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Contingency Procedures on Volcanic Ash in the Air Traffic Management (ATM)

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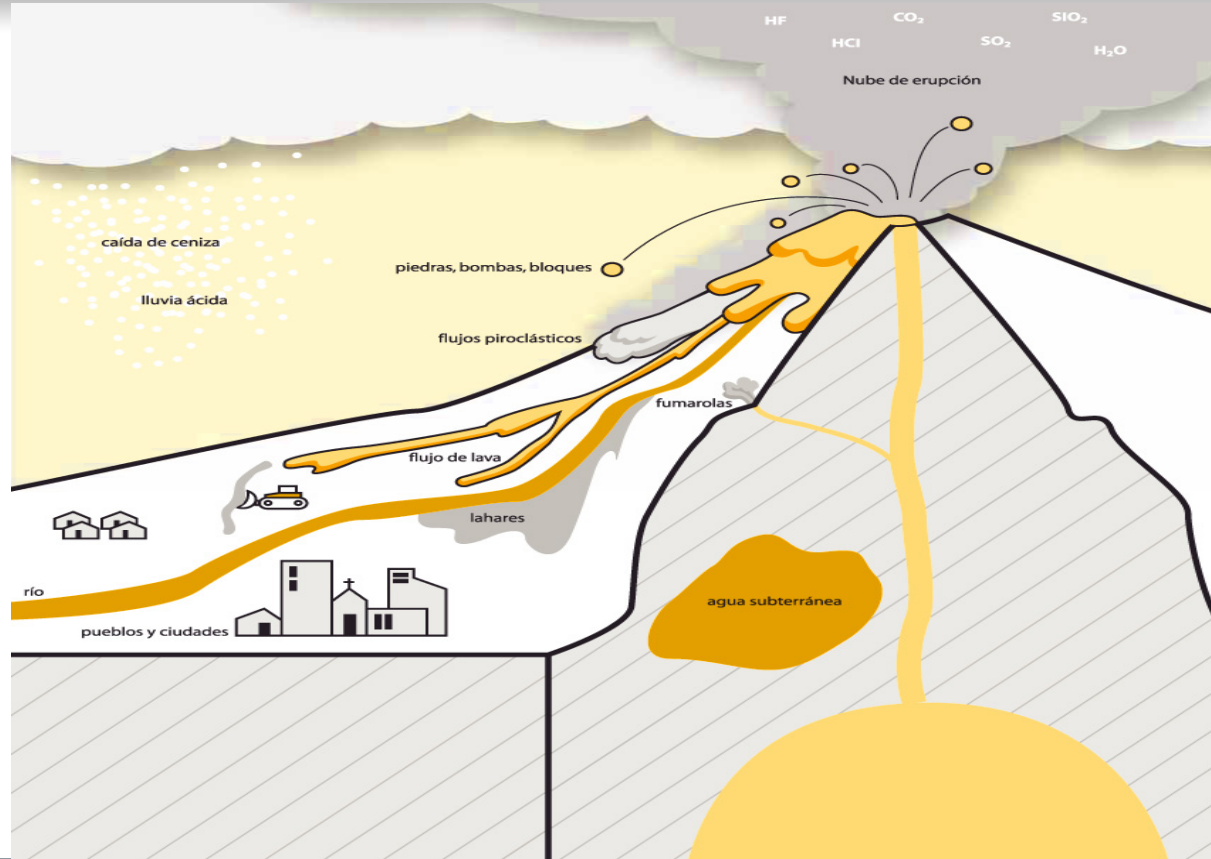
- ✈ **Learned lessons**
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Volcanic Activity





Volcanic Threat Type and its Effects in Health

Volcanic Ash	Respiratory tract infections Gastrointestinal disease Intoxication by fluoride Injury of ocular conjunctive and cornea Dermatitis Psychosocial manifestations Polytrauma
Lava Flows	Burns Inhalation of gasses intoxication Gastrointestinal disease Respiratory diseases
Explosions or blast	Polytrauma Burns, lacerations Death by inhalation of gasses



Health Effects	
Pyroclastic flows	Extensive and severe burns Respiratory tract problems Polytrauma
Mud flows or lahars	Polytraumas Fractures, burns Amputations Sepsis
Volcanic Gasses	Respiratory tract intoxication Gastrointestinal disease by polluted water Psychosocial manifestations
Acid rain	Gastrointestinal disease by polluted water sources



Other Impacts

- ✈ Psychological
- ✈ Weather related
- ✈ Infrastructure related: telecommunications, water supply, sewer and sumps, garbage collection systems, patients transfer services, transportation of sanitary personnel, surgical medical supply



Volcanic Gasses

Irritating Gasses

- ✈ Sulphur Dioxide (SO₂)
- ✈ Hydrogen Sulphide (H₂S)
- ✈ Hydrogen Chloride (HCl)
- ✈ Hydrogen Fluoride (HF)

Non irritating Gasses

- ✈ Carbon Dioxide (CO₂)



Regulatory Background

- ✈ **ICAO Annex 6 – Operation of Aircraft**
- ✈ **Annex 3, Annex 15 -**
 - ✈ MET on volcanic ashes and AIS messages distribution
- ✈ **Doc 4444, Paragraph 15.8 -**
 - ✈ Procedures for an ATC unit when a volcanic ash cloud is notified or predicted
- ✈ **Doc 9691 -**
 - ✈ Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds
- ✈ **Doc 9974 –**
 - ✈ Manual on Flight Safety and Volcanic Ash



Procedures

- ✈ Volcanic pollution = volcanic ashes
- ✈ The volcanic pollution can reach and exceed the aircraft cruising altitudes with turbine engines in matter of minutes and cover extensive geographic zones in few days
- ✈ Provide information to airlines and reroute aircraft before and during a volcanic eruption
- ✈ Safety risks to in flight aircraft
- ✈ Requires the mitigation of hazards caused in the atmosphere and/or in the aerodrome
- ✈ Collaborative Decision Making (CDM), with the participation of all involved parties



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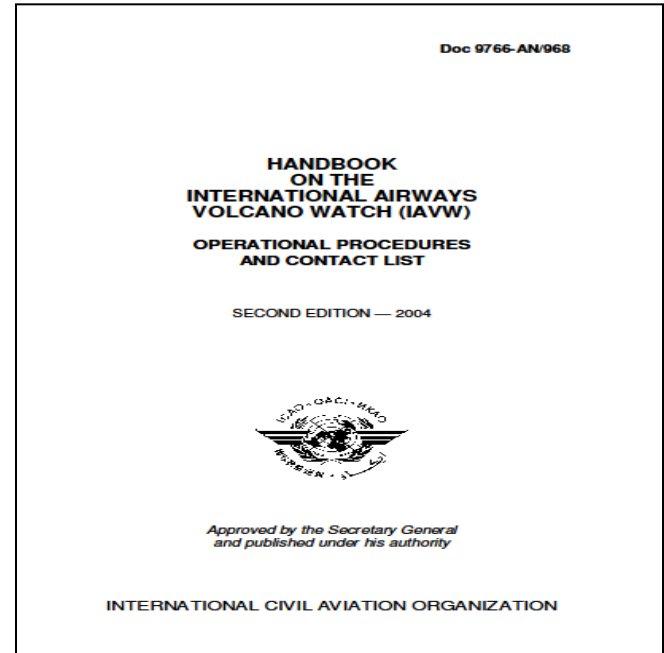
ICAO Doc 9766

Part 4

VIGILANCIA DE VOLCANES EN AEROVIAS INTERNACIONALES

OPERATIONAL PROCEDURES

FOR THE DISSEMINATION OF INFORMATION ON VOLCANIC ERUPTION AND VOLCANIC ASHES ASSOCIATED CLOUDS IN AREAS THAT COULD AFFECT THE ROUTES USED BY INTERNATIONAL FLIGHTS AND PRE-ERUPTION NECESSARY ARRANGEMENTS.





Impact of Volcanic Ashes in Aircraft

- ✈ Malfunction or failure in one or more engines, causing not only the reduction or total loss of thrust, but also the failure of electric, tires, and hydraulic systems
- ✈ Lock of pitot and static sensors, causing unreliable aerodynamic speed indications and erroneous warnings
- ✈ Partial or total opacity of the windshield
- ✈ Air pollution of the cabin with smoke, dust and/or toxic chemicals that force the crew to wear the oxygen masks, which affects the oral communications, and it can also affect the electronic systems
- ✈ Erosion of the external and internal components of the aircraft
- ✈ Less efficient electronic cooling, causing a series of failures in the aircraft systems
- ✈ It is possible that the aircraft has to be maneuvered in a way that it may be in conflict with other aircraft



Volcanic Ashes in Aerodromes

- ✈ Volcanic ashes can degrade the braking level of aircraft, moreover in runways polluted by wet ashes
- ✈ Restrictions to air operations or runway closures
- ✈ Aerodrome closed to operations
- ✈ Consequences in the ATM system, deviations, review of the traffic flows, etc.



Volcanic Eruption Phases

- ✈ PREVIOUS PHASE TO ERUPTION
- ✈ BEGINNING PHASE OF ERUPTION
- ✈ IN-PROGRESS PHASE OF ERUPTION
- ✈ RECOVERING PHASE OF ERUPTION



✈ **PREVIOUS PHASE TO ERUPTION:** Initial advisory, it starts when an eruption is foreseen

- ✈ Issue proper AIS and MET messages in accordance with Annex 15 and Annex 3, respectively, and disseminate such messages to the affected in flight aircraft, using the fastest mean. It is important to note that the volcanoes suddenly erupt and that is why the previous phase to eruption may be omitted.



✈ **BEGINNING PHASE OF ERUPTION:** The volcanic eruption begin and the volcanic ashes enter into the atmosphere.

- ✈ Issue proper AIS and MET messages in accordance with Annex 15 and Annex 3, respectively, and declare a dangerous zone through a NOTAM.
- ✈ Normally, no authorizations will be issued to cross the dangerous zone, unless it is explicitly requested by the flight crew



- ✈ **IN PROGRESS FASE OF ERUPTION:** It begins at the moment that the first Volcanic Ash Advisory (VAA) is issued.
- ✈ Information on the extension and movement of the volcanic ash cloud
- ✈ Issue proper AIS and MET messages in accordance to Annex 15 and Annex 3, respectively



✈ **RECOVERING PHASE:** It begins with the issuance of the first VAA containing a statement of “NO VA EXP” (“no volcanic ashes are expected”)

✈ Normally happens when it is determined that the occurrence of volcanic ashes is unforeseen in the atmosphere and the volcanic activity has returned to its previous condition before the eruption



Issuance of Reports

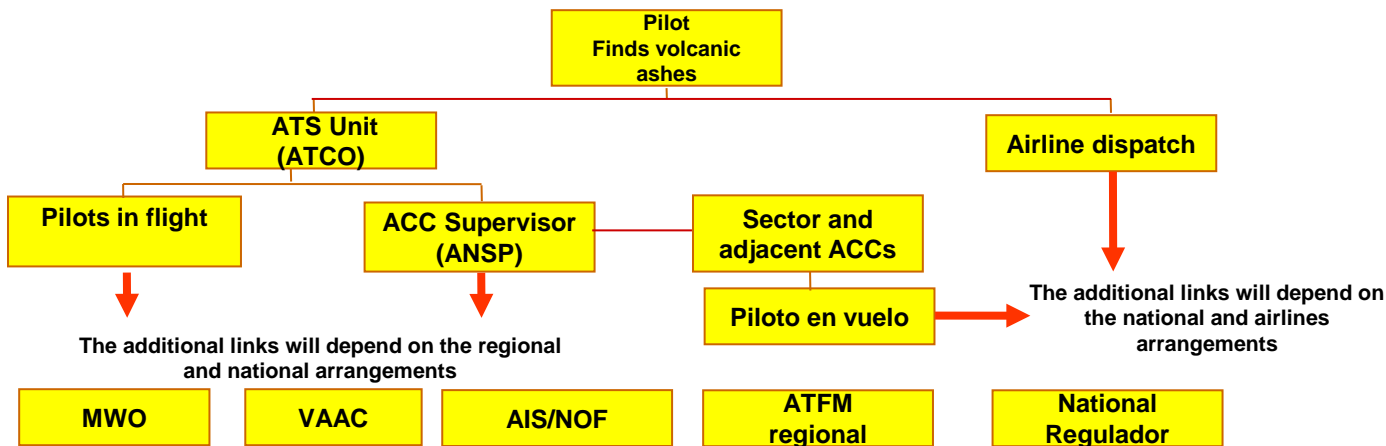
✈ TWR/ACC – Advisories to aircraft/NOTAM

✈ ATFM - TMI

✈ VAAC - ASHTAM

✈ MWO

Collaborative Decision Making (CDM)



The links with the database will depend on the national, regional, and global arrangements.





Volcanic Ashes CDM

PHASE	AIS	/ATS –(TWR/ACC)	ATFM	VACC	MWO	Volcano Observatory
PREVIOUS ERUPTION TO	NOTAM	Advisories and assistance to aircraft, MET, ATFM	Coordination with ANSPs, VAAC and MWO	Coordination with the involved parties	SIGMET ASHTAM Coordination with the involved parties	Monitoring
BEGINNING	NOTAM, ASHTAM / Hazardous Area	Unauthorize aircraft in the Hazardous area Coordinate with other ACC, ATFM, VAAC, MWO	TMIs, necessary coordination with ACCs, ANSPs, VAAC and MWO	Coordination with the involved parties	SIGMET ASHTAM Coordination with the involved parties	Monitoring
ERUPTION IN PROGRESS	ASHTAM / Hazardous Zone	Unauthorize aircraft in hazardous area Reroute aircraft Coordinate with other ACCs, ATFM, VAAC, MWO	TMIs Coordination with ACCs, VAAC y MWO	VAA	SIGMET ASHTAM Coordination with the involved parties	Monitoring
RECOVERY	NOTAM / Hazardous Area	Normal Operations	Normal Operations	VAA / NO VA EXP	SIGMET Coordination with the involved parties	Monitoring



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