2016

"Monitoring and Evaluation of Natural Hazard Preparedness at School Environment"

Newsletter #4

Field trials: Protection against volcanic hazard in the school environment

Humanitarian Aid and Civil Protection

Project co-funded under the Union Civil Protection Mechanism, Grant Agreement No. ECHO/SUB/2014/698447

CONTENTS

1. Introduction

The volcanic field trials took place in two local schools of Italy (INGV). Specifically, this field trial involved the monitoring and evaluation of the E-PreS system during the evacuation process in the school buildings. The main goal was the protection of the school staff and students from the poisonous gas that may be derived by the volcanic activity. In order to perform the respective trials the deployment and configuration of E-PreS infrastructure/system in the school was necessary. More specifically, floor-mounted sensors (RFID readers) allocated in the school facilities allowing the localization of the staff and students who participated in the trial. Also, the participants carried lightweight wearable sensors (RFID attached to the shoes of the participants) that allowed for constant, almost not perceivable, interaction between the user and the system. INGV partner prepared all printed and accompanied material that used during the drill.

2. Preparation of the field trials

2.1. E-PreS web platform at Educational Environment: General Aspects

The E-Pres web platform allows the user to:

- insert a new building plan along with all related information (e.g., number of floors, number of students in each floor, mustering stations),
- upload floor blueprints in a variety of forms (e.g., pdf, jpeg),
- insert checkpoints with associated metrics (e.g., maximum flux),

- define acceptable evacuation metrics (e.g., maximum evacuation time, number of students that did not follow the recommended evacuation path, order of class evacuation),
- fill out questionnaires regarding the building, student and staff preparedness level,
- fill out questionnaires regarding the execution of the evacuation drill.

Following a well-established solution, the user will interact with the E-PreS system by means of a web application, thus enabling both local and remote drill observation, result acquisition and decision making. The web application is accompanied by a strong authentication system ensuring the authorized access to potentially sensitive data of current and past drills. It consists of the following components:

- Drill Registration/Modification.
- Drill Review.
- Real Time Monitoring.

2.2. E-PreS web platform at Educational Environment: Testing and Evaluation

EPPO, NHMC and INCD got feedback from the users of the E-PreS web platform by a) tabletop exercises and b) questionnaires.

a) Tabletop Exercises

Tabletop exercises were implemented at EPPO's, NHMC's and INCD's premises, in order to check the functionality, usability and friendliness of E-PreS web platform. The testing of E-PreS web platform through tabletop exercises aimed to:

- evaluate the E-PreS Web Platform;
- identify weaknesses and determine how it can be improved to become more realistic and complete;
- obtain participant feedback and recommendations for web platform improvement;
- increase awareness and understanding of hazards and their potential impacts;
- adopt E-PreS platform in the emergency plan procedure according to school preparedness needs.

The duration of tabletop exercises depended on the audience, the topic being exercised and the exercise objectives. In our case the tabletop exercises were conducted in a few hours, so it was a cost-effective tool to validate the E-PreS web platform.

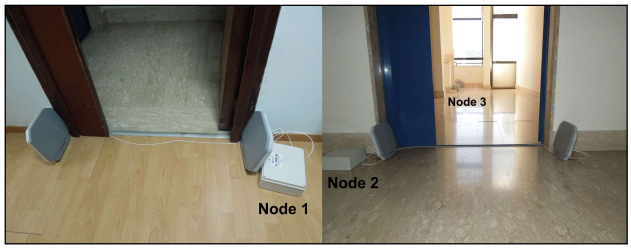
b) Questionnaires

Right after tabletop exercises, Questionnaire A was filled by EPPO's, NHMC's and INCD's staff that participated to these exercises, in order to detect participants' perception about the various principals' features of E-PreS web platform, such as: usefulness, ease of use, ease of learning etc.

Additionally, during the preparation of school drills, School Principals, teachers involved with school emergency planning and drill evaluators had the opportunity to test the E-PreS web platform and filled the following Questionnaire A as well.

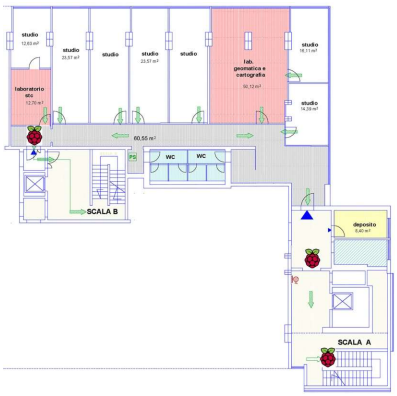
2.2.1. Testing and Evaluation in Italy: INGV Volcanic Activity Tabletop Exercise

The tabletop exercise was performed at Osservatorio Vesuviano, the Section of Napoli of INGV (Istituto Nazione di Geofisica e Vulcanologia) and involved both the members of INGV participating to the project E-preS and local colleagues asked to give suggestions about technical and procedural issues.



Checkpoint nodes displacement at 2nd floor of INGV building in Napoli

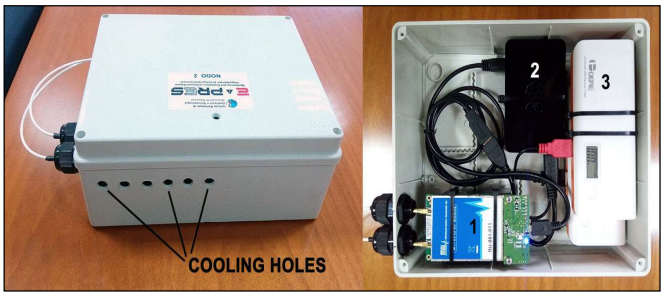
The equipment and three checkpoints were installed at the second floor of the INGV building in Napoli (Italy) in correspondence of a main and a secondary exit.



Map of the 2nd floor of INGV building. The raspberry icons represents the positions of checkpoint nodes

The tests were performed during the exercise suggested to set the Wi-Fi network by using a Wi-Fi repeater as Access Point and the others as simple Wi-Fi repeaters. This type of configuration was preferred as it is more stable and simple than the configuration with notebook as access point. During the test the Wi-Fi connection between notebook and nodes was excellent.

The tests also showed the necessity to produce air circulation in the box containing the checkpoint electronics due to the heating of RFID reader when it is active. Also the layout of electronic components inside the box was chosen in order to obtain more efficient heat dissipation of the RFID reader without overheating the other components.



The box containing the checkpoint electronics (1=RFID reader; 2=Raspberry Pi; 3=power banks). The picture on the left shows the cooling holes to allow the air circulation inside the box

RFID tags used by INGV

The RFID tags chosen are watch-type ones. The watchstrap revealed to be very easy to fix to lace-up shoes, to buckles and small ankles of children.

Particular of the metal clamps fixed to antenna. They provide a good stability preserving the correct orientation of the antenna.

All the electronic components are fixed to a Plexiglas plate by using small bands. The Plexiglas plate is fixed to the box with screws. The two power banks are fixed with Velcro tapes and the banks gave a long-life power (18000 mA x 2) to the node. The Velcro allows to rapidly change the power banks out-of-charge with others fully charged.

After the tabletop exercise, the INGV staff filled in Questionnaire A, created for the evaluation of the platform.

3. Implementation of Drills using E-PreS System

3.1. Volcanic Drill Procedure

Volcanic drills begins with a typical acoustic signal and the evacuation procedure involves the following steps:

- *the classrooms are evacuated by students and teachers are the last one to leave the classes in order to ensure that all children are out*
- *students evacuate the school building following the exit paths according to the emergency school plan*
- *students move carefully outside the school building towards the predefined open, safe place*

3.2. Volcanic Drills

Project co funded by the DG Environment of the EU

INGV Osservatorio Vesuviano

Scuola Primaria Paritaria "San Giovanni Battista"

Progetto EU E-PreS (Monitoring and Evaluation of Natural Hazard Preparedness at School Environment)

Gentile Insegnante, in occasione dell'esercitazione di evacuazione del 7 novembre 2016 la sua classe parteciperà al sistema di supervisione dell'esercitazione, sviluppato dal progetto Europeo **E-preS**. Tale sistema si prefigge di fornire strumenti a insegnanti e studenti per comprendere al meglio come agire appropriatamente per fronteggiare l'evacuazione dell'edificio scolastico. A tal fine il progetto ha concepito un sistema tecnologico "intelligente" che identifica, simula e valuta tutte le fasi dell'emergenza durante l'evacuazione.

La preghiamo di far allacciare i TAG passivi alle stringhe delle scarpe degli alunni prima dell'inizio della prova di evacuazione e compilare il questionario di valutazione a lei rivolto ad evacuazione ultimata.

Da un punto di vista puramente tecnico il sistema consiste in un sensore passivo (**TAG**) indossabile allacciandolo alle stringhe delle scarpe (a) e un **Nodo** collegato ad antenne di prossimità a pavimento (b) collocato in modo da monitorare il passaggio dei TAG passivi nelle aree di interesse durante le prove di evacuazione.

I dati pervenuti dai sensori durante la prova di evacuazione sono immagazzinati in un sistema centrale che dispone di un modulo in grado di elaborare le informazioni spaziali, mapparle in funzione del tipo di utilizzatore (ad es: insegnante, studente, personale ATA, ecc.) e stimare la riuscita della prova di evacuazione sulla base di quanto stabilito dai piani di evacuazione. L'elaborazione dei dati così ottenuti consente quindi di valutare l'efficacia delle misure di prevenzione, dei piani di evacuazione e di stilare eventualmente nuove linee guida più efficaci.

Scuola Primaria "San Giovanni Battista" - Primo piano

Scuola Primaria "San Giovanni Battista" - Piano terra

Il sistema di acquisizione ed elaborazione del dato è strutturato in modo da avere un elevato grado di flessibilità permettendo ai supervisori delle prove di evacuazione di configurare il profilo della prova adeguandolo alle caratteristiche ambientali dell'istituto Scolastico.

Nodo con antenna di prossimità

L'Osservatorio Vesuviano (INGV) è il partner italiano del **Progetto Europeo E-PreS**, progetto orientato alla prevenzione dei danni causati da disastri naturali nell'ambito dell'ambiente scolastico.

La ringraziamo per la cortese collaborazione.

Osservatorio Vesuviano – Istituto Nazionale di Geofisica e Vulcanologia (INGV) www.ov.ingv.it

Leaflet with simple guidelines to operate with the E-preS System

In the framework of E-PreS project two volcanic drills have been held. A few days before the drills, training seminars, addressed to School Principals, teachers responsible for school emergency planning and evaluators, have been implemented in order to understand the E-PreS System. Drills were carried out according with the school's evacuation plan. A guidelines leaflet explaining how to operate with the E-preS System has been prepare in order to be distributed to involve teachers.

The drills involved two schools located inside the RED ZONE, as established in the Volcanic Emergency Plan for Campi Flegrei volcano. For the RED ZONE the complete residents' evacuation have to be done when the alarm level is declared due clear to eruptive precursors occurring and before the eruption beginning.

The days before the drill the INGV E-PreS staff met the school directors, the responsible for the emergency plan and some teachers, in order to present the E-press System and train them on its procedure. Moreover, a brief presentation on volcanic hazard in Neapolitan area and the related volcanic emergency plans was also held.

3.3. Evaluation of Volcanic Drill Procedure using E-PreS System

The evaluation of the drill using E-PreS System is very important. Two closed form Questionnaires B3 and C have been developed in order to evaluate the volcanic drill procedure using E-PreS System.

Questionnaire B3 that addressed to the teachers, the administrative staff etc. who participated to the volcanic drills has been developed by INGV.

Questionnaire C that addressed to the School Principals, the teachers that are responsible for the school emergency planning and the Drill Evaluators has been developed by EPPO.

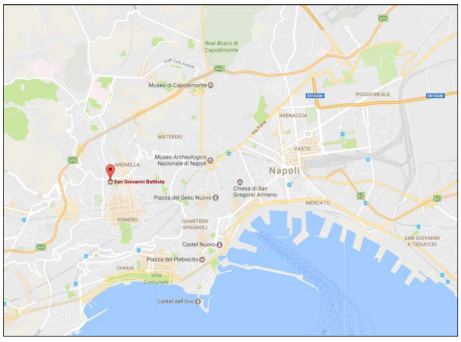
3.4. Volcanic Drills in Italy:

The INGV team performed in the city of Napoli (southern Italy) two volcanic drills involving the E-preS System.

Drill scenario

The transition from one level of alert (Base - Attention – Pre alarm –Alarm) to the other one corresponds to variation of the parameters (seismicity, ground deformation, the composition of gases in fumaroles, etc.) monitored, 24/7 by the INGV Observatorio Vesuviano and leads to a progressive increase in the probability of a new volcano eruption occurring. At the alarm level the complete evacuation of the population present in the red zone is called for. According with the Campi Flegrei plan and the declared attention level since 2012, the occurring of volcanic events as seismic swarms can request the schools evacuation. This is the drill scenario assumed.

3.4.1. Volcanic Drill at S. G. Battista Primary School



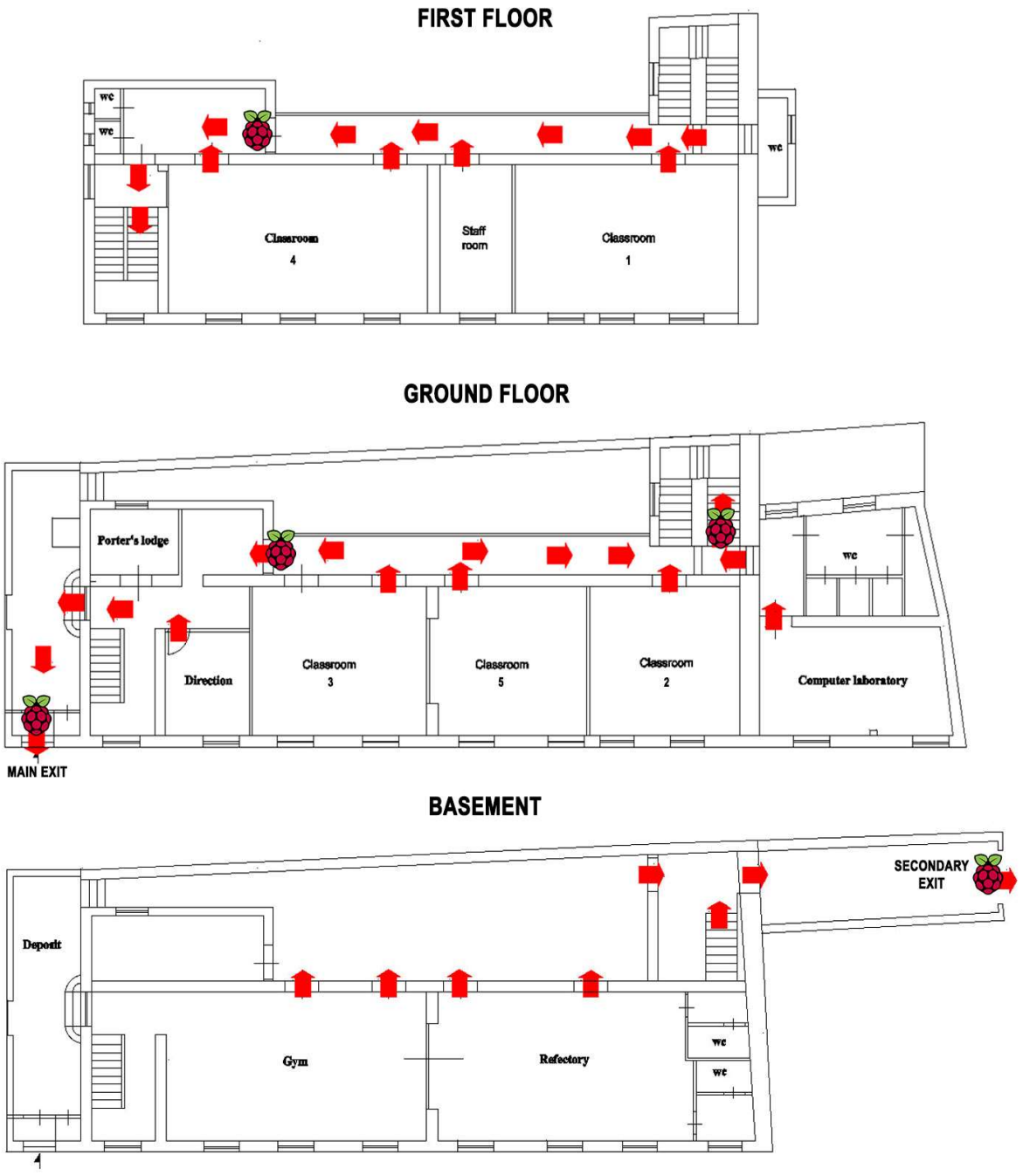
Map of Napoli city with the location of the Primary School San Giovanni Battista

The first drill took place on November 7, 2016 in the Primary School San Giovanni Battista inside the city of Napoli.

The Primary School San Giovanni Battista is hosted by a reinforced concrete building made of three floors: a basement, a ground floor and a first floor. The main exit is at ground floor and the secondary exit is at basement. At basement are placed a gym, the refectory and a little deposit; at ground floor are three classrooms, a computer laboratory, a toilet, the porter's lodge and the direction; at first floor are two classrooms, the staff room and a toilet. All the floors are connected by two different stairs.

The primary school holds 118 students, 5 teachers, 1 director and two staff persons. During the drill 5 students were absent so totally 121 tags (including teachers, staff and Director) were distributed.

The checkpoint nodes were placed in correspondence of the main exit, of the secondary exit, of the stairs accessing to the secondary exit and of the two main corridors at first and ground floors.

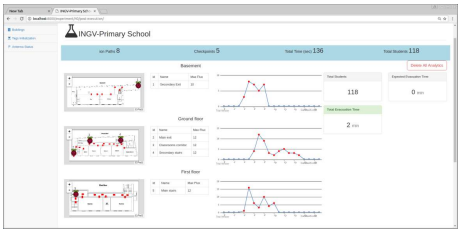


Floors plans of S. G. Battista Primary School. The red arrows shows the directions to evacuation paths. The raspberry images shows the positions of the E-PreS nodes with antennas for passive tags

Before the drill the INGV team distributed the passive tags and made a brief explanation to the students of all the classrooms about the E-preS System and its role during the drill.

At the beginning of the drill all the students were in the classrooms and nobody was in the gym, deposit, staff room and refectory. Staff persons and Director were at ground floor.

The results of drill show a total evacuation time of 136 sec in which 118 students passed the 5 checkpoints and all reached the exits.



Screenshot of some results of the drill

Checkpoints positions and main exit of S. G. Battista Primary School

Photos taken during the drill at S. G. Battista Primary School


32 Napoli Primo piano

La sicurezza

Microchip e antenne nella scuola primo test d'Italia sulle vie di fuga

A Napoli l'esperimento pilota voluto dall'Osservatorio Vesuviano

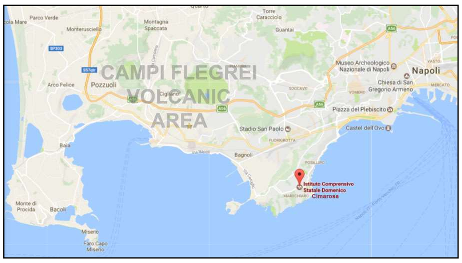
Article from the "Il Mattino" national newspaper, regarding the E-preS drill in S.G.Battista school in Naples executed by INGV Osservatorio Vesuviano

In order to disseminate the E-preS Project objectives, a journalist of the national newspaper "Il Mattino" was invited to be present during the drill and an article was published the day after.

In addition a video interview was made to INGV team by the journalist and it was published in the web site of the newspaper at the following link:

http://www.ilmattino.it/napoli/cronaca/microchip_e_antenne_nella_scuola_primo_test_d_italia_sulle_vie_di_fuga-2067798.html

3.4.2. Volcanic drill at D. Cimarosa Secondary School

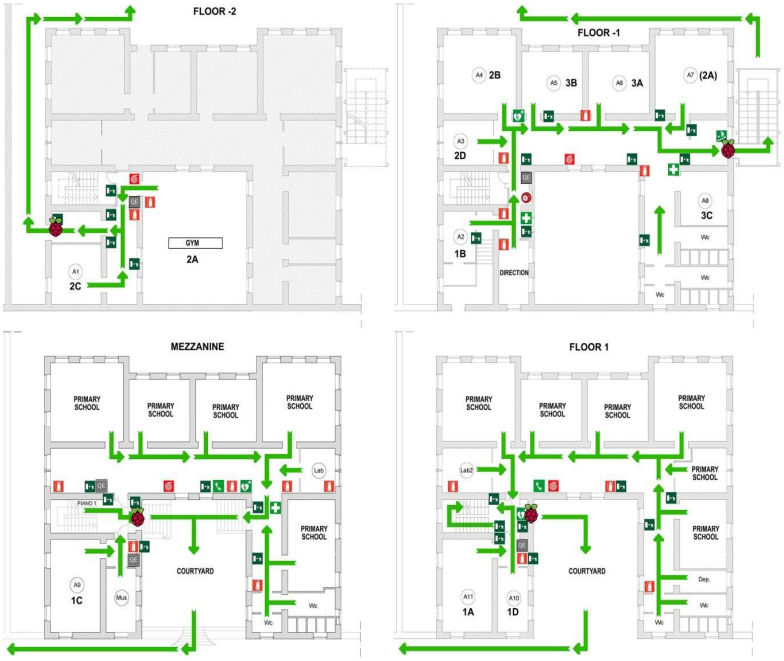


Map of western part of the city of Napoli and the Campi Flegrei volcanic area, with the location of the Primary School San Giovanni Battista

The drill took place on November 30, 2016 at D. Cimarosa Secondary School, Marechiaro Plexus, located in the western part of city of Naples (Italy) inside the RED area of Campi Flegrei volcanic caldera.

The building of D. Cimarosa Secondary School is made of four floors (figure 1) which hosted both the Primary School and the Secondary School. The drill concerned the Secondary School.

The building has three exits at floor -2, floor -1 (outside stairs) and at mezzanine (floor 0) respectively. At floor -2 are placed one classroom of Secondary School and the gym, which at the moment of the drill was occupied by the students of classroom 2A; at floor -1 are seven classrooms, the direction and the toilets; at mezzanine (floor 0) are two classrooms of Secondary School, five classrooms of the Primary School, a small laboratory, a magazine and the toilets; at floor 1 are two classrooms of Secondary School, six classrooms of the Primary School and the toilets. All the floors are connected by one stair except for floor -1 which has also an outside emergency stairs.



Floors plans of D. Cimarosa Secondary School. The green arrows shows the directions to evacuation paths. The raspberry images shows the positions of the E-preS nodes with antennas for passive tags

Checkpoints positions at D. Cimarosa Secondary School

Results of the drill at D. Cimarosa Secondary School

The D. Cimarosa Secondary School holds 11 classrooms covering totally 130 students and 11 teachers. During the drill the students of classroom 2B were absent (excursion outside the school) so totally 201 tags to students and 11 tags to teachers were distributed.

Before the drill the INGV team distributed the passive tags to students and teachers and made a brief explanation to the students of all the classrooms about the E-preS System and its role during the drill.

The results of drill show a total evacuation time of 179 sec in which 201 students passed the 4 checkpoints and all reached the exits.

After this testing course Questionnaire A was filled by School Principal and teachers involved with emergency planning and drill evaluators that participated to the preparation of the drill, in order to evaluate the various principal motives of E-PreS web platform.

Photos taken during the drill execution at D. Cimarosa Secondary School

Overview and Evaluation of E-PreS System at Naples Drill

After the end of the drill, an analysis procedure followed.

Questionnaire B3 was filled by teachers, administrative staff of schools etc. that participated to the drills, in order to evaluate the drill procedure using E-PreS System.

Questionnaire C was filled by the user(s) of E- Pres System during the drills (Drill Evaluator), in order to evaluate the E-PreS System.

The outcomes of both dynamic assessment module and web portal were discussed with the school staff and the students.

4. Importance of Evaluation of E-PreS System through Emergency Drills

Drills are an opportunity for schools and organizations to practice what to do during emergency case, such as earthquakes, and to improve their preparedness.

- During an emergency situation, life protecting actions must be taken immediately. There will be no time to decide what to do next; everyone must already know how to react appropriately.
- School safety and educational continuity require a dynamic, continuous process initiated by management and involving teachers, students, parents etc. A School Disaster Plan is always a work-in-progress, and never a finished document.
- School Emergency Plan should include: entrances and emergency exits, visitor check-in point, emergency open safe assembly area, gas, electricity and water shut off location(s), building evacuation routes, hazardous materials locations, fire suppression equipment locations, first aid staging area, roles and duties of teachers and school staff etc.
- Emergency drills/small scale exercises are an extremely important part of School Emergency Plan because they: 1) teach students and staff how to respond to the complications of a disaster e.g. an earthquake 2) help School Principal and staff to evaluate how well all parts of the emergency plan work together, and how well the staff and students are trained 3) offer an opportunity to identify training needs, gaps and vulnerabilities, establish new reflexes, and teach through action and repetition.
- Emergency drills and exercises should be conducted regularly in schools and working places to develop the capacity of students and staff to respond to a disaster, as well as to raise the awareness of students and staff on disaster mitigation. They are intended to be part of a larger continuous cycle of planning, training, exercising, analyzing shortcomings, and identifying areas requiring improvement, as well as subsequently taking of corrective actions.

So it is obvious that the importance of integrating drills using the E-PreS System into this broader cycle of improving preparedness is crucial.