

SOMMA VESUVIO MESIMEX – 2004/393427

Final Technical Implementation Report

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1. Summary

1.1 Description of the action/project:

The Government of Campania Region in Italy intended to organise in collaboration with the National Department of the Civil Protection, and following its indications about the upgrading of the emergency plan still in progress (a preliminary version has been tested), a Civil Protection Exercise at European-level in Volcanic Emergency Management entitled “SOMMA VESUVIUS MESIMEX”.

The exercise was focused on the preparedness phase for a major volcanic emergency in the area of Vesuvius.

The exercise aim was to test and improve emergency procedures and to establish a common understanding with respect to working practices in emergency response. Especially it has followed the development of the major Vesuvius volcanic emergency from the early warning phase up to the evacuation of the population from the risk area, before the volcanic eruption starts.

In this framework was tested, for the first time, the Member States effectiveness in responding to major emergency by testing models of intervention of VETs (Volcano Experts Team) and FASTs (Foreigners Assistance Support Teams). Also, anticipating a line of future activity of the Italian Civil Protection, i.e. the preparedness for cultural heritage protection, it was proposed to include a simulated intervention of this kind in the exercise.

Hence, the project was designed to examine the ability to set up and activate communications between emergency operations centres at the municipal level (in Italian, Centri Operativi Comunali, COC), the inter-municipal level (Centri Operativi Misti, COM), provincial level (Centri di Coordinamento dei Soccorsi, CCS), regional level (Centro Operativo Regionale), national command and control direction (Direzione di Comando e Controllo, DI.COMA.C.) and the European level (MIC and CECIS).

1.2 General objectives reached:

- To test the European Civil Protection Mechanism procedures;
- To involve the participating Countries both in the preparatory phase and during the exercise by establishing a network of experts and by comparing the various operational methodologies;
- To share scientific experiences by comparing working methods and by enhancing a scientific network of research Centres, through VET deployment;
- To improve mutual understanding of emergency management and civil protection systems regarding particularly the case of a major volcanic emergency;

- To test the activation and co-ordination of the existing foreigners assistance institutions in an emergency situation and the capability of identification and assistance to foreign citizens in the hazardous zone through FASTs deployment;
- To test the activity of EU liaison experts in managing the relations between the diplomatic offices and DICOMAC;
- To spread information about volcanic hazards to schools and among the population, in order to make them aware with the alert levels and with the National Emergency Plan for Vesuvius Area;
- To increase the cooperation among EU Member States in the field of civil protection from lesson learned of the exercise;
- To show EU Civil Protection potentials through interactive media videos and to disseminate knowledge about emergency capabilities across the EU Countries;
- To enhance the capabilities of the reception, deployment and coordination of international experts and teams.

Specific objectives for the VETs

VET in collaboration with INGV-OV scientific staff and Italian Department of Civil Protection will be tasked with:

1. Collection of geophysical and geochemical data through the employment of specialized equipment improving the pre-existing monitoring systems.
2. To support the achieved new data analysis and elaboration through other simulations and examples examined in other volcanic eruptions with the purpose of better understanding the precursory phenomena.
3. To interpret the results achieved from all the different research fields (volcanology studies, seismology studies, ground level deformation analysis, geochemical and temperature analysis) as to evaluate competently the volcano's activity critical state.
4. Constant up-date of data and critical status level up to the completion of training operations.

It has been evaluated that for each country the VET should consist of 3 persons.

The FASTs involved in the project are requested to support the Italian Civil Protection Unit in offering assistance to the foreign citizens (both residents and tourists) on location at the time and place of emergency during the evacuation phase. It has been evaluated that each FAST should consist of 3 persons.

Specific objectives for the FASTs

FAST will be following Italian authorities dispositions to achieve these specific objectives:

1. To calculate and localize the foreign population present at the time of emergency.
2. To supply foreign authorities (Embassies, Consulates, etc.), with adequate information on the course of events, measures adopted and codes of conduct to be followed.
3. To point out their specific needs and requests by analysing all possible solutions (from health, logistics, etc.)
4. To verify the foreign population's operative evacuation plan.
5. To adapt and activate transportation for tourists' evacuation to welcoming posts and to eventual hubs to be sent back to their countries or other established rescue locations.

The general impression of all the participants was of the project has been

Specific objectives for Protection of Cultural Heritage.

This is a new objective introduced in the exercise for the following reasons.

The present emergency plan for Vesuvius is devoted solely to the protection of the exposed populations. In the most hazardous zones there are, however, many sites of precious cultural heritage that also deserve attentions. It is proposed to include a simulated intervention of this kind in the exercise. On the same day in which population will be evacuated from their residence towns, a specialised team with voluntaries trained and lead by the experts of the Ministry of Cultural Heritage and of the National and Italian, will move outside of the risky area archaeological manufacts from a Roman Villa and test technical devised to protect in situ the heritage that cannot be moved. European Observatories will assist to the operation.

In conclusion it can be said that the main objectives of the project were substantially achieved, a discussion on positive aspects and remarks on problems aroused, aspects to be improved, are reported further on in the report, however remain the great enthusiasm and the great experience for all the participants to have had the chance to be involved in the simulation of one of the most tremendous disaster in the world.

2. Introduction

2.1 Main objectives

The main objective of the Exercise were the following:

- to test the European Civil Protection Mechanism procedures;
- to involve the participating Countries both in the preparatory phase and during the exercise by establishing a network of experts and by comparing the various operational methodologies;
- to share scientific experiences by comparing working methods and by enhancing a scientific network of research Centres, through VET (Volcanic Expert Team) deployment;
- to improve mutual understanding of emergency management and civil protection systems regarding particularly the case of a major volcanic emergency;
- to test the activation and co-ordination of diplomatic and consular structures in an emergency situation and the capability of identification and assistance to foreign citizens in the hazardous zone through FAST (Foreigners Assistance and Support Teams) deployment;
- to test the activity of EU liaison experts in managing the relations between the diplomatic offices and DICOMAC;
- to spread information about volcanic hazards to schools and among the population, in order to make them aware with the alert levels and with the National Emergency Plan for Vesuvius Area;
- to increase the cooperation among EU Member States in the field of civil protection from lesson learned of the exercise;
- to show EU Civil Protection potentials through interactive media videos and to disseminate knowledge about emergency capabilities across the EU Countries;
- to enhance the capabilities of the reception, deployment and coordination of international experts and teams.
- to test the technical capability of emergency intervention to protect cultural heritage in the zones threatened by expected eruption (Vesuvius eruption)

The specific objectives for the VET to achieved in close cooperation with INGV-OV and other Italian scientific teams were:

1. Collection of geophysical and geochemical data through the employment of specialized equipment improving the pre-existing monitoring systems
2. Support the achieved new data analysis and elaboration through other simulations and

examples examined in other volcanic eruptions with the purpose of better understanding the precursory phenomena

3. Interpret the results achieved from all the different research fields (volcanology studies, seismology studies, ground level deformation analysis, geochemical and temperature analysis) as to evaluate competently the volcano's activity critical state
4. Constant up-date of data and critical status level up to the completion of training operations

The specific objectives for the FAST to be achieved in close cooperation with the Italian Civil Protection were dealing with assistance to be provided to foreign citizens (both residents and tourists) on location at the time and place of emergency during the evacuation phase.

The Tsunami event in the Asiatic South-East has put in evidence the importance of these procedure to valorise the inter-action and synergy among the European Union countries and the importance of establish relationship and coordinating activity with diplomatic structures.

In particular the specific objectives of the FAST were:

1. Calculate and localize the foreign population present at the time of emergency
2. Supply foreign authorities (Embassies, Consulates, etc.), with adequate information on the course of events, measures adopted and codes of conduct to be followed
3. Point out their specific needs and requests by analysing all possible solutions (from health, logistics, etc.)
4. Verify the foreign population's operative evacuation plan
5. Adapt and activate transportation for tourists' evacuation to welcoming posts and to eventual hubs to be sent back to their countries or other established rescue locations

Protection of Cultural Heritage.

This objective was introduced for the following reasons. The present emergency plan for Vesuvius is devoted solely to the protection of the exposed populations. In the most hazardous zones there are, however, many sites of precious cultural heritage that also deserve attentions. It is proposed to include a simulated intervention of this kind in the exercise. The day before population will be evacuated from their residence towns, a specialised team with voluntaries trained and lead by the experts of the Ministry of Cultural Heritage, will move outside of the risky area archaeological manufacts from a Roman Villa and test technical devised to protect in situ the heritage that cannot be moved. European Observers will assist to the operation.

2.2 Time schedule of the project from proposal to evaluation

- In response to the Call for proposal n. 2204/C-92/11 of the European Commission – Directorate General Environment published on the EU Official Journal C93/93 of 16th April 2004, the Campania Region in cooperation with AMESCI presented a proposal for an international Civil Protection exercise entitled Somma Vesuvius MESIMEX. The project was dealing with a major simulation exercise in volcanic emergency management to be carried out at Somma Vesuvius Volcano, Naples.
- On the 7 December 2004 the EU Commission approved the project and the Grant Agreement - Action 07.030601/393427/2004/SUB/A5 – SOMMA VESUVIO MESIMEX was submitted to Campania Region; this G.A: was signed by Campania Region on the 10th December 2004.
- The initial foreseen date for MESIMEX Exercise for 15 July 2006. On 3 February 2006 the Campania Region requested to the EU Commission that the Exercise date be postponed. At the first Kick off meeting held at Brussels on 18 May 2005, the exercise date was definitively established for 18 -23 October 2006. In the course of the 2006 the National Civil Protection Department was also involved in the project.

2.3 Institutions involved

- The Italian Institutions involved in the MESIMEX Exercise were the following, all included in the Vesuvius Emergency Plan:
 - The Italian Civil Protection (National Department)
 - Campania Region (Regional Civil Protection Office)
 - Civil Protection emergency Teams from all Italian Region (for assistance in the people evacuation phase)
 - Osservatorio Vesuviano belonging to INGV (National Institute for Geophysics and Volcanology)
 - Other Sections of INGV (Catania, Palermo, Pisa, Roma)
 - Italian Universities (Firenze, Napoli, Pisa, Roma 3)
 - Study Center PLINIVS belonging University of Naples
 - Forze Armate
 - Corpo Nazionale Dei Vigili Del Fuoco
 - Guardia Di Finanza
 - Pubblica Sicurezza

- Corpo Forestale Dello Stato
- Capitanerie Di Porto
- Croce Rossa Italiana
- Ingv- Apat-Cnr
- Ministero Affari Esteri
- Ministero Comunicazioni
- Other Sector of Campania Region
 - Giunta Regionale
 - Assessorato Sanità
 - Assessorato Ll.Pp.
 - Assessorato Trasporti
 - Assessorato Al Turismo
- Regioni Gemellate
- Provincia Di Napoli
- Comuni
- Volontariato
- Cnsai
- Anas
- Autostrade Per L'italia
- Rfi
- Rai
- Enac – Enav
- Rappresentanza Telefonia Fissa E Mobile
- Enel

For Tasks assigned see Annex 1.

- European Commission DG Environment Directorate A, Unit A5 – Civil Protection
- European Core Group Countries:
 - France
 - Portugal
 - Spain
 - Sweden
 - United Kingdom (participated to the initial Kick-off meeting, but renounced to be a member the Core Group).

Some of these countries provided experts to the VET and FAST teams.

2.4 Short description of the scenario

The National Emergency Plan for Vesuvius Area (NEPVA) was approved in 1995 and it is being continuously updated. Vesuvius has been dormant since 1944. In the case of its reactivation, a sub-Plinian explosive eruption is expected to be the maximum likely event, so this has been taken as the reference event for NEPVA and consequently for MESIMEX Exercise.

The scenario associated with a sub-Plinian eruption includes the following main phenomena and related hazards:

- An initial eruption phase with a sustained eruptive column of gas and pyroclastic fragments, 15-20 km high, which is dispersed by the wind and from which pumice, lapilli and ash fall to the ground. The hazard is related to the thickness (and load) of this pyroclastic cover so that it may cause roofs to collapse. Other hazards are related to difficulty of breathing due to high concentrations of fine particles in the air, pollution of crops and water, difficulties in using the lifelines and traffic jams. (**yellow zone**)
- A phase when the eruptive column collapses, generating pyroclastic flows involving rapidly incoming clouds of gas with suspended pyroclastic particles, which may reach speeds of around 100 km/h and may have tremendous destructive power. Physical numerical models indicate that pyroclastic flows will reach the sea in 5 to 10 minutes from the collapse of the column, thus destroying almost everything they encounter. The zone exposed to this hazard is defined the **red zone**.
- The third main hazard is related to the generation of mudflows (lahars) during and after the eruption. These are very rapid and dense debris flows generated by rain which mobilises the loose pyroclastic material deposited by fallout on the steep slopes of the volcanic edifice and of the Apennine relief downwind. These lahars have great destructive power and people must be evacuated from the zones exposed to this hazard; in the plan, this is defined as the **blue zone**. When it is near the volcano it coincides with the red zone and it also covers that part of the yellow zone in the steep relief downwind which is likely to be affected by significant pyroclastic fallout.

Because of the great speed of pyroclastic flows, the red zone must be evacuated before the eruption begins, as soon as the Alarm level is declared.

The population of the yellow zone (where a significant probability of roof collapse by ash-fall loads exists) and of the blue zone, which is exposed to ash-fall and lahar hazards (about 150,000-250,000 people) is to be evacuated after the eruption's onset, when the wind direction is known. Only a part of these zones, about 10-20 per cent, will be significantly affected, depending on the wind direction at the time of the eruption, and it will be evacuated *after* the eruption's onset.

The success of the Vesuvius emergency plan depends on the ability to forecast the eruption.

In a volcano with closed conduit, like Vesuvius, which is at rest, the transition from repose to eruption will be accompanied and preceded by a **series of precursory** phenomena, such as:

- Ground deformation (consisting of both vertical and horizontal movements) produced by the pressure exerted on the overlying rocks by the rising magma.
- Anomalous seismicity generated by fractures produced by the pressure of the rising magma. The emergency plan includes the evaluation of the damages caused by the earthquakes likely to occur in the pre-eruption phase, that will also affect the road system to be used in the evacuation of the red zone.
- Increase in volatile fluxes reaching the surface, and changes in the temperature of the fumaroles and the chemical and isotopic composition of hot springs, water wells and fumarolic gases.
- Anomalies in the gravimetric, magnetic and electrical fields of the earth's crust generated by the rising magma.

The Vesuvius monitoring system is extremely modern and all relevant physical and chemical variables are systematically recorded. The monitoring networks are managed by the Italian National Institute of Geophysics and Volcanology (INGV) through its Vesuvius Observatory (Osservatorio Vesuviano- OV).

The surveillance system of OV is strictly connected to the Civil Protection System, both at national and regional level, that receives a timely communication on all the relevant information on the state of the volcanic activity.

The alert system described in the emergency plan and that will also be the reference system for MESIMEX, includes the following main levels:

- Attention: it is declared when monitored variables exceed their established thresholds; it leads to a strengthening of the monitoring processes, and the diffusion of advice to the local population and the civil authorities.
- Pre-alarm: the probability of an eruption has increased; all bodies involved in the emergency plan must enter a state of readiness and be dispatched on the area to be evacuated (red zone).
- Alarm: the eruption is impending and people are evacuated from the red zone.

Because of the relevant social and economic consequences, the alarm is issued by the Prime Minister, following the declaration of a national state of emergency by the Council of Ministers. The most serious challenge to the scientific community is being able to correctly recognize the signs that precede an eruption in order to avoid a false alarm or a failed or late alert.

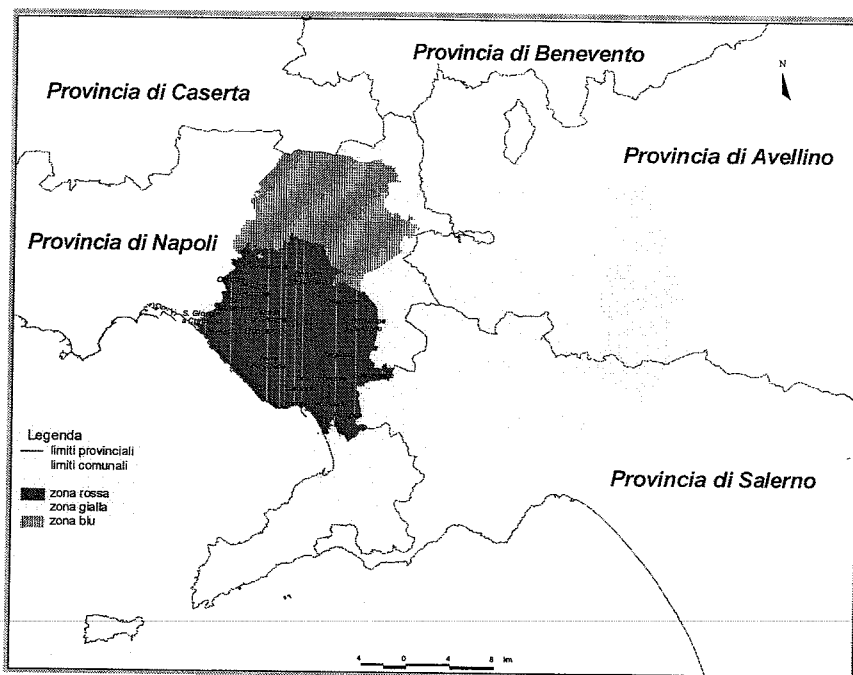


Fig. 1 The map shows the distribution of the red, yellow and blue zones on the Campania territory

The exercise scenario is meant to simulate the evolution of the volcanic crisis from the declaration of the attention level to the alarm level, when the population in the red zone is moved out. Therefore, the eruption phase nor the actions described in the plan for the yellow and the blue zone will be simulated.

In order to recognize the first signs of the rising magma process outwards and in order to follow its development we rely on the monitoring and surveillance system controlled by the Vesuvius Observatory (OV) on the volcano. A reliable diagnosis results not from a single, even decisive,

parameter, but from a combined, multiparametrical and multidisciplinary interpretation of all information that must be found in an interpretation model of the current process.

At this stage, the intervention of experts' teams of the participant Member States, able to provide technical-scientific support during the volcano's activity simulated by the O.V., is useful.

An independent body of scientists will prepare a scenario of the phenomena that will probably precede an eruption.

These will be successively communicated to the Vesuvius Observatory in order to test its reaction. Monitoring will be strengthened in order to test the timing and quality of the response.

The exercise will start when the OV communicates to the Italian Department of Civil Protection that a significant variation of two monitored parameters at least has occurred (or is occurring), that is the values of those parameters have gone over the ground level (background) twice the standard deviation value (σ).

Consequently, once OV communication has been received, the Civil Protection Department, together with the Central Functional Centre (The Monitoring and pre-warning centre of the Civil Protection Department), the Campania's functional Centre and the OV, evaluates the seriousness of their event, and declares, in case, the attention level thus activating the civil protection system.

According to the emergency plan, the assessment of the volcanic crisis development and the transition to higher levels (pre-alarm and alarm) will depend on the real time analysis of monitored parameters lead by volcanologists.

During the exercise, the whole Italian scientific surveillance system, in cooperation with the European experts teams, will be involved in a special vigilance phase, by deeply analysing those parameters which have shown some changes, by using additional instruments and specific on site investigations. Successively the same group of experts will follow the volcanic crisis by assessing surveillance data and by using models set up for other volcanoes, thus providing an evaluation of the rising eruptive reactivation levels.

Once the evolution of the phenomena has justified the transition to the "Pre-alarm" level and this has been officially declared by the Civil Protection Department, all structures and bodies involved in the emergency management are activated.

The transition to the pre-alarm level comes immediately before the "state of national emergency" declared by the Council of Ministers in agreement with the President of Campania Region. The National Civil Protection Operation Committee meets in Rome to coordinate the emergency management that requires the use of special means and powers, by activating the resources coming

from the whole Country. The Italian Department of Civil Protection sets up its operational base (Direzione di Comando e Controllo DI.COMA.C. - LEMA) in the operational area in constant connection with the Regional Emergency Centre of the Campania Region in Naples.

The Campania Region and the Prefecture of Naples guarantee the activation of the intermunicipal centres (COM) and the deployment of their available resources.

All the Municipalities of the red zone will be involved in the activation of their local emergency coordination bodies (COC) so as to test their response capabilities.

The Campania Region accommodation structures are alerted.

The following step is to declare the Alarm level, and consequently to move out the population living in the red zone.

Obviously only a small part of the inhabitants of the red zone can be directly involved in the exercise. We plan to test all the main evacuation methods with an adequate sample of evacuees. EU teams will be involved in the assistance of those people, coming from their Countries, who are in the red zone.

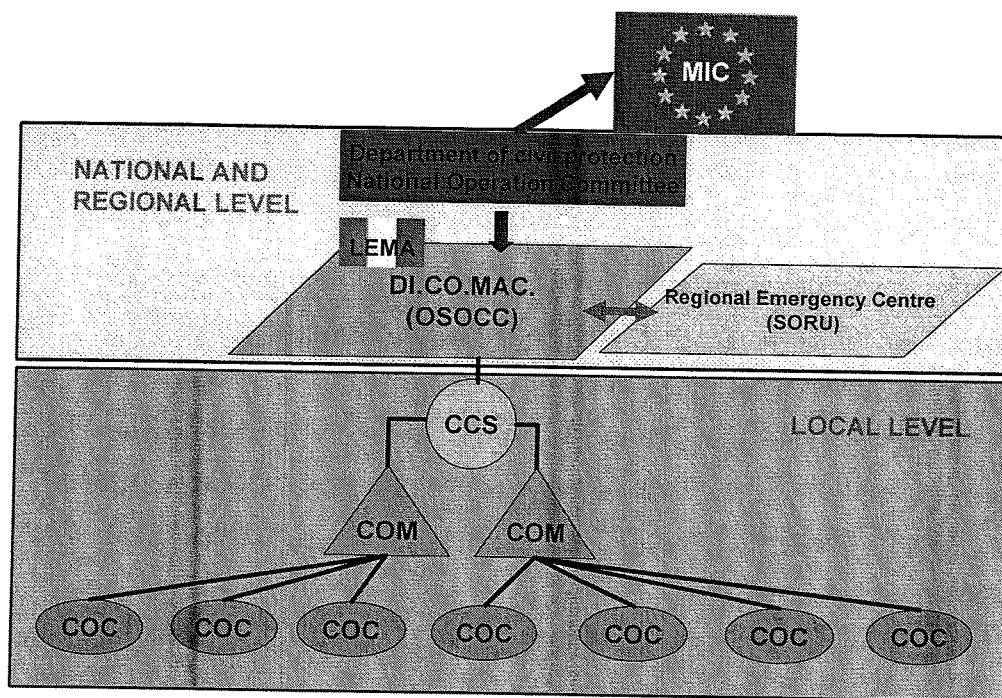


Fig. 2 - Functional relation among emergency operations centres at municipal level

The picture shows the functional relation among emergency operations centres at municipal level (COC), at inter-municipal level (COM), at provincial level (CCS), at regional and national level (DI.CO.MAC.) and at European level (MIC).

2.5 International Aspects

In the first phase, the Civil Protection Department Operations Room will send the MIC some messages about the current situation, that is about the precursory phenomena of the possible eruption. That's how Brussels will be provided with useful elements in order to let the MIC arrange info sheets to be addressed to all the EU Countries.

During the attention phase, Italy asks, through the MIC, for assistance from Member States which will provide volcanologists and experts and mobile equipment to monitor the volcanoes (i.e. mobile seismic stations, instruments for the geochemical data surveillance etc.).

The request of assistance to the MIC includes both the intervention of scientists expert in volcanic risk and of operational teams.

In the pre-alarm phase, Member States will be asked, through the MIC, to alert operational teams in order to support the Italian civil protection in identifying and assisting foreign citizens in the hazardous area. Those operational teams will be employed during the alarm phase.

3. Performance of the exercise

3.1 Exercise area

All the scientific activity by VET has been carried out in the Somma Vesuvius area; VET moved daily to the field to carry out their specific activity and they were radio linked to the Civil Protection Base. At the end of each day there was a scientific meeting involving all participants. In this meetings OV presented the data related to the monitoring permanent network and the responsible of any VET scientific discipline (Geology - Volcanology, seismology, ground deformation, gravimetry, geochemistry) as well as specialized groups in charge of simulation of volcanic ash fall out and earthquake damage assessment presented the results obtained during the day. There was then an open discussion of the results presented and at the end an evaluation report was transmitted to the Civil Protection.

This activity was coordinated by a Synthesis Group appointed by the Civil Protection Department.

This activity had mainly the objective of testing the capability of the scientific monitoring team to provide in short time reliable scientific data on the state of the volcano.

Obviously being the Vesuvius totally quiet, no anomalous phenomena were recorded. In order to activate the different phases of MESIMEX simulated precursory phenomena were provided daily to the Synthesis Group by three independent scientists belonging to the volcanology section of the High risk Commission of the Civil Protection Department.

All these scientific activities were made in the Naples offices of Regional Civil Protection with a close link with DI.CO.MAC. that was hosted by Naples Prefecture. Video Conferences were periodically held between DI.CO. MAC. And Synthesis Group. FAST meetings were held both at Campania Region Civil Protection Head Quarter and Naples Prefecture.

For the evacuation of the population and simulation of foreigner assistance the following emergency Check Points were established on the 21st and 22nd of October:, see fig. 3 for location

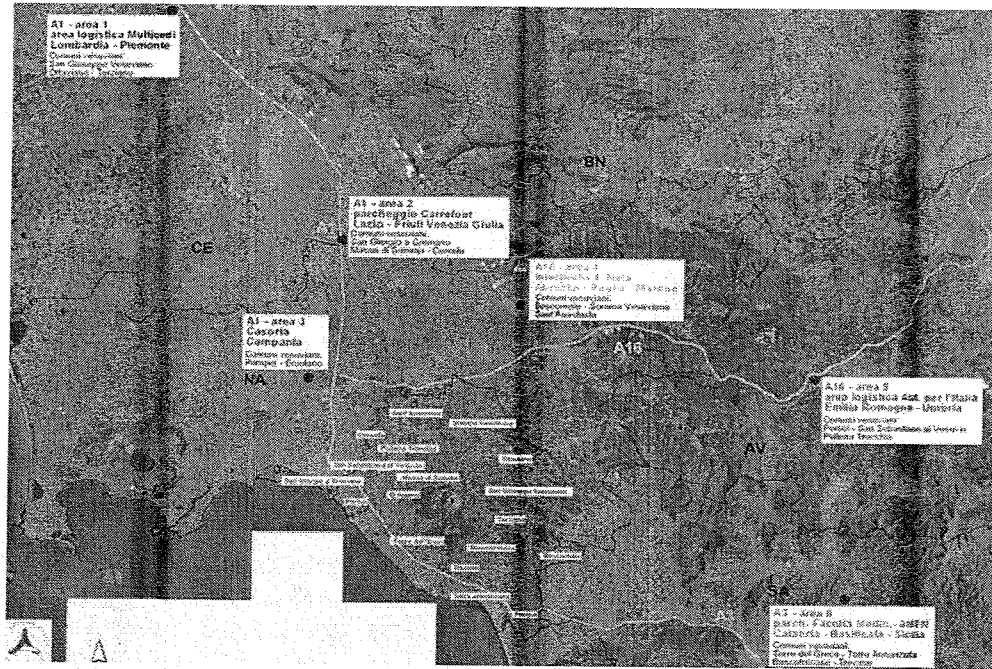


Fig.3 – Check Points location, the yellow roads represent the three main evacuation directions

The Civil Protections of the Italian Regions involved in the management of the Check Points and the Municipalities hosted in the Check Points are reported in the following table 1.

No.	Check Points	Municipalities involved	Regions involved
1	CAPUA Multicedi SPA	Terzino, S. Giuseppe V., Ottaviano	Lombardia
			Piemonte
2	MARCIANISE parcheggio Carrefour	Cercola, Massa di Somma S. Giorgio a Cr.	Friuli V. Giulia
			Liguria
3	CAIVANO Centro Sportivo Comunale	Pompei, Ercolano	Campania

4	NOLA Interporto	S. Anastasia, Somma Vesuv., Boscoreale	Puglia
			Lazio
			Abruzzo
			Marche
5	AVELLINO ex Mercato ortofrutticolo	Pollena Trocchia, Portici, S. Sebastiano al Vesuvio	Emilia Romagna
			Umbria
6	BARONISSI Università facoltà di Medicina	Torre Annunz., Torre del Greco, Boscotrecasse Trecase	Calabria
			Basilicata
			Sicilia

Table 1 – Check Points: Location, Municipalities and Regions involved

The cultural Heritage exercise was run on 21st of October at Roman Villa of Massa di Somma

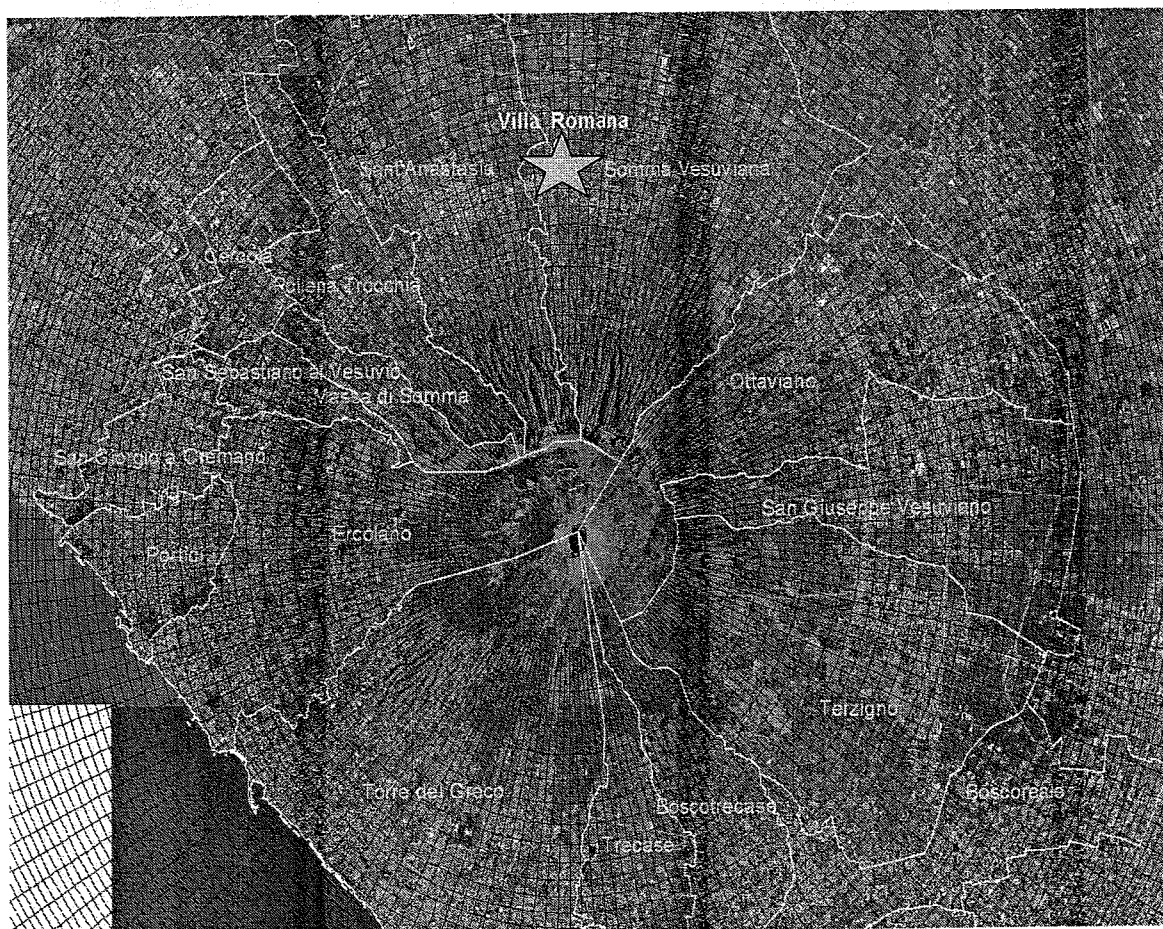


Fig. 4 – Location of the Villa Romana at Massa di Somma

3.2 Time schedule

18 October

- Activation Request to M.I.C.
- Arrival of the VETs from Italian Scientific Structures outside Naples and from participating European Countries.
- Introductory Scientific Workshop: Presentation of the Exercise; description of the Vesuvius eruptive scenario and of the Emergency Plan; description of the monitoring system; illustration of the activity to be carried out by VETs during the Exercise; presentation of Synthesis Group and of its tasks.
- Formation of the different VETs for the field work, presentation of the coordinators of the different scientific activity
- Logistic organization of the VETs activity (Car, radio links, driver, security, etc.)

First simulated activity of Vesuvius: OV informed that on 17 and 18 of October an anomalous seismicity was recorded at Vesuvius ($M_{max} = 4.2$) together with a small land slide. Anomalies were recorded also on the water table in south east of the crater. The synthesis group urgently convened evaluated that because of the lack of ground deformation and geochemical variation, the reported phenomena could be of tectonic origin as no phenomena indicating magma upraise have been recorded. However rock fracturing by seismicity could trigger magma motion in the near future. It is therefore suggested that the **Level of Attention** be declared and the volcano monitoring be strengthened.

The **Level of Attention** was officially declared by the Civil Protection Department

19 October

Activity of the Vets

The following activity were carried out by the VETs:

- Field:
 - Geological Check on fracture opening and land slides (also by aero photograph analysis)
 - Deployment of portable seismic network and extension of the ground deformation benchmarks
 - Geophysical measurements: gravity, precision leveling, EDM and GPS

- Geochemical measurement: CO₂ soil flux in the summit crater area, sampling and analysis of water and gas
- Laboratory
 - Collection of data on the wind field and simulation of the ash dispersal in case of explosive eruption with a sustained column of 18-22 Km high and evaluation of associated impact for ash fall out.
 - Processing of the data collected by the permanent geophysical and geochemical monitoring systems

Activity of the Synthesis Group

Three meetings were held to analyze the information (simulated) precursory phenomena continuously transmitted by the OV. Since the morning of the 19th the appearance of volcanic precursory phenomena, i.e. seismicity in the crater area with associated LP events, geochemical variations in both water and fumaroles indicating a significant increase in magmatic gas output, appearance of first ground movements led to suggest the activation of the **Pre Alarm Level**.

The **Pre Alarm Level** was officially declared by the Civil Protection Department

The Synthesis Group indicated also the specific scientific actions to be undertaken by the OV and the VETs in order to provide additional information crucial for the interpretation of the crisis evolution.

The declaration of the Pre Alarm activated all the operational structures foreseen by the Emergency Plan, the preparatory activity for emergency was coordinated by the DI.CO.MAC. whereas the Regional Civil Protection took care of the Volunteer Organization and of the contacts with red zone Municipalities. The Civil Protection Structures of the other Italian Regions were requested to send to the Vesuvius area specialized Teams and means to assist in the case of evolution of the crisis to a situation requiring people evacuation.

20 October

On this day substantially the same activity of the previous day was carried out. Simulated data provided to the synthesis group indicated a progressive increase in the probability of volcano reactivation (sustained seismicity with a new strong event: M=3.8, ground deformation with inflection of the crater area, appearance of positive gravity anomaly in the summit of the mountain,

appearance of new fumaroles and increase of CO₂ soil flux, marked raise of the water table, fracturing and small land slide in the seismic epicentral zone).

An evaluation of the damages produced by the two strongest seismic shocks was made using both vulnerability data contained in data bank and new field observation made by specialized teams ad-hoc activated. Partial collapses created obstruction on some of the road that represent main links for the evacuation. Data were transmitted to Civil Protection in order to promote urgent remediation interventions. In spite of the moderate magnitude of the earthquake (M=3.8, M=4.2) the shallow dept of the foci caused significant damages to the building over a wide area.

The same simulation of the previous day of the ash dispersal and fall out risk was performed with new updated wind data.

In the final meeting on the scientific activity of the day it was remarked with satisfaction that in only two days of field work the VETs had been able to provide a relevant quantity of new data that would have been fundamental in case of real crises. Satisfaction was expressed also on the quality of the results provided by OV and PLINIVS on the simulation of the eruptive ash clouds.

Arrival of FAST experts: briefing and planning of the work to be carried out.

21 October

In the course of the day the (simulated) evolution of the precursory phenomena led the Synthesis Group to believe that there were so clear signs on an ongoing magna up raise to justify the declaration of the **Alarm Level** so to proceed to the evacuation of the population from the red zone.

It was also suggested to the Civil Protection to pay attention to the zone south east of the volcano where wind forecast indicated a likely occurrence of dangerous ash fall out in case of eruption .

As foreseen from Emergency Plan the Prime Minister declared the **State of Alarm** in the late evening of 21st October and the red zone evacuation was activated for the following morning.

During the day the Civil Protection Teams of the Italian Regions together with that of Campania with their specialized personal volunteers and using their own means, prepared the installation Check Points for assistance to evacuated population and foreigners.

During the day the Cultural Heritage exercise was carried out at Massa di Somma. Movable and non movable goods to be preserved were treated. The movable works art were brought in a safe place identified previously, the non movable piece of art as columns and wall painting or plaster decorations were strengthened with hoops or protected with special shield of material resistant to the heat and to the dynamic pressure of ash.

The field and Laboratory scientific activity continued as in the previous days but the main attention of the daily meeting was devoted to the discussion of the simulated phenomena.

The Fast, in close collaboration with the Italian authority, pursued, during MESIMEX exercise, the following objects:

1. To perform a census of the foreigner population really presented in the area at risk and to proceed at their localization.
2. To perform coordination activity with the diplomatic bodies and transmit to themselves the information related to the events evolution.
3. To identify and to help all the specific needs of the foreigner citizen,
4. To elaborate and to verify the operative plan of evacuation for the foreigner population;
5. To adapt the plan of evacuation of the foreigners from the area at risk to the check point areas.

All the population either Italian or foreigner, evacuated from the zone at risk, was hosted in several Check Points to be then addressed toward twinned Regions as foreseen by the Civil Protection Emergency Plan. Alternatively, it was given to the foreigner citizen the possibility to be returned in their own countries, according to the modality identified by the FAST, strictly in contact with the Diplomatic Bodies.

22nd October

The fundamental activity of the day was devoted to the evacuation of a fraction of the population from each of the 18th municipalities of the red zone.

Managed by local administrators with the assistance of officials of National and Regional Civil Protection the evacuated population was carried by bus to the Check Points.

See Table 1 for description of the Check Points. At any Check Points people were given sanitary assistance and food. They were involved in educational activity (dissemination of information on Vesuvius volcano and its emergency plan) and children were entertained with dedicated activity. Each family was requested to fill up a questionnaire whose aim was the evaluation of the Vesuvius risk perception. At late afternoon the evacuees were brought back to their homes following the formal declaration of the end of the **Alarm State**. In order to avoid possible future misunderstanding the Synthesis Group released a formal bulletin explaining that such a situation will never occur in a real crisis. In fact also in the case in which an acceleration of the precursory phenomena so marked to have brought to the alarm state and people evacuation should slow down and even decrease, a very long time would be needed before declaring the end of the Alarm.

In the late afternoon a meeting was held at DI.CO.MAC. to share the experience of the different groups that participated to the exercise and for a first evaluation of the results.

During this day the field activity of VETs was suspended and only the current monitoring activity of OV went on.

23rd October

The final workshop was held at Regional Civil Protection (for the content see Chapter 4).

3.3 Teams and Means involved

3.3.1 Scientific Activity of VET Teams

The description of involved teams is summarised in table 3. Each VET had a four-wheel car with driver and radio. Five to ten additional cars were used by OV, DPC and Campania personnel involved in the scientific activity.

The number of foreigner scientists and the countries participating to VET activities are reported in the following table 2.

Foreigner VET	
Country	No. of People
France	5
Portugal	2
Spain	6

Table 2 - Foreigners Scientists participating at several VET groups

Mesimex				
VET Teams operating in addition to the OV permanent monitoring system				
Team ref. No.		Coordinator No. of people	Istitutions	Participating European VETs
	Seismicity	Marcello Martini		
1	Mobile wireless network	5	INGV-OV	Spain - Portugal
2	Mobile seismic network	6	INGV-OV	
3	Strengthening permanent network	5	INGV-OV	
4	Strengthening permanent network	3	INGV-OV	
5	Seismoacoustic network	3	UNIFI	
	Ground deform. and geophysics	Giovanni Macedonio		
6	Precision levelling	5	INGV-OV	Spain - Portugal
7	GPS Measurements	5	INGV-OV	
8	Laser scanner survey	5	INGV -RM	
9	Tide gauge survey	2	INGV -RM	
10	Gravimetric Measurements	3	INGV-OV	
11	Magnetic	3	INGV -CT	
	Fluid geochemistry	Giovanni Chiodini		
12	CO ₂ soil flux; gas sampling and analysis	5	INGV-OV	Spain
13	CO ₂ soil flux; gas sampling and analysis	4	INGV-OV	
14	CO ₂ soil flux; gas sampling and analysis	4	INGV-OV	
15	CO ₂ soil flux; gas sampling and analysis	4	INGV-PA	
16	Geochemistry of the gas plume	2	INGV-PA	
17	Geochemistry of the gas plume	2	GV-RM1/UniRi	
18	Geochemistry of water springs and wells	2	INGV-CT	
	Geo-volcanology	Giovanni Orsi		
19	Ground and helicopter observations	4	INGV-OV	France, Portugal, Spain
20	Geo volcanology	4	INGV-OV	
21	Geo volcanology	4	INGV-CT-OV	
22	Geo volcanology	4	INGV-OV	
	Slope stability			
23	Slope stability	4	UNIFI	
24	Slope stability	3	DPC	
25	Slope stability	4	DPC	
	Seismic damage assessment	Giulio Zuccaro		
26	Seismic damage assessment	3	Reg.-DPC-PLINIVS	France, Portugal, Spain
27	Seismic damage assessment	3	Reg.-DPC-PLINIVS	
28	Seismic damage assessment	3	Reg.-DPC-PLINIVS	
		Total: 109 people		

Table 3 – VET operating in addition to the OV permanent monitoring system

Other Special Activity at the Vesivius Observatory

- Simulation with real wind data of the fallout dispersion in case of sub-plinian eruption (with damage assessment by PLINIVS Study Centre of the University of Naples “Federico II”);
- Satellite data processing.

3.3.2 FAST Teams

The MESIMEX Exercise has represented the first real test at international scale of foreigners population assistance in a risky area. The wide participation of numerous international observers coming from several Civil Protection Authority of the European Union countries, from the Diplomatic Body in Italy, has shown the great interest for the initiative. The FAST activity was finalised to identify, assist and evacuate the foreign citizen present in an area interested from an emergency. Within the MESIMEX exercise, France, Spain, Portugal and Sweden sent expert teams, having the task to help the Italian Authority during the assistance operations of the foreigner citizens, present in the area at risk when the evacuation be started. Representatives of Naples UK Consulate also took to the FAST activity.

Country	N. of members of FAST
France	3
Portugal	13
Spain	5
Sweden	6
United Kingdom	2

Each Team, organized from the single country in full autonomy, was composed by several experts of which one had the role of coordinator, one was in contact with the diplomatic bodies and one had the task to care the logistic.

International Functions of FAST
Coordinator/Linkage
<ul style="list-style-type: none"> To ensure the relations with local authority and the Police body through the ICP To coordinate the activity required to the population census of each foreigner country in the zone at risk. Responsible of the emergency plan in coordination with the others team members.
Link with diplomatic bodies
<ul style="list-style-type: none"> To keep the relations with the diplomatic bodies directly and through the ICP. To identify the foreigner citizen to be evacuated (certification) To answer at the requests coming from the people of the same country related to consular problems (i.e. Passport lost).
Logistic
<ul style="list-style-type: none"> To study logistic solutions to evacuate from the Check Points the foreigner population toward the residence country. To search in the Check Points the foreigners evacuated from the red area.

The FAST operated either within the DICOMAC/LEMA base, through the International Coordination Point, to keep the contact with the Italian Authority or in the Check Point areas to study how to solve on the spot problem regarding foreigner citizen.

International Logistic supplied to FAST
For each single international FAST
<ul style="list-style-type: none"> • 1 DPC liaison officer
<ul style="list-style-type: none"> • 1 motor vehicle
<ul style="list-style-type: none"> • 2 radio/GSM
One position within the liaison offices provided of computer, internet connection and telephone.

ICP (International Coordination Point)

The international teams found assistance within the DICOMAC/LEMA (Local Emergency Management Authority) where it was set an International Coordination Point (ICP).

ICP Functions
Welcome and registration of the VET and FAST
Operative Briefing to the international teams
Coordination of the international team activity of the FAST
Logistic assistance VET and FAST
Facilitation of the relationship with the Italian Authority represented in the Italian FAST.

The ICP was composed of personnel from Italian Department of Civil Protection (DPC) and foresaw one coordinator that ensured also the function of MIC Liaison Officer.

Constant contacts were kept with the IPC through the "Sala Operativa" of the DPC

In the ICP was instituted the Italian FAST function to answer, in exhaustive way, to the requests of the International FASTs.

In the Italian FAST all the administrations useful to the activity of assistance and identification of the foreigner population in the area subject to evacuation were represented. In particular, within the Italian FAST, there were the following subjects with the following tasks:

Officer of the Ministry of Foreign Office
<ul style="list-style-type: none"> • To keep in contacts with the FAST and Diplomatic Bodies with regard to consular problems
<ul style="list-style-type: none"> • Responsible, together with the ICP Coordinator to keep in contacts with the Ministry of Foreign Office.
Officer of Prefecture
<ul style="list-style-type: none"> • To keep in contact with the local Institution for activities of census and personal data collection
Officer of the Police headquarter
<ul style="list-style-type: none"> • To prepare the lists of the foreigners resident in the area or temporary visitors
<ul style="list-style-type: none"> • To give information on the Public Order to the foreigners
Officer of the Local Administrations
<ul style="list-style-type: none"> • Responsible of the contacts with the local services (health , social services) for the localization of the foreigners

The procedures foreseen in Italy to localise the foreigner citizen were activated by:

- verifying through the Police Headquarter foreigners in accommodation facilities in the Red Zone.
- verifying the presence of foreigners through hospitals
- verifying the number of roaming contacts to determine the number of contacts towards abroad.

Moreover it was tested a semi automatic system of communication to alert and inform the population on the course of the activity.

3.3.3 Check Point Organization

The main data referring to the Check-Points organization and management are summarised in the following table 3.

Table 3. CHECK POINT ORGANIZATION

Check Points	Municipalities involved	Regions Involved	Means	Regional Civil Personnel(*)	Medical Assistance.	Secretary	Tends	Baths	Tends for relief personnel	Refectory	Mobile Cook
1 CAPUA Multicedi SPA	Terzino, S. Giuseppe V., Ottaviano	Lombardia	26	55	X	X	X	X	X	X	
2 MARCIANISE parcheggio Carrefour	Cercola, Massa Somma S. Giorgio a Cr.	Piemonte Friuli V. di Giulia Liguria	16 13 6	35 43 19		X X X					X X X
3 CAIVANO Centro Sportivo Comunale	Pompei, Ercolano	Campania	21	64	X	X	X	X	X	X	X
4 NOLA Interporto	S. Anastasia, Somma Vesuv., Boscoreale	Puglia Lazio Abruzzo Marche	9 13 15 1	24 30 36 3		X X X			X X X	X X X	X X X
5 AVELLINO ex Mercato ortofruticolo	Pollena Troccchia, Portici, S. Sebastiano al Vesuvio	Emilia Romagna Umbria	31 7	92 16	X X	X X	X X	X X	X X	X X	X X
6 BARONISSI Università facoltà di Medicina	Torre Annunz., Torre del Greco, Boscotrecasse Trecase	Calabria Basilicata Sicilia	14 7 14	28 15 57		X X		X X			X X
TOTALI			193	517	6	8	6	6	6	6	6

(*) In addition to Civil Protection volunteers (total 1305 persons)

3.3.4 Cultural Heritage exercise

The exercise - organised with participation of G. LA.BE.C. (the Interdepartmental work group for the preservation of cultural heritage from natural hazards) was carried out by special S.A.F teams (speleologists, Alpine and fluvial troops) from the Fire Brigade and “Legambiente” volunteers, all highly trained in the recovery and protection of cultural goods, under the guidance of the Superintendence for Archaeological Heritage of Naples and Caserta provinces. The preservation activities included:

- Finding an appropriate location outside the “red zone” to store the movable goods to be preserved
- Packing and transporting the archaeological goods
- Strengthening four non-movable columns by means of hoops
- Recovering two marble statues, one of which represents the young Dionysus holding a panther cub in his arms. The statues were brought above the ground from the excavation level having a dept of 10 meters by means of a cableway
- Protecting part of the paintings with a thermal shield made of a material resistant to high temperatures; evidence of the effectiveness of the shield produced by “PLINIVS Study Centre” of the Federico II University of Naples.

3.3.5 DI.CO.MAC.

The list of involved Institution has been provided in chapter 2.3 and annex. 1. Each Institution used its own transport, communication and computing facilities.

3.4 International Observers

The whole program of the exercise was followed by groups a international observers coming either from European Civil Protection Organizations or from Diplomatic Bodies presents on the Italian territory.

MIC Observers

European Commission, Austria, Belgium, Bulgaria France, Lithuania, Malta, Portugal, Hungary

Diplomatic Bodies Observers

China, Denmark, Finland, Norway, United Kingdom, Portugal, United States, Sweden, Hungary

Moreover it was present a NATO delegate.

A specific visit program for the observers was prepared in order to allow them to follow the most important phases of the exercise, either for the technical part or for the activity of assistance to the Italian and foreigner population.

4. Workshop during exercise

4.1 Summaries of presentations (reduced sized copies of the presentation are annexed)

The following activity was carried out:

- introductory scientific workshop to VETs (see 2.4 for the content)
- introductory briefing – workshop to FAST (see activity of 21 October for the content)
- daily scientific briefing within the Synthesis Group activity (see 3.2 for contents)
- Final workshop of 23 October. In the final Workshop the main scientific results of the exercise were synthetically presented by the coordinator of the Synthesis Group (Franco Barberi), the director of Vesuvian Observatory (Giovanni Macedonio) and the coordinator of the ash fallout and earthquake simulation (Giulio Zuccaro).
- The FAST activity was summarized by Agostino Miozzo (DPC). Then single contributions from participating EU Countries were given by J. Varet (France), N. Pere (Spain), N. Wallentein (Portugal).
- The final intervention was given by European Commission delegate P. Balla. The main content of the workshop corresponds to what is summarized in chapter 5 (evolution of the project).

Not all the speakers had a power point presentation, some specific presentations given at the final workshop are reported in Annex 2.

4.2 Conclusions of sub groups

The exercise activities carried out from the international teams, were managed by an Exercise Control (EXCON) cell.

The FAST carried out their job receiving a series of input from EXCON, that submitted them single cases and complex situations, to test their capacity to react and facilitate the interaction between different components and subjects during the exercise.

The VET carried out their job receiving a series of input from a group of volcanologist that simulated the Vesuvius behavior. The VETs so as the Synthesis Group and the DI.CO.MAC and MIC reacted to the evolution of the crisis.

The conclusion of the sub groups were generally positive and enthusiastic, final remarks of the Groups are reported in the presentations enclosed in Annex 2

5. Evaluation of the project

5.1 Positive experiences

5.1.1 Scientific aspects

One of the main objectives of the MESIMEX exercise was Heat of Testing, as in a real crises, the capability of the scientific community to rapidly collect and process.

The data necessary for a sound reliable evaluation of the crises, so to provide to the emergency managing structures the information needed to timely take the most appropriate decisions for the project of the exposed population. The following main actions were carried out :

- The prompt continuous processing of the data teletransmitted to Vesuvius observatory (OV), the permanent monitoring networks or stations operating on the volcano (seismic, ground deformation, gravimetry , fluid geochemistry, crater thermal anomaly).
- The procession of satellite data relative to thermal anomalies, geological phenomena, ground motion.
- The collection of real new field data by specialized VET (mobile seismic network, ground deformation, gravimetry, water and gas geochemistry, geological observations on fracturing and slope stability) to integrate the information provided by the permanent networks.
- The joint processing of data relative to the expected eruption (eruptive column height, mass discharge rate) and to the real or forecasted (72 hours) wind conditions (direction and velocity) to estimate and update the downwind ash fallout, which is the first hazardous phenomenon likely to occur in case of Vesuvius eruption.
- The processing of (simulated) precursory earthquakes in order to evaluate the likely produced damages and their consequences on both the population safety and the practicability of the roads to be used for the people evacuation.

The response was extremely positive. The exercise proved the remarkable capability of scientific community to provide in a very short time a relevant body of scientific data that, in the case of a real crises, would be of fundamental importance for the correct interpretation of the ongoing and expected phenomena so to allow Civil Protection to timely adopt the needed operational decisions. Of fundamental importance has been the role of OV that,

besides its laboratory activity, coordinated all the Italian and European VETS operating in the field.

The decision to connect the task of formulating the scenario of the simulated precursory phenomena used during the exercise, to an expert team external to the monitoring organization, proved a right one as it permitted to have, as in a real crisis, animated scientific discussion among participating VET components.

Equally very positive was the experimentation (for the first time in Italy) by the Civil Protection National Department of a Synthesis Group uncharged of the timely evaluation of all scientific data to be transmitted with recommendation to the DI.CO.MAC. The Group was composed by the volcanology experts of the national Higher Risks Commission of DPC, integrated with the scientific responsible of any involved discipline (total 9 persons). This positive experience led DPC to appoint a similar Synthesis Group for the scientific management of the real Stromboli volcanic emergency began a February 2007, again with very positive results.

Positive and promising was also the testing of special material to protect some precious wall paintings during the Central Heritage exercise at the Roman Village of Massa di Somma. This permitted to establish that the temperature (T) case actively be maintained at the ordinary not dangerous ambient level behind the protective cover although the very high external artificially created temperature) (280°C)

5.1.2 Simulated emergency management.

The exercise provided the opportunity of practically testing during a simulated Vesuvius emergency that was conceived and organized so to approach as realistically as possible a real one, the operational capability of all the bodies and Administrations that have a role to play according to the emergency plan (see chapter...)

This activity was coordinated by DI.CO.MAC. at the Naples Prefecture and included a complex activity such as:

- To organized prompt operational response to all the scientific evaluations received by the Synthetic Group such as the activation through the DPC at Rome of the alert levels from the attention to the alarm and the related contacts with the Prime Minister office.
- The activation of the analyses, following the scientific forecast (e.g. fallout, landslides, etc.) or simulated event, (e.g. earthquakes) so to evaluate all aspects requiring real-time adjustments of the emergency plan previsions; this required frequent field checks by specialized personnel teams.

- The coordination of all evacuation operations, from the close continuous contacts with the Administrations of the Vesuvius Red Zone Municipalities to the assignment of specific tasks to all the operational bodies (Fire Brigade, Police, Army, Volunteers, Civil Protection teams from the Italian Regions, Health bodies) both in the preparation of the check-points and in the real evacuation exercise of the population.
- The evaluation of the lifelines (electricity, water, gas, etc.) vulnerability to the expected eruptive events and the definition of possible risk mitigation actions.
- The maintenance of a permanent and efficient communication link among all operational teams and the DI.CO.MAC. (mobile satellite phones, radio).
- The FAST activity evaluations on the exercise realization were extraordinary positive either about the contents of the exercise or the way in which the activity were developed. The effort to elaborate procedures in such a new and complex field was strongly appreciated from all the participants. The Italian and Regional Civil Protection are still receiving continues stimulus to carry on further developments of this thematic.

The most positive results were the following:

- A real test of the operational capability of all bodies, each of which had to perform its specifically assigned tasks in close cooperation with the others and in permanent contact with DI.CO.MAC.
- A first real test of the response of the Italian Regions in a joint coordinated Civil Protection effort
- The improvement of the cooperation between the National Civil Protection and that of the Campania Region in a clear framework of responsibilities and tasks.
- The MESIMEX exercise had in addition the overall benefit of obliging all bodies and structures, to whom the Vesuvius emergency plan assigned specific tasks, to be fully aware of their role and responsibility and to test their effective preparedness.

5.2 Major problems encountered

In the phase of MESIMEX preparation, the major difficulty encountered was the negative attitude against the exercise of Administrators of one Vesuvius Red Zone Municipality who complained their alleged scarce involvement, though their time objective was to rediscute

with DPC the Vesuvius emergency plan. After several meetings and a decisive intervention of both national and regional authorities, their difficulties were overcome and all Vesuvius Municipalities took active part in the exercise.

During the exercise some practical problems were encountered regarding mostly the telecommunications, such as some difficulties in ensuring an effective radio link among the teams operating in the field and the emergency coordination structures (both at the Campania Region and at DI.CO.MAC.). This problem is being solved as the Campania Region and DPC are creating an efficient radio network that will cover the whole region. Also the video conferences suffered some difficulties and the system will have to be improved to ensure more efficient contacts between Campania Civil Protection, DI.CO.MAC. and OV.

The decision to have the scientific coordination and evaluation activities in a place (Campania Region) physically distinct from DI.CO.MAC. (Naples Prefecture) proved a right one as it permitted to avoid disturbing interferences between two basically different functions. However, in preparation of a time emergency, graphic and printing system and a very efficient electronic link has established with the monitoring room of OV.

FAST:

The major problem regarded the difficulty of obtaining from consular authorities or Italian police stations an updated reliable list of the foreigners present in the risk area and their actual distribution on the territory.

During the population evacuation to the checkpoints some (minor) problems were encountered due to traffic and car accidents (not involving exercise vehicles); however this kind of problems should not occur in a real evacuation as no private traffic will be allowed and all roads will be severely controlled by the police.

5.3 Lessons Identified for improvements with regards to emergency preparedness and response as well as to exercise preparation.

The following main lessons were identified for improvements:

- The simulation of the expected ash fallout indicated that in some zones near but external to the Red Zone, which according to the emergency plan will not be encountered before the eruption onset, there might be a significant number of roof collapses because of an heavy ash load; this problem will have to be conveniently observed in the plan updating.

- The simulated precursory phenomena indicated as possible event the occurrence of an eruption from the flank of the volcano; as the simulation of the most dangerous event , i.e. the generation of pyroclastic flows (p.f.), has been so far made assuming always an eruption from the central crater, there is an urgent need to simulate p.f. effects among the eruption event so to evaluate whether there will be modifications in the Red Zone boundaries.
- The damages caused by the simulated but realistic precursory earthquakes affected very early the circumvesuvian inhabited area; this requires both a more close look at the seismic vulnerability of that zone and a deep reflection on how to protect exposed people and avoid difficulties in the evacuation escape roads.
- The ash fallout simulation indicated that downwind checkpoints must be located far from the volcano.
- The simulated eruptive events indicated that the vulnerability of the lifelines (e.g. electricity lines) to a Sub-Plinian Vesuvius eruption has to be more deeply considered and included in the provisions of the emergency plan.
- The FAST activity was very useful, but it is obviously at a very early stage; this activity must be continued and expanded and its result included into the emergency plan, so to be ready to offer an efficient assistance to foreigners in the case of a true emergency.
- Very useful was also the part of the exercise devoted to the protection of the Cultural Heritage (C.H.); again this is simply a beginning and ... more activity has been carried out; the main objectives are: the inventory of all C.H. goods present in the Vesuvius risk area with a distinction between those that can be moved and those that have to be protected on site, the identification and equipping of suitable and safe goods recovery rooms, the definitive and testing of on site protection devices and, the selection and training of dedicated personnel to be conveniently equipped.

Some of these questions are being specifically addressed in a research project jointly promoted by DPC and Campania Civil Protection after MESIMEX.

With regard to the exercise preparation we cannot see any major lacunae, though several details could be improved (see chapter 5.2).

6. Conclusions including recommendations

The MESIMEX exercise has been a very positive experience and all its initial objectives have been achieved. It permitted a very realistic test of the capability of the volcanological scientific community to face a complex volcanic crisis; it provided also a complete check-up of the state of the volcano that confirmed that it is presently in a completely quiet phase. MESIMEX experience permitted to identify some crucial questions that, if conveniently addressed, will significantly improve the Vesuvius emergency plan (see 5.3). The exercise permitted also to strengthen the relations among both scientific and Civil Protection teams of the participating European Countries, through a deep exchange of experience and opinions. With regard to emergency preparedness, MESIMEX improved the relations between National and Campania Region Civil Protection systems and represented a fruitful occasion to improve the cooperation among DPC and all Italian Regions in a coordinated Civil Protection intervention. To the many public bodies that would have a relevant role to play in a true emergency, it offered the fundamental opportunity of improving their cooperation sharing common objectives but in a well defined framework of separated specific tasks and responsibilities.

As already stressed in chapter 5.3, very positive proved the idea of including in MESIMEX activities devoted to the assistance of foreign people (FAST) and to the protection of the Cultural Heritage exposed to the volcanic risk. As practically it is during MESIMEX that these two questions have been firstly addressed, it is recommended to continue play.

Vesuvius scenario is a very complex one and in case of eruption, the emergency to be faced is perhaps the most difficult in the world because of the great number of exposed people. To increase the probability of success of the emergency plan, both DPC and Campania Region should intensively their efforts in educating vesuvian population and its Administrations to increase their risk perception, to assimilate the correct behavior to be adopted during an emergency and to respect the risk environment where their live.