"Insights from volcanic unrest simulation exercises"

2nd VUELCO short-course: «Coping with volcanic unrest»
Roseau (Dominica), 14th May 2015

Stefano Ciolli, Chiara Cristiani – Department of Civil Protection, Italy
OVERVIEW ON CIVIL PROTECTION EXERCISES:

- goals
- types
- organization
- good practices

VUELCO PROJECT EXERCISES:

- Colima exercise: preparation, development, debriefing.
- Cotopaxi exercise: “ “ “ “

SYNTHESIS AND LESSON LEARNED

INTRODUCTION TO VUELCO DOMINICA VOLCANIC UNREST SIMULATION EXERCISE
EXERCISE GOALS

Exercises are essential to:

- Test existing procedures and emergency plans (communication chain, means, emergency areas, evacuation routes, functionality of operational centers, radio-communication, displaying of forces, timing, ...).
- Improve people preparedness.
- Improve cooperation and relationships among stakeholders.
- Raise attention on the spot.
- Let problems come up.
- Judge scientists skill
- ...

Exercises should be repeated frequently according to: behaviour of the volcano, socio-economic context, risk perception level, changes in political administration...

They risk to become ineffective if limited to single events!
**TYPES OF EXERCISE**

**Table-top**
- Test the command and control chain of emergency response (protocols and procedures) at national, regional or municipality scale.
- Do not involve the population.

**Full-scale**
- Test the whole response system (roads, evacuation, communication). Usually after some TT.
- Involve the population.

**Reduced**
- Not reduced

**Announced**
- Unannounced

**Degraded mood**
- No limitations
EXERCISE ORGANISATION

Things to be defined in advance:

- **Goals**
- **Type of exercise**
- **Scenario**: type of hazard (or multihazard) and its evolution
- **Scale**: national, regional, municipal
- **Players and observers**
- **Roles and rules** (possibly according to reality)
- **Budget**
- **Duration** (real and simulated)
- **Logistics**
- **Agenda**
- **Debriefing**: oriented to aspects that need to be analysed
# Name of the Exercise

<table>
<thead>
<tr>
<th>Type of exercise:</th>
<th>Site address of exercise:</th>
<th>Scheduled date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Table-Top</td>
<td></td>
<td>Level of the players</td>
</tr>
<tr>
<td>2. Full scale</td>
<td></td>
<td>Time slot:</td>
</tr>
<tr>
<td>3. Reduced</td>
<td></td>
<td>1. Day/night</td>
</tr>
<tr>
<td>4. Announced</td>
<td></td>
<td>2. AM/PM</td>
</tr>
<tr>
<td>5. Unannounced</td>
<td></td>
<td>3. Begin of exercise:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. End of exercise</td>
</tr>
</tbody>
</table>

### Theme

<table>
<thead>
<tr>
<th>Objectives</th>
<th>General Objective:</th>
<th>Interim Objectives:</th>
<th>Specific Objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1:</td>
<td>2:</td>
<td>1:</td>
</tr>
<tr>
<td></td>
<td>2:</td>
<td>3:</td>
<td>2:</td>
</tr>
</tbody>
</table>

### Players

<table>
<thead>
<tr>
<th>Players</th>
<th>Lower Animation</th>
<th>High Animation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CP of operators</td>
<td>e.g. Regional Civil P</td>
</tr>
<tr>
<td>Private company</td>
<td>CP of operators</td>
<td>e.g. Regional Civil P</td>
</tr>
<tr>
<td>Operators</td>
<td>CP of operators</td>
<td>e.g. Regional Civil P</td>
</tr>
<tr>
<td>Electricity</td>
<td>CP of operators</td>
<td>e.g. Regional Civil P</td>
</tr>
<tr>
<td>Railway company</td>
<td>CP of operators</td>
<td>e.g. Regional Civil P</td>
</tr>
</tbody>
</table>

| Public Institutions: | e.g. Mayor | e.g. Regional Civil P |
| Private Company:     | Students, Consultant, Scientists - Experts |

<table>
<thead>
<tr>
<th>Kinetic</th>
<th>Speed?</th>
<th>Slow?</th>
<th>Compressed time?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather</td>
<td>Real?</td>
<td>Fictitious?</td>
<td>If fictitious:</td>
</tr>
<tr>
<td>--------------</td>
<td>-------</td>
<td>-------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Direction of wind</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Hygrometry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Speed wind</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication</th>
<th>yes</th>
<th>no</th>
<th>If yes, who, where and when?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>yes</td>
<td>no</td>
<td>Who and since when.</td>
</tr>
<tr>
<td></td>
<td>yes</td>
<td>no</td>
<td>In case roles and number of figurants should be planned</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario and timetable</th>
<th>Outline and cutting time:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phase 1: .....................</td>
</tr>
<tr>
<td></td>
<td>Phase 2: .....................</td>
</tr>
<tr>
<td></td>
<td>Phase 3: .....................</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Logistics</th>
<th>Drinks, meals, blankets, etc.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Evaluators</th>
<th>1....................., 2....................., 3.....................</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Observers</th>
<th>1....................., 2.....................</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Hot feedback</th>
<th>What time, where and with whom? In general just after the end of the exercise or one day later.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cold</th>
<th>What time, where and with whom? In general 30 days after the end of the exercise</th>
</tr>
</thead>
</table>
SOME GOOD PRACTICES FOR EXERCISES

**Organisation:** based on regulations and laws of the country and goal oriented

**Coordination:** a steering group should be in charge of coordination and leadership

**Scenario:** to test the scientific response, a «hidden direction team» is necessary to define the scenario and possibly modify it timely (even in response to the reactions of the participants)

**Work plan:** essential to clarify goals, participants, command-chain, roles, rules, strategy, agenda...

**Preparation time:** at least 6 to 12 months are usually necessary to prepare a full-scale exercise. If the exercise is repeated on a fixed schedule, a shorter preparation time can be sufficient.

**Debriefing:** organize a hot-debriefing on the spot and possibly another one a few months later.

**Communication:** if media or people are involved a communication plan is essential (who tells what, when, where, by what mean, who prepare the contents).

**Players:** preparation should involve all players since the beginning.
OVERVIEW ON CIVIL PROTECTION EXERCISES:
- goals
- types
- organization
- good practices

VUELCO PROJECT EXERCISES:
- Colima exercise: preparation, development, debriefing.
- Campi Flegrei exercise:
- Cotopaxi exercise:

SYNTHESIS AND LESSON LEARNED

INTRODUCTION TO VUELCO DOMINICA VOLCANIC UNREST SIMULATION EXERCISE
VUELCO EXERCISES

Work Package 9: Decision making and unrest management
Task 9.6: Simulation of unrest and decision making

TARGET VOLCANOES

- Colima (MEX) Nov. 2012
- Cotopaxi (EC) Nov. 2014
- Soufrière Hills (UK) May 2015
- Morne aux Diables (WD) May 2015
- Teide (E)
VUELCO EXERCISES GOALS:

- Explore the applicability and helpfulness of the methods, models and procedures developed within the project (especially probabilistic models and communication protocols), to the decisional-operational chain in an unrest crisis. (as defined by Project Annex 1: “Description Of Work” -Task 9.6)

- Other goals defined at local/national level in agreement with local authorities.
Colima Volcano Exercise
17th – 24th November 2012

FULL-SCALE EXERCISE
(focused on scientific and civil protection aspects)
PREPARATION

- Distribution of a wide bibliography
- Distribution of the simulation plan
- Field-trip
- Involvement of Civil Protection representatives from: Colima, Jalisco, Italy
DEVELOPMENT
4 phases + evacuation and debriefing in 4 days (2h)

…focus posed on subsequent phases:
EXERCISE PHASES:

A. **Analysis and interpretation of precursory signals.**

B. **Elaboration of scenarios and advice-giving.**
   
   Possible scenarios defined:
   1. Effusive
   2. Explosive (sub-Plinian, Plinian)
   3. Mixed (dome growth and destruction)
   4. Flank collapse
   5. Eruption stop

C. **Decision making.**

D. **People and media communication.**
   Meeting with population + press conf.

E. **Evacuation of an exposed village.**
   200 people
F. Debriefing. via email after 2 months

- Colima monitoring and surveillance system.
- Colima Civil Protection system.
- Scientific Advisory Committee management and advice-giving.
- Organization and development of the next exercises.
2nd VUELCO EXERCISE

CAMPI FLEGREI caldera

TABLE-TOP REDUCED SIMULATION
(focused on scientific aspects)
PREPARATION

✓ Distribution of a summary report on volcanic hazard

✓ Distribution of the simulation plan

✓ Field-trip and visit to volcanic observatory.

✓ One day briefing session.

✓ Involvement of Civil Protection representatives from: Italy (national and regional), Dominica, Spain (Canary Island) and Argentina.
Volcano team released volcano signals.

INGV communicated what they can observe with monitoring networks (possible degraded mood) and delivered a bulletin.

SAC evaluated the ongoing situation, on the basis of the bulletin delivered by the INGV-OV. After an initial analysis of the report, they had a videoconference with INGV-OV in Naples, in order to ask for further details. After that they had the time (a couple of hours) to discuss and to elaborate a written report to DPC.

Following the release of the advice from the SAC, an interaction phase occurred, during which DPC had the opportunity to ask the SAC more information and/or evaluation regarding the advice released.

This process was repeated across 4 subsequent meetings, each time simulating increasing monitoring signals.

[Probabilistic models were included in INGV report (BET) and provided by CSIC (HASSET). In the third phase, after releasing the advice, the DPC asked the SAC for further information. To answer some of these questions, the SAC decided to perform an elicitation].

DEVELOPMENT

4 phases + debriefing in 3 days (in 2 cities)
To optimize the short time available, 4 working-phases were shifted between Naples and Rome.

<table>
<thead>
<tr>
<th>VOLCANO</th>
<th>INGV-OV</th>
<th>SCIENTIFIC COMMITTEE</th>
<th>DPC - CGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUN 10/02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Signals outcome 1</td>
<td>Start of 1st phase-release of 1st comm.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Release of 1st INGV bulletin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAR 11/02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Videoconference</td>
<td>Start of 1st phase works</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Signals outcome 2</td>
<td>Start of 2nd phase-release of 2nd comm.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Releasing of advice n.1</td>
<td>Alert level definition-end of 1st phase</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lunch</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Lunch</td>
<td>Start of 2nd phase works</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Videoconference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Signals outcome 3</td>
<td>Start of 3rd phase-release of 3rd comm.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Releasing of advice n.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Release of 3rd INGV bulletin</td>
<td>Alert level definition-end of 2nd phase</td>
<td></td>
</tr>
<tr>
<td>MER 12/02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Videoconference</td>
<td>Start of 3rd phase works</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Signals outcome 4</td>
<td>Start of 4th phase-release of 4th comm.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Releasing of advice n.3</td>
<td>Alert level definition-end of 3rd phase</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lunch</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Lunch</td>
<td>Start of 4th phase works</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Videoconference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Releasing of advice n.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HOT-DEBRIEFING
Half day debriefing session on site.

GENERAL ASPECTS

SCIENTIFIC PROCESS

COMMUNICATION AND INTERACTION BETWEEN SCIENTISTS AND CIVIL PROTECTION

- Structure, composition and activities of the Scientific Advisory Committee.
- Advice contents and releasing procedures.
- Better definition of alert levels.
- Organization and development of the next exercises.

LESSON LEARNED...

STRENGTHS

WEAKNESSES

SUGGESTIONS FOR
Questions for scientists:
- Completeness and adequateness of information and data to define possible scenarios.
- Usefulness of probabilistic forecasting models for scientific analysis and advice releasing?
- Effectiveness of Scientific Advisory Committee functioning and of advice releasing modalities?

Questions for civil protection representatives:
- Main differences between Italy and your Country, regarding the organization of support given by the scientific community to the civil protection.
- Communications flow among the different groups
- Usefulness of probabilistic hazard assessment into scientific advise?
3rd VUELCO EXERCISE

COTOPAXI Volcanic Unrest Simulation Exercises
Quito (Ecuador)
13th November 2014

TABLE-TOP REDUCED SIMULATION
(focused on scientific aspects)
PREPARATION

 ✓ Distribution of a document on eruptive scenarios.

 ✓ Field-trip and visit to volcanic observatory.

 ✓ Summer-school.

 ✓ Involvement of Civil Protection representatives from: Ecuador (national, regional, local), Italy.
DEVELOPMENT
6 phases in 1 day + debriefing

VOLCANO team

monitoring signals

International Scientific Advisory Committee

IGEPN

Civil Protection

decision making
- Improvement of monitoring system.
- More consideration to probabilistic models.
- Advice contents and releasing procedures.
- Improvement of facilities at national operational room.
- Organization and development of the next exercises.
COTOPAXI VOLCANO
EXERCISE
13th NOVEMBER 2014

DEBRIEFING REPORT

WP 9: Decision-making and unrest management
Task 9.5: Simulation of unrest and decision making
OVERVIEW ON CIVIL PROTECTION EXERCISES:

- Goals
- Types
- Organization
- Good practices

VUELCO PROJECT EXERCISES:

- Colima exercise: preparation, development, debriefing.
- Campi Flegrei exercise: 
- Cotopaxi exercise: 

SYNTHESIS AND LESSON LEARNED

INTRODUCTION TO VUELCO DOMINICA VOLCANIC UNREST SIMULATION EXERCISE
## SYNTHESIS

<table>
<thead>
<tr>
<th>VOLCANO</th>
<th>COLIMA</th>
<th>CAMPIFICLEGREI</th>
<th>COTOPAXI</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>• Full-scale</td>
<td>• Table-top reduced</td>
<td>• Table-top reduced</td>
</tr>
</tbody>
</table>
| PREPARATION | • Bibliography on VH  
• Workplan  
• Field-trip  
• 3 Civil Protection inv. | • Report on VH + brief  
• Workplan  
• Field-trip + Volc Obs.  
• 5 Civil Protection inv. | • Report on scenarios  
• ...  
• Field-trip + Volc Obs.  
• 4 Civil Protection inv |
| DEVELOPMENT | • 5 ph. in 4 days (2h) | • 4 ph. in 3 days | • 6 ph. in 1 day |
| DEBRIEFING | • Cold  
• 4 themes | • Hot  
• 3 themes + questions (1/2 day) | • Hot  
• 3 themes (1/2 day) |
The essential is:
- think about them;
- know what your needs and goals are;
- inform participants.

LESSON LEARNED

- Goals
- Type of exercise
- Scenario
- Scale
- Players and observers
- Roles and rules
- Budget
- Duration
- Logistics
- Agenda
- Debriefing

...can be very different according to your needs and goals...
DOMINICA VOLCANIC UNREST SIMULATION EXERCISE

PREPARATION

✓ Distribution of a summary report on volcanic hazard and of a selected bibliography

✓ Distribution of the exercise plan

✓ Field- trip.

✓ Involvement of Civil Protection representatives from: Dominica, Caribbean, Italy.

DOMINICA EXERCISE PLAN

14th – 15th
May 2015

TABLE-TOP REDUCED (focused on scientific aspects)
GOALS

- Explore the applicability and helpfulness of the methods, models and procedures developed within the project (especially probabilistic models and communication protocols), to the decisional-operational chain in an unrest crisis. (as defined by Project Annex 1: “Description Of Work” -Task 9.6)

- Other goals defined at local/national level in agreement with local authorities. (as defined in the workplan)

To test:

- The Communication of scientific information from the monitoring scientists to the Office of Disaster Management (ODM) of Dominica.
- The ODM response mechanisms for volcanic emergencies.
- The emergency protocols of the SRC (the regional monitoring entity) in dealing with volcanic emergencies.
- The Regional Response Mechanism for volcanic emergencies.
DEVELOPMENT
3 phases + debriefing in 2 days

International Scientific Group (by disciplines)

Probabilistic models

SRC

monitoring signals

VOLCANO team

Civil Protection

decision making
### HOT-DEBRIEFING

<table>
<thead>
<tr>
<th>General Aspects</th>
<th>( \text{STRENGTHS} )</th>
<th>( \text{WEAKNESSES} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Process</td>
<td>( \text{STRENGTHS} )</td>
<td>( \text{WEAKNESSES} )</td>
</tr>
<tr>
<td>Interaction Scientists-Civil Protection</td>
<td>( \text{STRENGTHS} )</td>
<td>( \text{WEAKNESSES} )</td>
</tr>
<tr>
<td>Civil Protection Aspects and Public Comm.</td>
<td>( \text{STRENGTHS} )</td>
<td>( \text{WEAKNESSES} )</td>
</tr>
</tbody>
</table>

- ...  
- ...  
- ...  
- ...  
- ...
Thank you