The emergency planning for volcanic risk at Vesuvius and Campi Flegrei

Fabrizio Curcio
Italy: a disaster prone Country

Pop. 60,000,000

20 Regions

2 Autonomous Provinces

104 Provinces

8100 Municipalities

72% with a pop. ≤ 5000

Risks:

- Seismic
- Volcanic
- Hydro-geological
- Forest fires
- Technological
- Industrial and nuclear
- Environmental
The risks

- seismic
- hydrogeological
- floods
- volcanic
- forest fire
- industrial and nuclear
- technological
- transports
- supply networks
- environmental
About 2 million people live in volcanic areas, 1 million of them live in Campania Region.
Operational procedures for the information flow

1 – Event communication

2 – Action taken and planned (type, location, timing and resources)

3 – Available resources (characteristics, quantity, location and timing)

4 – Evaluation of the necessity of additional support

5 – Constant contact with actors involved

6 – Activities report
To strengthen the standard monitoring nets and/or to activate further ones.
The Operational Committee is convened within the Department of Civil Protection to ensure a unified direction and coordination of emergency management.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>An emergency plan in case of volcanic eruption in Flegrea area was developed after the bradyseismic crisis of the '80s.</td>
</tr>
<tr>
<td>1995</td>
<td>First version of the National Emergency Plan for Vesuvio area.</td>
</tr>
<tr>
<td>1998</td>
<td>Delivery to the Commission of a document developed by the researcher of the Osservatorio Vesuviano including a scenario and alert levels for the Flegrean area.</td>
</tr>
<tr>
<td>2001</td>
<td>Plans Update.</td>
</tr>
<tr>
<td>2006</td>
<td>Road plan for the evacuation of the population drawn up by “La Sapienza” University.</td>
</tr>
<tr>
<td>2006</td>
<td>MESIMEX International Exercise on Vesuvio.</td>
</tr>
<tr>
<td>2009</td>
<td>Constitution of the Working Group for the definition of an eruptive scenario and alert levels in case of eruption at Campi Flegrei.</td>
</tr>
<tr>
<td>2012</td>
<td>Delivery of the new scientific scenario of event for Vesuvio area.</td>
</tr>
<tr>
<td>2013</td>
<td>Delivery of a document with an eruptive scenario and alert levels for Flegrean area.</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Update of the National Emergency Plans.</td>
</tr>
</tbody>
</table>
Steps for the elaboration of an emergency plan

1. Strong interaction with local authorities in order to share the strategy and to include all the involved administration in the emergency planning process

2. Legislation at national, regional and local level
3. Shared operational procedures with components and operational structures of the National System of civil protection

4. Involvement of the other regions

5. Dissemination of the emergency plan to the civil protection operators and to the population
# Emergency plan

1. Eruptive scenario and alert levels
2. Operational strategy
3. Intervention model

### Territorial emergency plans:
- Regional
- Provincial
- Local

### Specific emergency plans:
- Health
- Volunteers organization
- Telecommunication
- Transportation and traffic control
- Logistics
- Information
- Essential services
- Secondary risks
- Safety
- Cultural heritage
- Aeronautical and maritime activities
Vesuvio: last eruption (1944)
Emergency Plan 2001

Scenario: sub-plinian eruption (referring historical events: 1631 or 472 a.D.)

Dangerous zone:

RED ZONE: The red zone is the area immediately surrounding the volcano, and is in greater danger as potentially subject to invasion by pyroclastic flows. The National Emergency Plan provides that the red area is completely evacuated before the eruption.

YELLOW ZONE: corresponds to the entire area that could be affected by the fallout of pyroclastic particles - ash and lapilli. The National Emergency Plan provides that the yellow area is evacuated during the eruption.

BLUE ZONE. The Blue Zone falls within the yellow zone, but is subject to an agent of further danger. It corresponds to the "valley of Acerra - Nola," which, for its hydrogeological characteristics, may be subject to floods as well as the fallout of ash and lapilli.
Scenario: sub-plinian eruption (referring historical events: 1631 or 472 a.D.)

Dangerous zone:

RED ZONE. The red zone is the area immediately surrounding the volcano, and is in greater danger as potentially subject to invasion by pyroclastic flows or buildings collapse caused by the ash deposit. The National Emergency Plan provides that the red area is completely evacuated before the eruption.

YELLOW ZONE. The yellow zone corresponds to the entire area that could be affected by the fallout of pyroclastic particles - ash and lapilli. The fallout of particles may cause buildings collapse and respiratory problems, particularly in susceptible individuals who are not adequately protected, damages to crops and problems to air, rail and road traffic.

BLUE ZONE. The Blue Zone falls within the yellow zone, but is subject to an agent of further danger. It corresponds to the "valley of Acerra-Nola," which, for its hydrogeological characteristics, may be subject to floods as well as the fallout of ash and lapilli.

24 municipalities and 3 neighborhoods of Napoli

To be defined

Valley of Acerra-Nola and slopes of the Appennini.
To be defined
### Vesuvio plan 2001- alert levels and operational phases

<table>
<thead>
<tr>
<th>ALERT LEVELS</th>
<th>STATE OF THE VOLCANO</th>
<th>ERUPTION PROBABILITY</th>
<th>TIME TO THE ERUPTION</th>
<th>PHASES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base</strong></td>
<td>No significant variation of monitored parameters</td>
<td>Very low</td>
<td>Undefined, not less than several months</td>
<td>Scientific Community: Surveillance activity according to schedule</td>
</tr>
<tr>
<td><strong>Attention</strong></td>
<td>Significant variation of monitored parameters</td>
<td>Low</td>
<td>Undefined, not less than some months</td>
<td>Technical and scientific alert, and improvement in the monitoring system</td>
</tr>
<tr>
<td><strong>Warning</strong></td>
<td>Further variation of monitored parameters</td>
<td>Medium</td>
<td>Undefined, not less than some weeks</td>
<td>Continuance of the surveillance activity; simulation of the expected eruption phenomena</td>
</tr>
<tr>
<td><strong>Alarm</strong></td>
<td>Appearance of phenomena and/or evolution of parameters suggesting a pre-eruption dynamic</td>
<td>High</td>
<td>from weeks to days</td>
<td>Surveillance through remote system</td>
</tr>
</tbody>
</table>

#### During the eruption

- Surveillance through remote system; defining the boundaries of the affected area inside the yellow zone
- Defining boundary of the affected area inside the yellow zone
- Yellow zone evacuation
- Accommodation in hotels, hostels,.. of Campania

#### IV phase During the event

- Surveillance through remote system; reinstallation of the monitoring system "in situ"
- Damage evaluation
- Restoration of lifelines affected by the eruption
- The people return to their homes

#### V phase Post event
Region/AP | Municipalities in the red zone
--- | ---
Piemonte | Portici
Valle d'Aosta | Nola – pro parte
Liguria | Cercola
Lombardia | Torre del Greco, Somma Vesuviana
Trentino-Alto Adige | Pollena Trochcia
Veneto | San Giuseppe Vesuviano, Sant'Anastasia, enclave di Pomigliano d'Arco
Friuli V.G. | Palma Campania
Emilia Romagna | Ercolano
Toscana | San Giorgio a Cremano
Umbria | San Gennaro Vesuviano
Marche | Poggio Marino
Lazio | Ottaviano, Napoli (3 quartieri) – pro parte
Abruzzo | Terzigno
Molise | Massa di Somma
Puglia | Torre Annunziata, San Sebastiano al Vesuvio
Basilicata | Boscotrecase
Calabria | Boscotrecase
Sicilia | Scafati, Trecase
Sardegna | Pompei
Planning elements of Campi Flegrei 2001

Dangerous zone:

RED ZONE: The red zone is the area immediately surrounding the volcano, and is in greater danger as potentially subject to invasion by pyroclastic flows. The National Emergency Plan provides that the red area is completely evacuated before the eruption.

Municipality of **Napoli**: quattro quartieri per intero (Bagnoli, Fuorigrotta, Soccavo e Pianura1) e 54 sezioni censuarie dei quartieri Vomero, Arenella, Posillipo e Chiaia2; Municipality of **Pozzuoli**: circoscrizioni I e II per intero e 7 sezioni censuarie della III; Municipality of **Bacoli**; Municipality of **Monte di Procida**.

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![Map of Campi Flegrei with zones marked]
## Planning elements of Campi Flegrei 2001

### Alert levels

<table>
<thead>
<tr>
<th>LIVELLI DI ALLERTA</th>
<th>STATO DEL VULCANO</th>
<th>PROBABILITÀ DI ERUZIONE</th>
<th>TEMPO DI ATTESA ERUZIONE</th>
<th>AZIONI</th>
<th>COMUNICAZIONI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>Nessuna variazione significativa di parametri controllati</td>
<td>Molto bassa</td>
<td>Indefinito, comunque non meno di diversi mesi</td>
<td>Attività di sorveglianza secondo quanto programmato</td>
<td>L'Osservatorio Vesuviano produce bollettini semestrali sull'attività del vulcano</td>
</tr>
<tr>
<td>Attenzione</td>
<td>Variazione significativa di parametri controllati</td>
<td>Bassa</td>
<td>Indefinito, comunque non meno di alcuni mesi</td>
<td>Stato di allerta tecnico scientifico ed incremento dei sistemi di sorveglianza</td>
<td>L'Osservatorio Vesuviano quotidianaente produce un bollettino e comunica le informazioni sullo stato del vulcano al Dipartimento della Protezione Civile</td>
</tr>
<tr>
<td>Preallarme</td>
<td>Ulteriore variazione di parametri controllati</td>
<td>Media</td>
<td>Indefinito, comunque non meno di alcune settimane</td>
<td>Continua l'attività di sorveglianza; simulazione dei possibili fenomeni eruttivi</td>
<td>L'Osservatorio Vesuviano comunica continuamente le informazioni sullo stato del vulcano al Dipartimento della Protezione Civile</td>
</tr>
<tr>
<td>Allarme</td>
<td>Comparsa di fenomeni e/o andamento di parametri controllati che indicano una dinamica preeruttiva</td>
<td>Alta</td>
<td>Da giorni a mesi</td>
<td>Sorveglianza con sistemi remoti</td>
<td>L'Osservatorio Vesuviano comunica continuamente le informazioni sullo stato del vulcano al Dipartimento della Protezione Civile</td>
</tr>
</tbody>
</table>
The Working Group, which was constituted on 2009 with the aim of defining the eruptive scenario and the alert levels necessary for the drawn up of the emergency plan for the Flegrea area, has concluded its activity. The Working Group has elaborated a Report that was delivered on 31 of December 2012. This document was analyzed by the Major risk Commission. Nowadays the CPD and Campania region are working in order to update the red zone for the Flegrea area.
State of the Volcano

October 2012 – activities for the transition to the attention level

December 2012 – Meeting of the Major risk Commission. Information to local authorities.

Transition to the “attention phase”

January 2013 - Meeting of the of civil protection Operational Committee
If the Major Risk Commission evaluates the necessity to change the alert level, it will immediately notify the change to the Department of Civil protection.
<table>
<thead>
<tr>
<th><strong>VESUVIO</strong></th>
<th><strong>VS</strong></th>
<th><strong>CAMPI FLEGREI</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volcano with a central conduit</td>
<td>Caldera with different vents</td>
<td></td>
</tr>
<tr>
<td>One established referring eruptive scenario</td>
<td>Several eruptive scenarios</td>
<td></td>
</tr>
<tr>
<td>Alert levels: transition from <em>base level</em> to <em>attention level</em> according to predefined parameters</td>
<td>Alert levels: transition from one level to another one subject to evaluation</td>
<td></td>
</tr>
<tr>
<td>Medium level of risk awareness among the population</td>
<td>Low level of risk awareness among the population</td>
<td></td>
</tr>
<tr>
<td>Higher number of population living in the red zone</td>
<td>Population living inside the caldera</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevailing winds blowing towards Napoli</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>High vulnerability of structures and infrastructures</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Inadequate viability</strong></td>
<td></td>
</tr>
</tbody>
</table>
Open questions about the decision making process

- TIMING (EVACUATION TIME VERSUS DECISION TAKING TIME).
- FALSE/MISSED ALARM: LACK OF RELIABILITY OF THE WARNING SYSTEM ALSO TOWARDS THE POPULATION, ECONOMIC LOSS CAUSED BY THE ACTIONS UNDERTAKEN TO RESPOND TO.
- RELATIONSHIP WITH LOCAL AUTHORITIES AND POPULATION.
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Roma, 7th November 2013