office issues the first area of forecasted ash, Danger Areas should normally be deactivated.

*Size and dimensions of Danger Areas:*

- the area will be centered on the estimated or known position of the volcanic activity;
- the size of the Danger Area should not exceed 120NM in the NAT Region;
- in case of strong wind speeds the danger area should be extended downwind, not exceeding half the size of the area but will not follow the wind further;
- the Danger Area should be promulgated via NOTAM.



## ATTACHMENT X5

### AIR TRAFFIC FLOW MANAGEMENT ARRANGEMENTS

#### *EUR Region – Eastern Part*

*Intentionally left blank.*

#### *EUR Region – Western Part*

##### *EUROCONTROL/Network Manager*

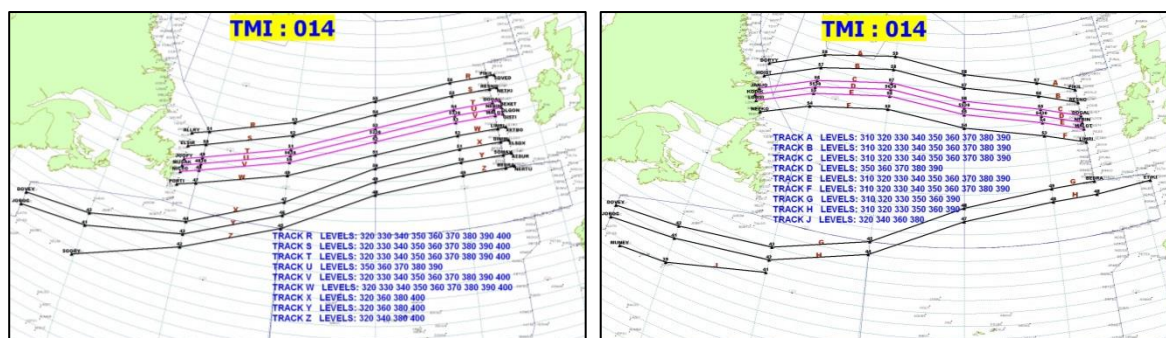
1. In the EUROCONTROL/Network Manager (NM) area of operations the NM perform the ATFM function in collaborative approach with all operational stakeholders.
2. Comprehensive guidance on ATFM in the NM area of operations can be found in the EUROCONTROL/Network Manager (NM) Network Operations Handbook (<http://www.eurocontrol.int/network-management/publications> )

#### *NAT Region*

##### *NAT Organised Track System (OTS) and oceanic clearance arrangements:*

1. North Atlantic air traffic generally follows a diurnal pattern, with traffic flowing eastbound during the night and westbound during the day. To facilitate this two sets of Organised Tracks are established daily with:
  - the eastbound OTS operating between 0100 and 0800 UTC; and
  - the westbound OTS between 1130 and 1900 UTC.
2. Examples of typical NAT OTS structures are as shown:

*Figure 2: Structure of eastbound (left) and westbound (right) NAT OTS*



3. Comprehensive guidance on the North Atlantic Organised Track System can be found at Chapter 2 of the ICAO *North Atlantic Operations and Airspace Manual* (NAT Doc 007). Guidance on oceanic clearance procedures can be found at Chapter 5 of the same document.

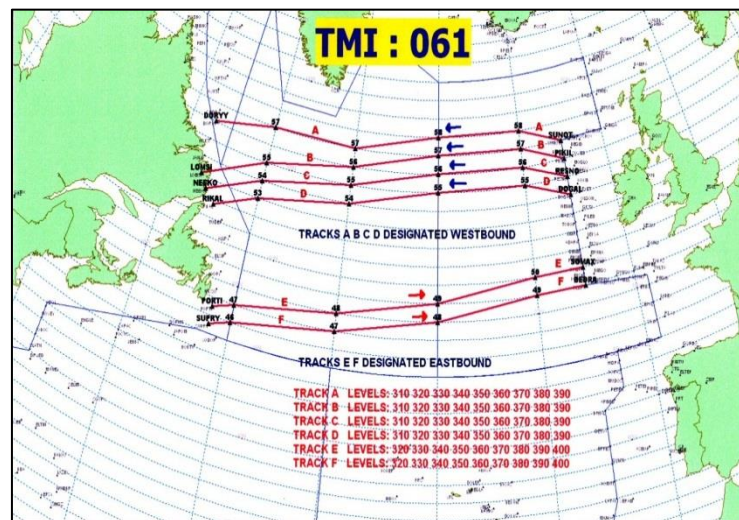
Attachment X5 (page 2 of 2)  
— Air Traffic Flow Management arrangements —

4. During a volcanic contamination contingency situation Oceanic ANSPs will take cognisance of volcanic ash forecasts when planning the OTS. NAT organised tracks will not necessarily avoid areas forecast by the VAAC to be contaminated by volcanic ash. (see footnote). If Organised Tracks are established through forecast contaminated areas, a note will be included on the NAT Track Message to identify such tracks.

5. During volcanic ash contingency situations established track design and promulgation procedures will continue, as will the established oceanic clearance procedures. However, operators should be aware that the traffic situation is likely to be more random and complex than usual. Crews should be encouraged to contact ATC as early as possible to request clearance and clearances may take longer to formulate. The cleared flight profiles issued to flights are also more likely to contain changes to the requested lateral and vertical elements and crews should take particular care to check and confirm the clearance issued.

6. Especially during the Recovery Phase, when aircraft may be dispersed on either side of the NAT region, Oceanic ANSPs may design a non-standard OTS which supports both westbound and eastbound organised tracks to suit customer demand. An example of such a track system is shown:

Figure 3: Example of a structure a non-standard NAT OTS during recovery phase



**Footnote:** Aircraft penetration into contaminated areas is based on specific safety assessments that are expected to vary between aircraft operators. Therefore, ATM cannot take these into account in the OTS design. Designing an OTS through a contaminated area may also falsely lead operators to believe that operation on a published track within the contaminated area has been deemed safe without an (operator-specific) safety assessment.

## ATTACHMENT X6

### CRISIS MANAGEMENT ARRANGEMENTS

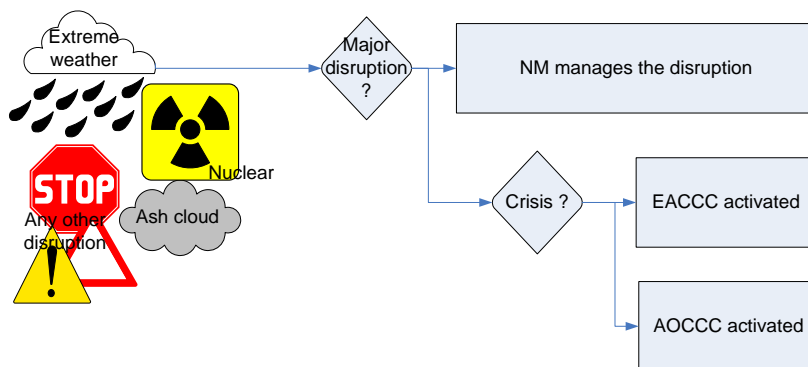
#### *EUR Region – Eastern Part*

*Intentionally left blank.*

#### *EUR Region – Western Part*

##### *EUROCONTROL/Network Manager*

1. In the EUROCONTROL/Network Manager's area of operations the Network Manager (NM) provides the best assistance it can to help to mitigate the impact of major network disruptions or crisis situations. It also provides tools and services which enable users to anticipate or react to events more effectively, based on the best available knowledge of the ATM situation.



2. NM is liaising with other regions both on a daily basis (E.G. with FAA ATCSCC) and ad-hoc.

##### *EACCC:*

3. Within the EUROCONTROL/Network Manager's area of operations the management of network crises is supported by a European Aviation Crisis Coordination Cell (the EACCC) where The Network Manager, with the support of the EACCC, is responsible for coordinating the management of response to the network crisis, in accordance with the EACCC Rules of Procedure, involving close cooperation with corresponding structures in Member States.

##### *NOP Portal*

4. The Network Operations Portal (NOP) is designed for ATM professionals. It provides real-time information on air traffic operations. The NOP enables partners to anticipate or react to events more effectively.

- Access to [public NOP](#)
- Access to [protected NOP](#)

|                                                                                     |
|-------------------------------------------------------------------------------------|
| <p><i>Attachment X6 (page 2 of 2)</i></p> <p>— Crisis Management Arrangements —</p> |
|-------------------------------------------------------------------------------------|

### *Teleconferences*

5. During crisis situations teleconferences are normally convened to facilitate collaboration and information sharing with operational stakeholders as well as coordination within the EACCC. In addition EACCC Chair may decide to invite State Focal Points and, depending on the nature of the crisis, experts from relevant fields of expertise.

### *European crisis Visualisation Interactive Tool for ATFCM (EVITA)*

6. EVITA is a collaborative online tool which allows users to visualise the impact of a crisis on air traffic in Europe.

7. In the event of a volcanic ash event, EVITA:

- displays ash concentration data received from VAAC London and VAAC Toulouse;
- displays the coordinates of Danger Areas, as declared by States via NOTAM;
- displays local areas defined by aircraft operators;
- detects sectors, aerodromes and flights impacted by either ash concentration data or Danger Areas, or areas locally defined by aircraft operators.

|                                 |
|---------------------------------|
| <p><b><i>NAT Region</i></b></p> |
|---------------------------------|

*Intentionally left blank.*

---

## ATTACHMENT X7

### VOLCEX ARRANGEMENTS (GM IN DOC 9766)

#### *Common to both EUR and NAT Regions*

Two steering groups were formed by the European Air Navigation Planning Group (EANPG) Programme Coordinating Group (COG) and North Atlantic (NAT) Implementation Management Group (IMG) to ensure continuation of regular volcanic ash exercises, in accordance with Appendix F of Doc 9766 and VOLCEX Operating Instructions (OPINS), in the EUR and NAT Regions.

#### *European and North Atlantic Volcanic Ash Exercises Steering Group (EUR/NAT VOLCEX/SG)*

- i. Volcanic ash exercises called VOLCEX are conducted once per year with a rotation simulating a volcanic eruption in EUR NW (Iceland), EUR SW (Azores or Canarias) and EUR SE (Italy or Greece)
- ii. Planning meetings are conducted in order to determine the Exercise Leader, objectives of the exercise, exercise scenario and attributes, reporting timelines.
- iii. Debrief meetings are conducted in order to determine lessons learned and recommendations, where some recommendations may include proposed changes to the VACP
- iv. Steering Group meetings occur with one of the meetings above once per year to determine the exercise schedule for the next two years
- v. ToRs, Exercise Directives, exercise reports, summary of discussions of meetings as well as future work programme can be found on the ICAO portal under the group VOLCEXSG

#### *Volcanic Ash Exercises Steering Group for the (far) Eastern part of the EUR Region (EUR (EAST) VOLCEX/SG)*

- vi. Volcanic ash exercises called VOLKAM are conducted once per year of a volcano located in Kamchatka or Kurile Islands, Russian Federation using predominant wind profile with westerly component that impacts the northern Pacific (NOPAC) routes and possibly Pacific Organized Track System (PACOTS)
- vii. Planning meetings are conducted in order to determine objectives of the exercise, exercise scenario and attributes as well as reporting timelines
- viii. Debrief meetings are conducted in order to determine lessons learned and recommendations. The recommendations are used mainly to update the draft document called *Assistance for Operations when Volcanic Ash Impacts NOPAC, PACOTS and trans-east routes*
- ix. Steering Group meetings occur with the above meetings to determine the exercise schedule for the next two years as well as update the task list
- x. ToRs, Exercise Directives, exercise reports, summary of discussions of meetings as well as future work programme can be found on the ICAO portal under the group EEVOLCEXSG

Summary reports of volcanic ash exercises are provided to the NAT IMG, NAT SPG, EANPG METG, EANPG COG and EANPG.

## ATTACHMENT X8

### REGIONAL REGULATIONS, MEANS OF COMPLIANCE AND GUIDANCE MATERIAL (REFERENCES)

#### *EUR Region – Eastern Part*

1. Though there are no sub-regional regulations in the EUR Region – Eastern Part, documentation containing contact information; sequence of events during a volcanic ash event; examples of VONA, VAA/VAG, SIGMET, NOTAM and special air-report on volcanic ash; re-route procedures and teleconference instructions are provided at the following website:  
<http://www.icao.int/EURNAT/Pages/welcome.aspx> (select EUR/NAT Documents; EUR Documents; Volcanic Ash EUR East).

#### *EUR Region – Western Part*

##### *EU Regulations, Directives, AMC, GM, etc*

1. Within the area of applicability of EU regulations (28 EU Member States and States having agreed to implement EU regulations<sup>14</sup>) a number of regulations, directives and tools relevant for VA contingency operations exist:

- a) Commission regulation (EU) No 965/2012 (*Air Operations*)
  - AMC/GM to Annex III (PART-ORO)
    - GM2 ORO.GEN.200(a)(3) Management system
    - Risk management of flight operations with known or forecast volcanic ash contamination*
- b) Commission regulation (EU) No 1178/2011 (*Air Crew*)
  - AMC/GM to Annex VII (PART-ORA)
    - GM3 ORA.GEN.200(a)(3) Management system**
    - Risk management of flight operations with known or forecast volcanic ash contamination* (applies to approved training organisations = ATOs)
- c) Commission regulation (EU) No 452/2014 (*Third Country Operators*)
- d) Commission regulation (EU) No 677/2011 (*ATM Network Function*) as amended by No 970/2014
  - Chapter IV; Network Crisis Management
- e) EASA Safety Information Bulletin concerning Flight in Airspace with Contamination of Volcanic Ash can be found:
  - via EASA website <http://ad.easa.europa.eu/sib-docs/page-1>
  - Or in the Crisis Management portlet of the protected EUROCONTROL/Network Manager/Network Operations Portal: <https://www.nm.eurocontrol.int/auth/html>
  - User's guide available via <http://www.eurocontrol.int/network-operations/library>

<sup>14</sup> According to EU Regulation 216/2008 (EASA Basic Regulation), Iceland, Norway, Switzerland and Liechtenstein are considered as "participating States".

*Attachment X8 (page 2 of 3)**— Regional Regulations, Means of Compliance and Guidance Material —**Additional National Regulations*

2. Apart from those special provisions applicable within a whole ICAO Region or sub-Region, national provisions, regulations and/or guidance material may apply. Operators are advised to carefully review the references given below before planning flights into the airspace of the State(s) listed below:

a) Germany:

Guidance for the use of German airspace, being complementary to this EUR/VACP has been published by the German Federal Ministry of Transport and Digital Infrastructure as **AICIFR 08** (latest revision by 16 Oct 2014).

*SRA application in the EUR region*

3. As part of the overall decision making process regarding the operation of aircraft into airspace or at aerodromes forecast or known to be contaminated with VA, some States will restrict the operator's decision-making process based on its SRA even if the latter had accepted by the operator's regulatory authorities.

4. For further details and guidance see national AIP/AICs and EASA SiB concerning Flight in Airspace with Contamination of Volcanic Ash

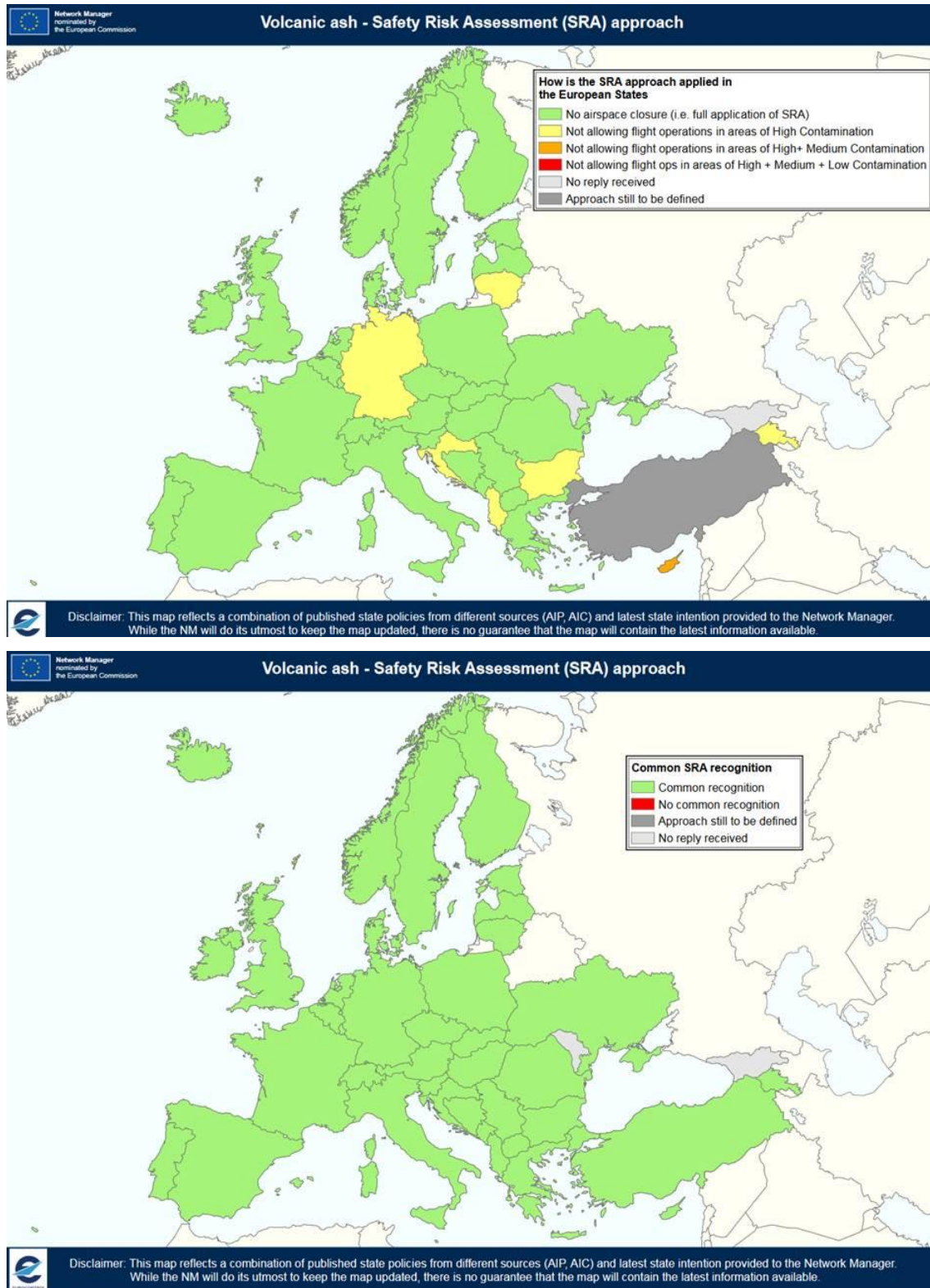
5. The latest update of the SRA acceptance by States is available in the Crisis Management portlet of the protected EUROCONTROL/Network Manager Network Operations Portal: at <https://www.nm.eurocontrol.int/auth/html>.

An example, not to be used for operational purposes, of SRA acceptance by States is as shown:



*Attachment X8 (page 3 of 3)*

## — Regional Regulations, Means of Compliance and Guidance Material —

**NAT Region***Intentionally left blank.*



**TERMINOLOGY, DEFINITIONS AND ACRONYMS****Terminology**

- Appendices*, according to ICAO Practice, comprise material grouped separately for convenience but forming part of the main body of the document.
- Attachments*, according to ICAO Practice, comprise material supplementary to the main body of the document, or included as a guide to the application of the provisions in the document. Information contained in an Attachment is applicable to individual Regions or sub-Regions, and may contain variations from the main body text.
- Supplementary information, in this document*, means additional information on volcanic activity available beyond that prescribed by ICAO SARPs.

**Definitions**

- ATFM* (Air Traffic Flow Management): ‘*a service established with the objective of contributing to a safe, orderly and expeditious flow of air traffic by ensuring that ATC capacity is utilised to the maximum extent possible, and that the traffic volume is compatible with the capacities declared by the appropriate ATS authority.*’ (PANS-ATM [Doc 4444] refers).
- ATM* (Air Traffic Management): ‘*the dynamic, integrated management of air traffic and airspace including air traffic services, airspace management and air traffic flow management — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions.*’ (PANS-ATM [Doc 4444] refers).
- ATM Community*: (Air Traffic Management Community): ‘*the aggregate of organizations, agencies or entities that may participate, collaborate and cooperate in the planning, development, use, regulation, operation and maintenance of the ATM system.*’ (Doc 9854 refers).

**Acronyms**

- |        |                                                                                 |
|--------|---------------------------------------------------------------------------------|
| ACC    | Area Control Centre                                                             |
| AIS    | Aeronautical Information Service                                                |
| ANP    | Air Navigation Plan                                                             |
| ANSP   | Air Navigation Service Provider                                                 |
| ASHTAM | a special Notice to Airmen (NOTAM) on volcanic ash                              |
| ATC    | Air Traffic Control                                                             |
| ATFM   | Air Traffic system capacity and Flow Management ( <i>see also definition</i> ). |
| ATM    | Air Traffic Management ( <i>see also definition</i> ).                          |
| ATS    | Air Traffic Service                                                             |
| CDM    | Collaborative Decision Making                                                   |
| EACCC  | European Aviation Crisis Coordination Cell                                      |
| EANPG  | European Air Navigation Planning Group                                          |
| EASA   | European Aviation Safety Agency                                                 |
| EGT    | Exhaust Gas Temperature                                                         |

---

*Terminology, Definitions and Acronyms*

---

|               |                                                                                                     |
|---------------|-----------------------------------------------------------------------------------------------------|
| EUR           | (ICAO) European (Region)                                                                            |
| EVITA         | European Crisis Visualization Interactive Tool for ATFCM (Air Traffic Flow and Capacity Management) |
| FIC           | Flight Information Centre                                                                           |
| IAVW          | International Airways Volcano Watch                                                                 |
| IAVW Handbook | Doc 9766                                                                                            |
| MWO           | Meteorological Watch Office                                                                         |
| NAT           | (ICAO) North Atlantic (Region)                                                                      |
| NAT SPG       | North Atlantic Systems Planning Group                                                               |
| NOTAM         | Notice to Airmen                                                                                    |
| OEM           | Original Equipment Manufacturer                                                                     |
| OTS           | Organised Track System                                                                              |
| PANS-ATM      | <i>Procedures for Air Navigation Services – Air Traffic Management</i> (Doc 4444)                   |
| SARPs         | Standard and Recommended Practices                                                                  |
| SIGMET        | Significant Meteorological information                                                              |
| SMS           | Safety Management System                                                                            |
| SRA           | Safety Risk Assessment                                                                              |
| VAA           | volcanic ash advisories, in alphanumeric form                                                       |
| VAAC          | Volcanic Ash Advisory Centre                                                                        |
| VACP          | Volcanic Ash Contingency Plan                                                                       |
| VAG           | volcanic ash advisories, in graphic form                                                            |
| VO            | Volcano Observatory                                                                                 |
| VONA          | Volcano Observatory Notice for Aviation                                                             |

*Referenced Documents***REFERENCED DOCUMENTS****SARPs**

- Annex 3 — *Meteorological Services for International Air Navigation* — Applicable 14 November 2013  
page(s) 7, 11, 12, 13, 16, 19, 20, 21, 22, 26, 27, 31, 35, 38, 39, 40, 42, 44, 45, 47, 48, 49, 52, 53, 58, 61, 62
- Annex 6 — *Operation of Aircraft* — Applicable 13 November 2014  
.....page(s) 6
- Annex 11 — *Air Traffic Services* — Applicable 14 November 2013  
.....page(s) 6, 7, 14
- Annex 15 — *Aeronautical Information Services* — Applicable 14 November 2013  
.....page(s) 7, 11, 13, 14, 17, 19, 20, 21, 22, 61, 62
- Annex 19 — *Safety Management* — Applicable 14 November 2013  
.....page(s) 7, 33
- Doc 4444 — *Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)* —  
Applicable 13 November 2014  
.....page(s) v, 6, 10, 12, 19, 21, 26, 27

**Guidance**

- Doc 9691 — *Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds*  
.....page(s) 6, 24
- Doc 9766 — *Handbook on the International Airways Volcano Watch (IAVW Handbook)*  
.....page(s) 6, 15, 16, 19, 20, 26, 29, 31, 38, 39, 41, 43, 44, 47, 48, 67
- Doc 9854 — *Global Air Traffic Management Operational Concept*  
.....page(s) 6
- Doc 9859 — *Safety Management Manual (SMM)*  
.....page(s) 33
- Doc 9974 — *Manual on Flight Safety and Volcanic Ash – subtitled: Risk Management of Flight Operations  
with Known or Forecast Volcanic Ash Contamination*  
.....page(s) 7, 30, 33

— **END** —