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# SCIENTIFIC REPORT

## The October 30, 2020, Mw=6.9, Samos (Eastern Aegean Sea, Greece) Earthquake: Preparedness and Emergency Response for Effective Disaster Management

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## 1. INTRODUCTION

On October 30, 2020 (11:51:26 UTC time) an earthquake struck the eastern part of Greece and the western part of Turkey. The magnitude has been assessed as  $M_w=6.9$  and its focal depth was determined at 13 km (Papadimitriou et al., 2020). Based on the fault plane solutions provided by several seismological observatories and institutes, the earthquake was generated by the activation of an E-W striking and N-dipping normal fault offshore northern Samos.

The mainshock was felt in several areas of Greece and Turkey, from the North Aegean Islands to Peloponnese in Greece and from the Minor Asia to Istanbul in Turkey. The most affected areas were the Samos Island in the Region of North Aegean (Greece) and Izmir city along the Turkey's Aegean coast. Unfortunately, it claimed 119 lives, in particular 117 in Izmir city and 2 in Vathy town of Samos Island based on official announcements of authorities in Greece and Turkey respectively, involved to the earthquake disaster management (General Secretariat of Civil Protection, 2020; AFAD, 2020). As regards the injured, 1034 were reported in Turkey and 19 in Samos (General Secretariat of Civil Protection, 2020; AFAD, 2020). The fatalities and injuries are attributed mainly to partial or total collapse of buildings and secondarily to debris falling.

The 2020 Samos induced primary and secondary environmental effects in Samos Island (Lekkas et al., 2020; Triantafyllou et al., 2020). The primary effects included permanent surface deformation and coseismic surface ruptures, while the secondary effects comprised tsunami, slope failures and liquefaction phenomena (Lekkas et al., 2020; Triantafyllou et al., 2020).

As regards damage on the built environment of Samos, the old structures with load-bearing masonry walls built on the beginning of the previous century suffered the most by the earthquake (Lekkas et al., 2020; Vadaloukas et al., 2020). Structural damage varied from heavy cracking to partial or total collapse of the structures. Non-structural damage included small cracks and detachment of plasters from the masonry walls.

Every time a strong earthquake strikes, disaster management plans for emergency response tested in drills are applied under real conditions and on large scale. After the 2020 Samos earthquake caused many environmental effects and damage to buildings and infrastructures, Greek authorities launched the largest mobilization of resources for assisting the affected population since the completion of "Enceladus", which is the national action plan for earthquake disaster management in Greece.

Public authorities from all administration levels, civil protection agencies as well as security and armed forces were mobilized for the disaster management. All emergency plans for protection of life, health and property of the affected population and of the natural environment were applied according to the existing legislation for Civil Protection in Greece. The immediate response comprised first-aid treatment and medical care, search and rescue operations, provision of emergency supplies, provision of emergency shelters, building inspections and assessment of damage extent. Moreover, Greek government announced the



implementation of measures for financially supporting the affected population. The provided financial assistance included immediate relief measures and financial assistance for reconstruction and repairs.

This report focuses on the actions of the emergency response taken shortly after the earthquake. These actions comprised initial notification of the earthquakes, earthquake alerts and announcements, guidance through 112 emergency communications service, mobilization of the state authorities involved in Civil Protection and disaster management, search and rescue operations and first-aid treatment and medical care, immediate housing in emergency shelters, psychosocial support for the affected population, awareness and education for the earthquake effects and protective measures due to the continuous aftershock sequence, participation of volunteer teams in disaster management, provision of essential emergency supplies, issue of Government Gazette of the Hellenic Republic for defining affected areas, post-earthquake building and infrastructure inspections and hazard mitigation actions during the emergency response. Further actions include community housing and support as well as financial assistance to the affected population comprising housing assistance and financial compensation among others.

Along with the aforementioned, an introduction to the Civil Protection in Greece is also provided presenting the resources of Civil Protection, the Greek bodies responsible for the implementation of civil protection measures, the services involved in providing disaster relief in Greece and the organizations and institutes assisting the General Secretariat of Civil Protection. Special emphasis is given on “Enceladus”, which is the national action plan for earthquake disaster management in Greece.

From the aforementioned, it is concluded that the natural disaster management policy in Greece proved to be more efficient than previously thought with a well-planned and well-structured procedure for dealing not only with earthquakes but also with all types of natural disasters.



## 2. COMPONENTS OF DISASTER MANAGEMENT

Disaster management is generally viewed as a cycle comprising a sequence of four successive phases: mitigation (disaster risk reduction), preparedness, response, and recovery (Alexander, 2002) (Figure 1). While there is a range of terminology often used for the description of the disaster management phases, disaster management utilizes each of these four components in the following effective manner (Alexander, 2002; Coppola, 2015) (Figure 1):

(a) **Mitigation** includes (i) structural measures which are such engineering solutions to problems of safety as strict codes for hazard-resistant buildings and constructions, structural modifications, construction of community shelters, detection, deflection and retention systems as well as (ii) non-structural measures which comprise modification of human behaviour (e.g. public awareness and education, warning systems and behavioural modification) and non-structural physical modifications (e.g. land-use planning) for the lessening and the limitation of the likelihood or the adverse impact of natural hazards, environmental degradation and technological hazards.

(b) **Preparedness** involves the actions taken by the governmental disaster management agencies, professional response and recovery organizations, voluntary teams and individuals in order people to increase their chances of survival and to effectively reduce the impact of likely, imminent or current hazard events or conditions. This phase includes such activities as drawing up of general contingency plans, stockpiling of emergency supplies, construction of emergency shelters, arrangements for cooperation and coordination among agencies and public information as well as planning, organization and execution of emergency drills.

(c) **Response** is the most complex phase of the emergency management due to its performance under high stress, with time constraints and limited information about the extent of the disaster. Once a hazard event begins and is recognized, response efforts commence in earnest. They comprise emergency actions and public assistance in order to reduce or eliminate the impact of recent or ongoing disasters. The principal emphasis is given to saving and safeguarding human lives. With the mobilization of all resources and means of Civil Protection, the short-term emergency response is added in increasing priority order. The distinction between the response phase and the subsequent recovery phase is not so clear due to the fact that response actions often overlap recovery projects and programs or they may span the same time period.

(d) **Recovery** includes the repair of damage, the restoration of services, the reconstruction of facilities and infrastructure of the disaster-affected communities as well as efforts for development and implementation of measures for the reduction of the risk of a similar disaster in the future. Recovery is classified into (i) the short-term recovery phase that begins immediately after the event aiming at the re-establishment of a sense of normality in the life of the affected local population and (ii) the long-term recovery phase that begins after the



end of the emergency phase and includes rehabilitation in the frame of sustainable development and can last from months to years.

Every time a strong earthquake strikes, the disruption of the normal functioning of the affected community often exceeds its ability to cope using its own resources. Thus, the necessary response plans tested in a series of drills in all levels of administration (local, regional, central and global level) are applied under real conditions and on large scale. Moreover, within the earthquake affected region, there will be variations in the scale of the earthquake impact on the natural, human and building environment and in the capacity to manage different aspects of relief. Consequently, the various actions of the response to the earthquake disaster may be achieved within different timescales in different districts.

<b>Disaster management</b>		
<b>Prevention – Preparedness (Pre-disaster phase)</b>	<b>Response- Intervention (Disaster)</b>	<b>Restoration - Recovery (Post-disaster phase)</b>
<ul style="list-style-type: none"> <li>• Strengthening research capacity</li> <li>• Hazard - vulnerability assessment</li> <li>• Risk assessment</li> <li>• Vulnerability reduction</li> <li>• Compilation of regulations – codes</li> <li>• Spatial planning – urban planning</li> <li>• Institutional framework</li> <li>• Financial resources</li> <li>• Strengthening resources and means</li> <li>• Volunteers education and training</li> <li>• Education – informing general public</li> <li>• Communication planning – media</li> <li>• Compilation of operational plans</li> <li>• Table-top exercises</li> <li>• Field training exercises</li> <li>• Strengthening preparedness</li> </ul>	<ul style="list-style-type: none"> <li>• Decision making system – mobilization</li> <li>• Coordination of involved authorities</li> <li>• Communications</li> <li>• Assessment of extent of disaster impact</li> <li>• Search and rescue operations</li> <li>• First-aid treatment and medical care</li> <li>• Immediate care of injuries</li> <li>• Mitigation of damage induced by geodynamic phenomena</li> <li>• Evaluation of aftershock sequence and related phenomena</li> <li>• Informing affected population – media</li> <li>• Volunteers coordination and cooperation</li> <li>• International assistance</li> </ul>	<ul style="list-style-type: none"> <li>• Relief measures</li> <li>• Temporary housing</li> <li>• Social support</li> <li>• Financial assistance to the affected population</li> <li>• Informing affected population</li> <li>• Control of rumor diffusion</li> <li>• Reopening of public services</li> <li>• Management of public health issues</li> <li>• Psychological support of affected population</li> <li>• Proposals for interventions</li> <li>• Actions for special sectors (industry, tourism, environment)</li> <li>• Evaluation of actions – improvement of operational plans</li> <li>• Insurance against earthquakes and natural disasters</li> </ul>

**Figure 1:** The disaster management. Components and guidelines for the pre-disaster (prevention – preparedness), disaster (response – intervention) and post-disaster (restoration – recovery) phases (from Lekkas et al., 2019).



### 3. CIVIL PROTECTION IN GREECE

#### 3.1 The General Secretariat of Civil Protection – Objective and mission

The General Secretariat for Civil Protection (GSCP) is a subdivision of the Ministry of the Interior and was established in 1995. Its mission is to design, plan, organize and coordinate actions regarding risk assessment, prevention, preparedness, information and response to natural, technological or other disasters or emergencies, to coordinate rehabilitation operation, to monitor the above actions and to inform the public on these issues. Moreover, it organizes and supervises the Civil Protection Volunteerism System. In the context of this mission, the Hellenic Fire Service is a subdivision and operational arm of the GSCP.

The GSCP promotes the country's relations with the European Union, international organizations and other respective bodies in the field of civil protection. The competence to request international assistance on behalf of our country belongs exclusively to the GSCP. Furthermore, the GSCP contributes to the good functioning of the Civil Protection Operations Centre (CPOC), which joined the Unified Operations Coordination Centre (UOCC) of the Hellenic Fire Service.

At the national level, the Civil Protection Operations Centre (CPOC) coordinates and manages the provision of resources to address emergencies, in order to strengthen the bodies operating in the field of short-term consequence management. The CPOC operates throughout the year, on a 24-hour basis, is staffed by officers and non-commissioned officers of the Armed Forces, the Hellenic Police, the Hellenic Coast Guard and the Hellenic Fire Service and in case of an emergency is supported by specialized scientific staff, if necessary.

#### 3.2. Resources of Civil Protection and Greek bodies responsible for the implementation of Civil Protection measures

Civil Protection in Greece comprises the following resources:

(a) **Specialized civil protection officials** at central, regional and local level, who are assigned to supervise the development and implementation of plans, programs and civil protection measures and coordinate the necessary actions.

(b) **All state services, public services of local administration organizations and public utilities** responsible at operational level for the civil protection actions and more specifically for the disaster preparedness and response. These services include the Hellenic Fire Service, the Hellenic Coast Guard, the Hellenic Police Force, the National Center for Emergency Care, the Armed Forces, the Earthquake Planning and Protection Organization, services of the Decentralized Administrations, Regions and Municipalities, the Public Power Corporation and



its subsidiaries, the Hellenic Telecommunications Organization and its subsidiaries, the water supply and sewerage companies, the Public Gas Corporation, the Administrator of the Natural Gas System, the National Meteorological Service etc.

(c) **The Civil Protection organizations** including non-governmental organizations and the voluntary organizations and the specialized volunteers of Civil Protection at central, regional and local level are involved in plans and actions concerning prevention, preparedness, response and management of disasters.

(d) **Citizens with special knowledge and experience** and all means belonging to natural and legal persons with their respective operators, if necessary for the disaster management. The procedures and amounts of compensation for operators and equipment provided for protection, rescue and aid, as well as compensation for any damage or destruction are specified by the Ministry of Finance and the Ministry of Interior and Administrative Reconstruction.

### 3.3. Services involved in providing disaster relief in Greece

The services involved in providing disaster relief in Greece are the Hellenic Fire Service, the Hellenic Police Force, the Hellenic Coast Guard, the Armed Forces, and the Hellenic National Centre of Emergency Care.

The **Hellenic Fire Service** constitutes the major operational mechanism at national level of the General Secretariat of Civil Protection and deals with the management of natural and technological disasters including earthquakes, floods, CBRN incidents and threats as well as the rescue of citizens and the reduction of property losses from disasters. To that end, it utilizes the available scientific and technical data and information, it prepares, organizes and mobilizes the Fire Services personnel and equipment and it requests for assistance from other authorities, when necessary. Special mention should be made of the Disaster Management Special Units. There are eight special units able to address fires in oil refineries, liquid fuel tanks, chemical products, explosives, in high buildings, industrial and military facilities, carry out search and rescue operations in collapsed buildings after earthquake, in flood affected areas, and during accidents in sea, lakes and rivers and deal with leakage and release of chemical and hazardous materials. Each Disaster Management Special Unit consists of an underwater rescue team, a mountaineering search and rescue team, a dog search and rescue team and a team trained for chemical, biological, radiological and nuclear incidents with the appropriate equipment including vehicles and machinery.

In its continuous mission to serve and protect citizens, the **Hellenic Police Force** is involved in any emergency state resulting from natural and technological disasters in order to ensure public safety and public order in collaboration with other authorities competent in civil protection and the Armed Forces. Among other responsibilities, the police officers engage in patrol duties and traffic control in disaster affected areas, divert traffic to safe routes and safeguard property.



The **Hellenic Coast Guard** carries out search and rescue operations at sea jointly with the Hellenic Air Force, which is responsible for search and rescue by air, protects the marine environment, responds to marine pollution incidents and provides emergency maritime radio communication services.

Since 2010, the response of the **Hellenic Armed Forces** to disasters and complex emergencies is organized and coordinated according to the “Defkalion” project, which is activated when necessary by the Ministry of National Defense. As foreseen by the project, 1174 disaster relief military personnel operating directly under the command and operational control of the Hellenic National Defense General Staff are available for supporting Fire Service and other authorities competent in civil protection. Moreover, the Armed Forces provide logistics support, engage in patrol duties in affected areas, provide emergency supplies including food, water, clothing, healthcare material and emergency shelters including military tents and navy ships. They also contribute to organized evacuation of civilians from the affected area and to the partial or total post-disaster infrastructure restoration.

The **Hellenic National Centre for Emergency Assistance** (HNCEA, Greek acronym EKAV) established in 1985 is the sole public provider of emergency pre-hospital care in Greece. It is responsible for coordinating the provision of citizens with emergency first-aid treatment and medical care and their effective and prompt transfer to units providing health services. In case of massive casualties from natural and technological disasters, the Special Unit for Disaster Medicine is activated for the insurance and protection of public health during emergency situations that require pre-hospital care to a large number of victims and the coordination between emergency pre-hospital and hospital response. The Special Unit for Disaster Medicine comprises emergency physicians, nurses, paramedics and dispatchers trained in pre-hospital management of such mass casualty incidents as mass accidents and natural and technological disasters.

### 3.4. Organizations and institutes assisting the General Secretariat of Civil Protection

The services and institutes assisting the General Secretariat of Civil Protection are the Earthquake Planning and Protection Organization (EPPO, Greek acronym OASP), the General Directorate of Natural Disaster Recovery (GDNDR, Greek acronym GDAEFK), the Engineering Seismology and Earthquake Engineering Institute (ESEEI, Greek acronym ITSAK) and the Geodynamic Institute of the National Observatory of Athens (GINOA).

The **EPPO** is a legal entity of Public Law and operates under the supervision of the Hellenic Ministry of Infrastructure and Transport. EPPO is the competent authority for planning and processing the earthquake policy in Greece and is responsible for the coordination of public and private resources for the implementation of this policy. Among other activities related to disaster prevention and preparedness, EPPO mobilizes to the disaster area the Immediate Response Teams (IRT) and the Technical Teams (TT) of Experts. The IRT consists of well-



educated and experienced EPPO staff and members of EPPO advisory board for assessing the extent of damage from an earthquake, providing the proper information to the central authorities and supporting local authorities to cope with emergencies and managing the consequences of the disastrous event. The TT comprises of EPPO scientists and researchers for the interpretation of the event and of the damages occurred as well as for the installation of more scientific instruments for better monitoring of the seismic sequence if it is necessary.

The **ESSEI** was established one year after the 1978 Thessaloniki earthquake. Its role is to conduct applied research in the fields of engineering seismology, earthquake engineering and soil dynamics for the mitigation of earthquake effects on humans and structures (buildings, bridges, dams etc.). The ESSEI is one of the agencies involved in "Xenokratis" General Contingency Plan for earthquakes. After the occurrence of a strong earthquake, qualified personnel comprising researchers and technicians visit the affected area for installing temporary accelerometer arrays, acquiring data from existing strong motion accelerometer records and informing the State and all the authorities competent in disaster management with technical reports containing earthquake data (accelerometer records, ground accelerations, geotechnical data, response spectra, earthquake ground shaking amplification, seismic intensity assignments, preliminary assessment of the earthquake damage on buildings etc.).

The **GDNDR** was established in 1981 for the rapid and effective implementation of the rehabilitation of the people affected by the 1981 Athens (Greece) earthquakes. Since then, the GDNDR under the supervision of the Ministry of Infrastructure, Transport and Networks is the responsible authority for the temporary and permanent housing of people and the rehabilitation and reconstruction of areas affected by natural disasters (earthquakes, floods, fires and landslides). After an earthquake disaster, the GDNDR is mobilized in order to conduct post-earthquake damage and safety assessment in buildings of the affected area (first- and second-degree building inspections).

The **GINOA** is one of the oldest institutes in Greece operating continuously since 1893. It is the main centre in Greece for the continuous, detailed and precise monitoring of seismicity of Greece and reporting to national and international authorities. Among other responsibilities, the GINOA has a crucial mission, which is to provide the state, the GSCP, the EPPO and public with direct, detailed and reliable information related to the occurrence of strong earthquakes.

### 3.5. “Enceladus” – Action plan for earthquake disaster management in Greece

The General Secretariat for Civil Protection, aiming mainly to the coordination of bodies involved in the whole spectrum of disaster risk management, proceeded to the completion and publication of the “General Plan for emergency response and immediate/short-term management of earthquakes effects”, with codename “Enceladus” on February 2020 (Figure



2) (General Secretariat of Civil Protection, 2020). The Plan was sent to all the involved bodies, which are mentioned below in the respective subchapter.

Enceladus, in Greek mythology, is referred as the leader of the Giants, son of Uranus and Earth. During the Gigantomachy, the war between Giants and Gods for controlling the world, Enceladus was the traditional opponent of the goddess Athena (Figures 3, 4). Athena eliminated him by throwing Sicily over him. Since then, Enceladus is trying to set himself free, by causing earthquakes and volcanic eruptions.



**Figure 2:** The front cover of the “General Plan for Emergency Response and Immediate/Short-Term Management of Earthquakes Effects” with the code name “Enceladus” (General Secretariat of Civil Protection, 2020).



**Figure 3:** Athena and Enceladus fighting. Interior from an Attic red figure dish, ca. 525 BC. Musée du Louvre, Paris, France.



**Figure 4:** Pediment of the Gigantomachy in the Acropolis Museum (Athens, Greece). The goddess Athena is shown in full stride, as she overcomes the Giant Enceladus, of whom only one leg is preserved. She raises her aegis (goat-skin cape) with her left arm and holds a spear in her right hand. To the right, another Giant, falls to the ground, while at the corners of the composition two Giants gaze downward, ready to attack.

The **aim** of the General Plan for Emergency Response and Immediate/Short-term Management of Earthquakes Effects is the immediate and coordinated response of the authorities involved in National, Regional and Local level for the effective response to effects caused by earthquakes and their immediate management, actions that aim at the protection of life, health and property of citizens as well as the protection of the natural environment, the wealth-producing resources and infrastructures. The requirement for achieving this aim is the synergy, cooperation and interoperability of the authorities involved in National, Regional and Local level.

The **goals** of Enceladus comprise:

- Identification of the roles and the responsibilities of all authorities involved in National, Regional, Local level and in all phases of mobilization of the Civil Protection System.
- Setting of preparatory measures and civil protection actions that contribute to the preparedness of human resources and means for emergency response and the immediate/short-term management of earthquakes effects.
- Coordinated action of the authorities involved in the emergency response and the immediate/short-term management of earthquakes effects.
- Harmonization of all the authorities involved planning with this plan.

The **requirements for the implementation of the general plan for emergency response** comprise:

- Situation: Earthquakes belong in the category of natural disasters. They usually occur without clear warning, they cannot be prevented and despite their short duration, they may cause big damage to human infrastructures along with serious injuries and fatalities. Also, earthquake may triggered environmental effects comprising slope



failures, liquefaction, tsunami and ground cracks among others and technological disasters including disasters etc. Given the inability of short-term earthquake prediction, early warning cannot be, in general, applied in emergency response earthquake planning.

- Assumptions: Earthquakes may cause (a) injuries and fatalities and a sense of insecurity to the affected population, (b) disasters in infrastructures and in the structural wealth of the affected country, (c) direct and indirect financial losses from the disasters in private properties, in the primary sector (agriculture, livestock), in various infrastructures of the country (electricity networks, telecommunications, etc) and also effects on tourism.
- Requirements: The requirements for the implementation of the General Plan for the Emergency Response and Immediate/Short-term Management of Earthquakes Effects are the following:
  - The clarification of the roles and responsibilities of all authorities involved in Civil Protection per action based on the current institutional framework.
  - The review, update and harmonization of Civil Protection plans of all involved authorities according to this plan and the issue or the update of the corresponding memorandum actions.
  - The definition of human resources and means that might be available in National, Regional and Local level for the emergency response and the immediate/short-term management of earthquakes consequences.
  - The reassurance of preparedness of all operational authorities involved in every stage of the operations.
  - The reassurance of communication among all authorities involved for the free and continuous flow of information.
- Planning Parameters: They comprise earthquake with effects in infrastructures, buildings and public health, the involvement of the authorities in National, Regional and Local level, the inability to immediate/ short-term management of the effects in local level.

The **authorities involved** in the frame of Enceladus are the following:

- All administrative regions, regional units and municipalities.
- Ministry of Citizen Protection including the General Secretariat of Civil Protection, the Hellenic Fire Service, the Hellenic Police.
- Ministry of Infrastructures and Transport comprising the GDNDR, the General Secretariat of Infrastructures, the EPPO, the Building Infrastructure SA (former School Buildings Organization S.A.), the General Directorate of Transport Infrastructure, the General Directorate of Hydraulic, the Port and Building Infrastructure, the Dam Administrative Authority, the Airport Administrations (Hellenic Civil Aviation Authority, the Athens International Airport SA, the Fraport Regional Airports of Greece SA), the Water Supply and Sewerage Company.



- Ministry of Shipping and Island Policy including the Headquarters of the Coast Guard - Hellenic Coast Guard, port administration and operation bodies (port organizations, port funds, municipal port funds, etc).
- Ministry of National Defense including Hellenic National Defense General Staff.
- Ministry of Health comprising General Directorate of Public Health & Quality of Life, National Center For Emergency Assistance, Hellenic National Public Health Organization.
- Ministry of Environment & Energy comprising supervised bodies of the Ministry of Environment and Energy, Hellenic Survey of Geology and Mineral Exploration.
- Ministry of Education, Research and Religious Affairs including Department of Emergency Policy Planning, Geodynamic Institute of the National Observatory of Athens.
- Ministry of Culture & Sports
- Presidency of the Government
- Ministry of Labor and Social Affairs comprising General Directorate of Social Solidarity, National Center for Social Solidarity.
- Ministry of Development and Investment including General Secretariat of Industry / Directorate of Industrial Policy.



## 4. DEMOGRAPHIC, SOCIAL & ECONOMIC PROFILE OF THE AFFECTED AREA

### 4.1. North Aegean Region

The affected area is located in the central part of the North Aegean Region (Figure. 5). The North Aegean Region is bounded to the north by the Region of Eastern Macedonia and Thrace and the Region of Central Macedonia, to the west by the Region of Thessaly and the Region of Central Greece, to the south by the South Aegean Region and to the east by Turkey (Figure 5). It covers a total area of 3.836 km<sup>2</sup> and consists of large and small islands with the large inhabited islands from north to south being Lemnos, Agios Efstratios, Lesvos, Chios, Samos, Fournoi and Ikaria (Figure 6). It comprises the regional units of Lemnos, Lesvos, Chios, Samos and Ikaria from north to south. The population of the North Aegean Region is 221098 representing 2.1 % of the total population of the country.

The following data comes from The Regional Innovation Monitor Plus (RIM Plus) provides a unique online platform for sharing knowledge and know-how on major innovation and industrial policy trends in the EU regions (<https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/region/ellada/nisia-aigaiou-kriti/voreio-aigaio>).

Regional gross domestic product (GDP) has experienced negative growth over the last years, and according to the available Eurostat figures, in 2018 it only accounted for 1.4% (€2,549m) of the national GDP. On the other hand, GDP per capita in purchasing power standards (PPS) has been hovering around 15,000 between 2012-2015, and in 2018 (14,400) it ranked as last among the 13 Greek regions, below both the national (21,100) and the EU28 (31,000) averages (Eurostat, 2020).

In 2019, 1.9% of the country's workforce (74.6 thousand) is employed in the region: 76.0% in the tertiary sector, 7.8% in the secondary sector and 16.0% in the primary sector (Eurostat, 2020). According to the Eurostat (2020), in 2017 the tertiary sector dominates the regional economy, accounting for 83.5% of the regional gross value added (GVA), which totalled €2,219m, while the secondary sector share was 10.8% and that of the primary one was 5.7%, exhibiting positive trends after a decade of continuous decline.

Within the services sector, retail trade, real estate activities and transport services account almost 50% of the value added of the tertiary economy in the region. Finally, an emerging sector but with regional orientation is that of financial services.

The most dynamic manufacturing sectors are those of food and beverages, manufacture of fabricated metal products, manufacture of furniture and manufacture of wood and of products of wood. Their share in regional added value has increased over the previous decade, partly as a result of regional policies to diversify the regional economy that was heavily dependent on tourism and agriculture.

Following the economic crisis, the unemployment rate rose to 22.4% in 2014, however since then it has been steadily decreasing to 17.7% in 2019 (Eurostat, 2020). Such unemployment rate is the fifth highest among the 13 Greek regions, above the national



average (17.3%), the 2008 level (4.7%), and the current EU28 average (6.3%) (Eurostat, 2020). This negative trend can be mainly attributed to the steep reduction in demand due to reduced incomes, affecting mainly the trade and construction industries while the current refugee crisis is expected to affect negatively tourism.

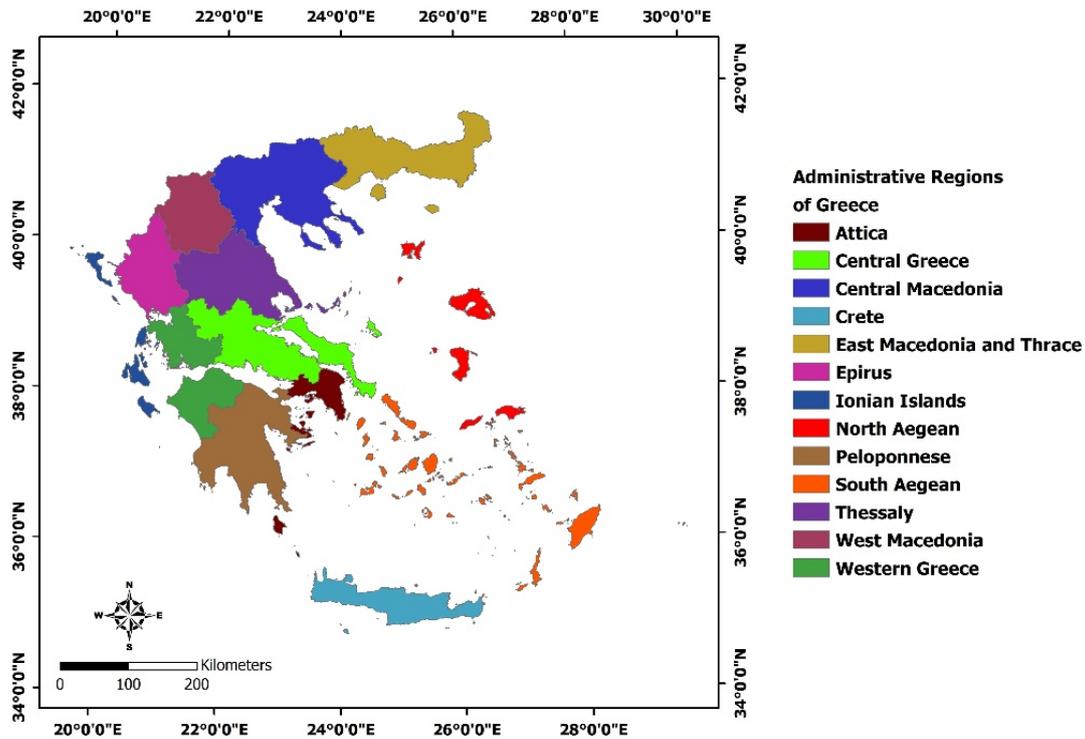


Figure 5. The administrative regions of Greece.

#### 4.2. Regional Unit of Samos

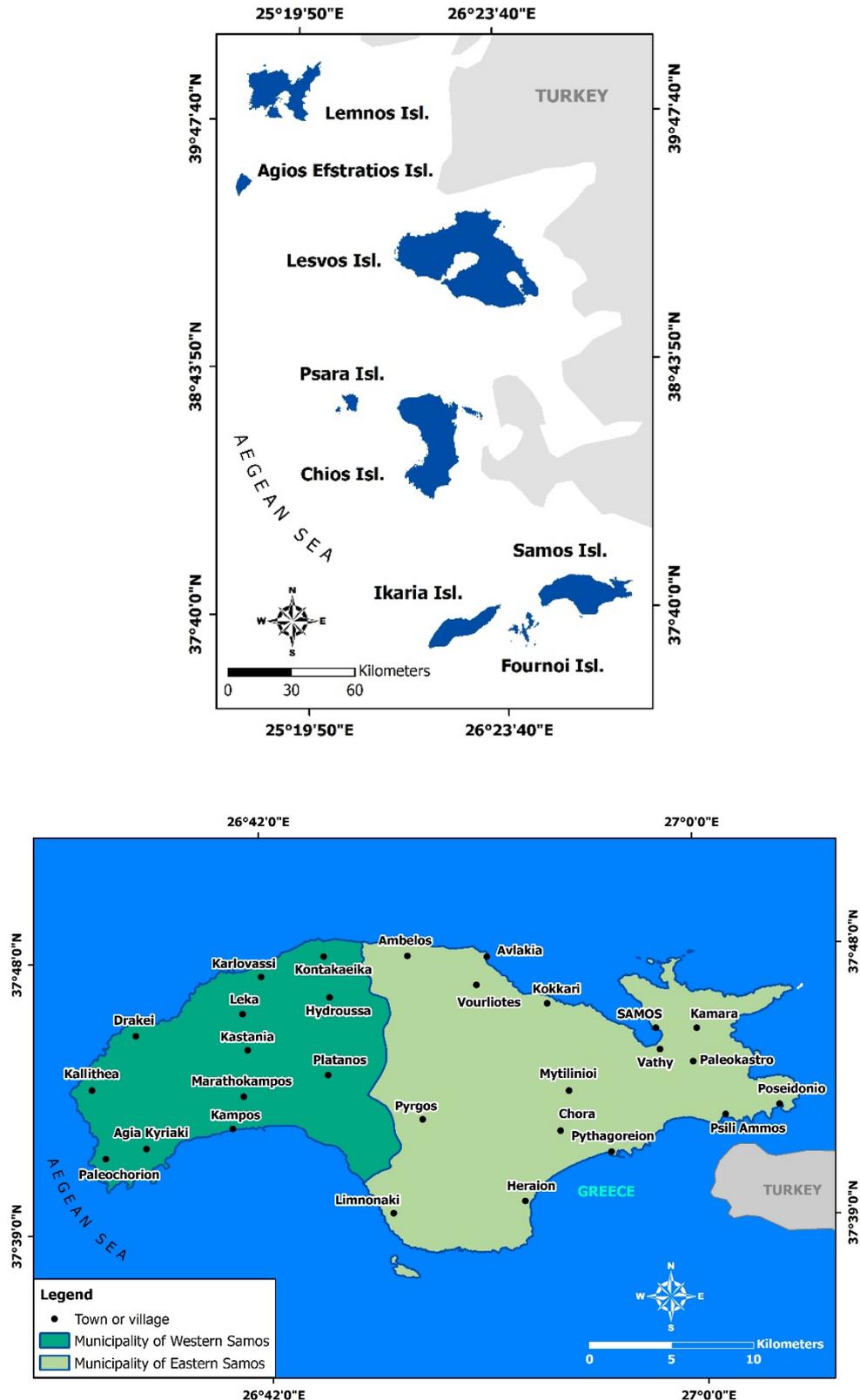
The earthquake-affected regional unit of Samos comprises 2 municipalities: the municipality of Eastern Samos and the municipality of Western Samos (Figure 6). Its total registered population is 32977 people according to the population census of 2011 (Hellenic Statistical Authority, 2011).

The municipality of Eastern Samos includes two municipal units, the municipal units of Vathy and Pythagoreion. The capital town of the municipality of Eastern Samos is Vathy and the historic capital is Pythagoreion. Its resident population is 20513 people according to the population census of 2011 (Hellenic Statistical Authority, 2011).

The municipality of Western Samos includes two municipal units, the municipal units of Karlovassi and Marathokampos. The capital town of the municipality of Eastern Samos is Karlovassi. Its resident population is 12464 people according to the population census of 2011 (Hellenic Statistical Authority, 2011).



# THE 2020 SAMOS EARTHQUAKE PREPAREDNESS & EMERGENCY RESPONSE



**Figure 6.** (Up) The largest islands of the North Aegean Region: Lemnos, Agios Efstratios, Lesvos, Psara, Chios, Ikaria, Fournoi, Samos. (Down) The Municipalities of Western and Eastern Samos along with some of their towns and villages.



## 5. PREVENTION, MITIGATION AND PREPAREDNESS BEFORE THE 2020 SAMOS EARTHQUAKE

In Greece, a national policy is in place to support earthquake prevention and preparedness in national, regional, local, workplace and family level. As mentioned before, EPPO is a Legal Entity of Public Law and operates under the supervision of the Hellenic Ministry of Infrastructure and Transport as the competent authority to develop and design the national policy on earthquake protection. EPPO, among other actions, contributes substantially to build an earthquake safety culture in order to protect the citizen's life, health and property from earthquakes. EPPO organizes and/or participates to trainings and exercises designed to help users to plan and implement effective earthquake mitigation strategies, in collaboration with the involved local authorities.

### 5.1. Risk communication and raising awareness in Samos

On March 2017, EPPO implemented the following:

- Training Seminar at Samos' prefecture level, in order to be appropriately educated and adequately trained the School's Directors and teachers responsible for school earthquake planning. The teachers were trained to follow specific documented preparedness and evacuation procedures in case of an earthquake and to teach basic safety concepts to students, including drills and other learning activities. The seminar took place in collaboration with the Samos' Divisions of Ministry of Education.
- Training Seminar targeting child care centers' personnel at Municipality level. EPPO provided education to the child care providers by utilizing a mix of brief information along with discussion, in an effort to expand their knowledge and to improve their skills on earthquake management to the specific settings (Figure 7).

### 5.2. Earthquake exercises in Samos Island

#### 5.2.1. Table-top-exercise in 2015

On April 30, 2015, a table-top-exercise took place in Samos, with the code name «Efpalinos 2015» (EPPO, 2018). Efpalinos is the name of the great architect of the ancient time, who constructed a water tunnel in the island. The exercise was planned and organized by the Prefecture of Samos with the collaboration of EPPO. In the exercise, the following agencies also participated: the Municipalities of Samos and Ikaria, the Hellenic Armed Forces, the Hellenic Police, the Hellenic Fire Service, the Hellenic Coast Guard, the National Centre for Emergency Assistance, the General Hospital of Samos, volunteer teams, etc (Figure 8) (EPPO, 2018).



**Figure 7.** Seminars for Directors of primary and secondary schools of Samos in March 2017 conducted by the EPPO (Source: EPPO).



**Figure 8.** Table-top-exercise “Efpalinos 2015”. The teams of decision makers and volunteers (Source: EPPO).

### 5.2.2. Field Exercise in 2017 – Efpalinos 2017

On March 15, 2017, the field exercise of “Efpalinos 2017” was organized by the Prefecture of Samos, under the coordination of EPPO (EPPO, 2018). According to the scenario, the earthquake was of magnitude 6.4 and characterized by focal depth of 11 km. Its epicenter was located 8km SSE of Samos Island. The local authorities participated in the exercise were the Regional Unit of Samos (Department of Civil Protection), the Municipality of Samos, the 79th Senior National Guard Battalions Command, the Police Directorate, the Fire Department, the Port Authority, the National Center For Emergency Assistance, the General Hospital, the Hellenic Electricity Distribution Network Operator, the Samos Amateur Radio Association, volunteer organizations and teams of the island as well as a 4-member Special Team for Special Missions from Ikaria (EPPO, 2018). Among the incidents of the exercise were the evacuation of buildings, decision-makers meetings, search and rescue operations, triage (for the injured), communication problems, camp management and food distribution by the Hellenic Armed Forces, organized evacuation of population and inspection of building (Figures 9, 10, 11). The level of the drill was characterized as “excellent” and “very good” by the majority of the participants (EPPO, 2018).



Figure 9. “Efpalinos 2017” Field exercise. Decision-makers meetings (Source: EPPO).



Figure 10. “Efpalinos 2017” field exercise. Search and rescue operations (Source: EPPO).



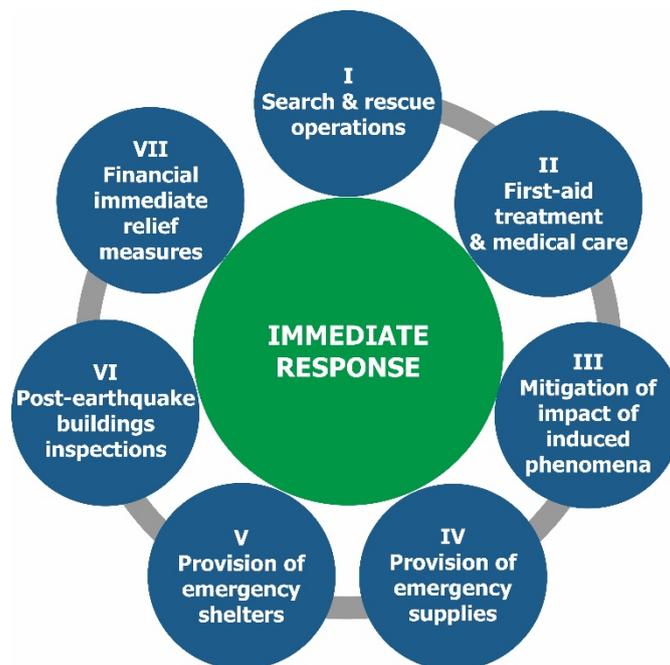
Figure 11. “Efpalinos 2017” field exercise. Food distribution by the Armed Forces (Source: EPPO).



## 6. IMMEDIATE ACTIONS OF THE EMERGENCY RESPONSE

The immediate actions of the emergency response were directly linked to the immediate rehabilitation and replacement of such utilities and services as restoration of water and sanitation services, transport and communication infrastructure etc., essential for normal existence. They comprised (Figure 12):

- (i) Search and rescue operations.
- (ii) First-aid treatment and medical care.
- (iii) Mitigation of the impact of the induced phenomena.
- (iv) Provision of essential emergency supplies.
- (v) Provision of emergency shelters and procedures of housing restoration.
- (vi) Post-earthquake building inspection.
- (vii) Immediate financial relief measures.



**Figure 12:** Immediate actions of the emergency response conducted shortly after the generation of the October 30, 2020, Mw=6.9, Samos earthquake by the authorities, agencies and services competent to earthquake disaster management. All these were assisted by volunteer teams.



### 6.1. Initial notification of the earthquakes, earthquake alerts and announcements

The staff of the local police departments in cooperation with the staff of the fire agencies initially and officially notified the General Secretariat of Civil Protection (GSCP) and especially the Civil Protection Operations Centre (CPOC) as well as their senior administration police officers and the decentralized Civil Protection Agencies for the situation in the earthquake affected area. Acting on the orders of the Prefect, the Mayor and the presidents of the local administrative districts and according to the already set contingency plans, the staff of the local Civil Protection agency collected data from the local police departments and fire agencies in order to further and in detail inform the Prefect, the Mayor, the presidents of the local administrative districts, the Civil Protection Agencies of the Region of the Ionian Islands and the CPOC / GSCP. The above actions were possible because the information and communication technology infrastructures and services were not damaged and fully operational after each earthquake. The GINOA was responsible for the earthquakes announcement and the official notification of the GSCP and the EPPO.

### 6.2. Guidelines through 112 emergency communications service

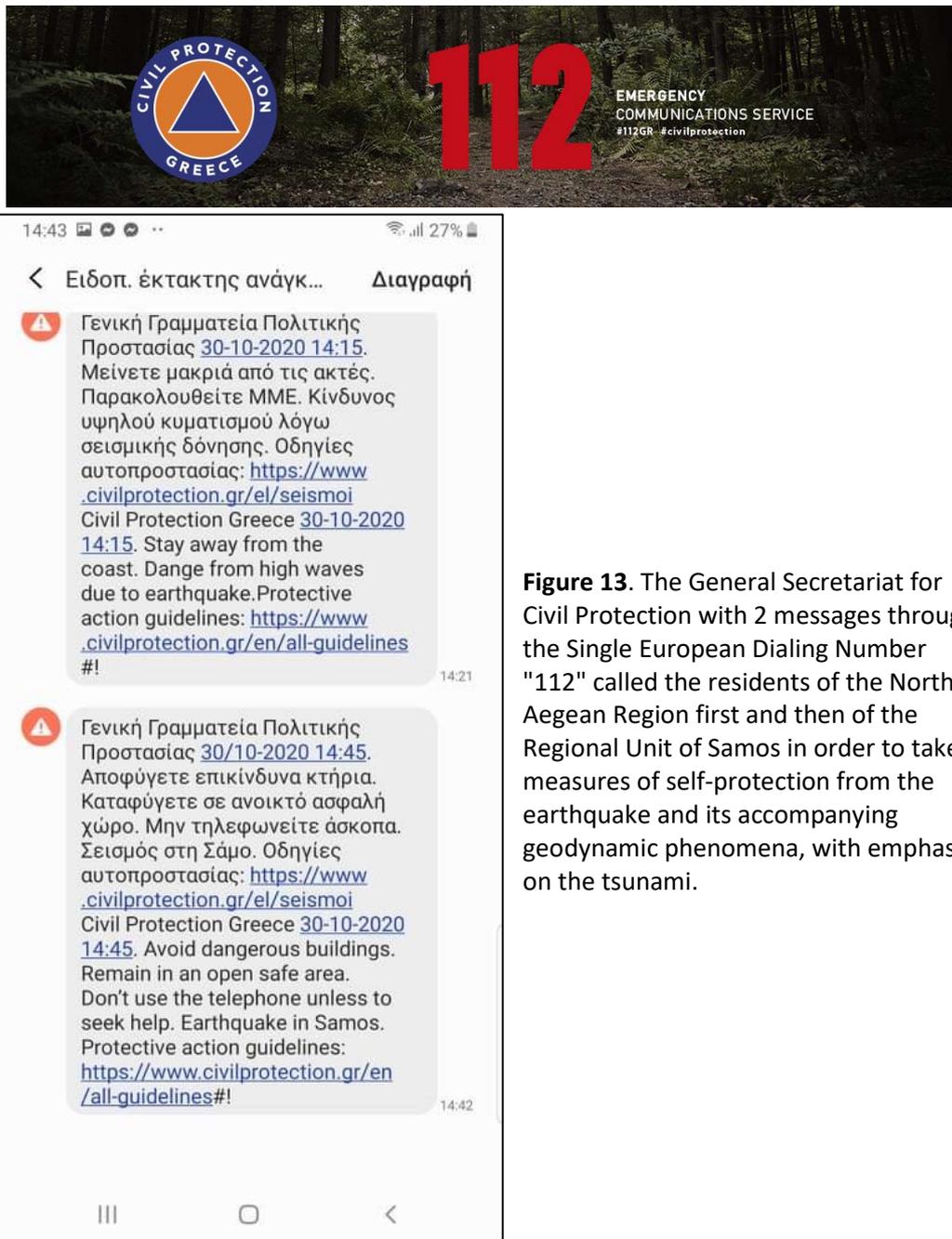
112 is an integrated emergency communications service, which includes an inbound and an outbound component. People in any emergency may dial 112 for free anywhere in Greece and the European Union. The outbound component allows people to receive warnings via multiple technologies and communication channels in case of imminent or occurring incident or dangerous situation constituting an immediate threat to their health and safety, so that they can take protective actions and measures.

The General Secretariat for Civil Protection informed residents of the islands of the northeastern part of the Aegean Sea with two messages through the single European emergency number “112” in order to take self-protection measures. The first message was sent to the inhabitants of all the islands located with the triangle Ikaria – Kos – Chios and comprised recommendations for staying away from the coasts in order to avoid the adverse effects of possible tsunami generation after the mainshock and from severely affected buildings on the verge of partial or total collapse in order to avoid falling debris in case of an aftershock (Figure 13). The second message was exclusively sent to the residents of Samos Island, who were recommended to stay away from buildings and remain to safe open sites away from the adverse effects of the earthquake and the induced geodynamic phenomena (Figure 13).

Similar information and updates were posted by the municipalities of Eastern and Western Samos on their websites with self-protection measures and information about the emergency shelters for the affected population. Recommendations included avoiding coastal areas, avoiding power lines, moving away from old and abandoned masonry buildings, away from unstable slopes, and away from streams and bridges.



They also advised residents of Samos to avoid spending the night inside their homes and to stay in safe open spaces, emergency shelters or cars and away from buildings in order to avoid debris falling and buildings collapse.



**Figure 13.** The General Secretariat for Civil Protection with 2 messages through the Single European Dialing Number "112" called the residents of the North Aegean Region first and then of the Regional Unit of Samos in order to take measures of self-protection from the earthquake and its accompanying geodynamic phenomena, with emphasis on the tsunami.

### 6.3. First assessment of the impact – Mobilization of the state authorities

The October 30, 2020, Mw=6.9, Samos earthquake disrupted the normal functioning of the island society directly through fatalities and injuries, and indirectly through damage on



building stock, infrastructure networks and facilities and economic losses. The island society resilience in the face of an earthquake disaster mainly depended on the level of preparedness of competent agencies and critical facilities at central, regional and local level of administration and on the capacity of the population to cope with the disaster and recover to the normal condition.

Immediately after the earthquake, Greek government launched a major mobilization for the assistance and relief of the affected local population. All response plans to earthquake for saving and safeguarding life and health, for protecting natural environment and properties were applied according to the existing Civil Protection framework of Greece, which is mainly based on the “Enceladus” action plan in the case of destructive earthquakes.

The mobilization of the state authorities of Greece was immediate. This has emerged through a series of natural disasters, which have hit Greece in recent decades. These disasters affected the population, the natural environment, the buildings and the infrastructure of the country, but at the same time they have worked positively in preparing and implementing more flexible and effective procedures in the first critical hours and days after a natural disaster and therefore in its management.

According to the General Secretary of Civil Protection, the prescribed protocol for destructive earthquake based on the Enceladus plan. During the first hours of the emergency response phase and among the first actions that followed the official announcement of the earthquake characteristics and the updates on the effects of the earthquake in the eastern part of Aegean, the Minister of Citizen Protection went to the operational center of the Hellenic Fire Service, from where all actions of services and agencies involved in the management of the earthquake disaster were coordinated and monitored.

The Deputy Minister for Civil Protection and Crisis Management visited the earthquake-affected island of Samos together with governmental staff comprising the Deputy Minister of Interior, the Directors of the 1st and the 2nd Regional Healthcare Authorities of the Ministry of Health, staff of the Planning and Crisis Management Directorate of the General Secretariat of Civil Protection and the First Response Team of the General Secretariat for Civil Protection (Figure 14). The assessment of the situation, which had been formed by the earthquake in the population, in the natural and in the built environment, was very important for the implementation of the planned actions to deal with the adverse effects of the earthquake ground motions. Due to the fact that the airport of Samos remained was not operational after the earthquake until the first inspection and assessment of possible damage in its facilities, the aforementioned officials visited the earthquake-affected island by helicopters.

All Civil Protection authorities and services were immediately activated to deal with the earthquake effects. They scattered throughout Samos and in the surrounding islands of the North Aegean Region in order to assess the situation and to provide immediate assistance, where necessary.

By mandate of the Chief of the Hellenic Fire Service, all the Disaster Management Special Units (E.M.A.K. – D.M.S.U.) of the Hellenic Fire Service were put on increased alert. A team of



the 1st EMAK established in Elefsina along with a rescue dog and search and rescue equipment visited Samos in order to mainly conduct search and rescue operations for trapped people (Figure 14). Moreover, rescuers from the Special Department of Disaster Medicine of the National Center for Emergency Assistance and civil engineers of the Ministry of Transport and Infrastructure visited Samos with special flights organized by the General Secretariat of Civil Protection. A second team of the 1st EMAK followed along with a second team of the Special Department of Disaster Medicine.

It is important to highlight the constant readiness of the aforementioned disaster management units. They were ready to visit not only the earthquake affected area of Samos, but also the worst affected coastal parts of the neighboring Turkey, in order to assist the search and rescue operations conducted by the respective disaster management units of Turkey.

Regarding the actions of the North Aegean Region, its Civil Protection mechanisms in all of its islands were activated. A quick assessment of damage to buildings and infrastructures was implemented mainly in the regional unit of Samos, which was severely affected by the earthquake.

The European Union (EU) and the North Atlantic Treaty Organization (NATO) expressed their readiness to provide assistance to Greece and Turkey after the strong earthquake that shook the Eastern Aegean Sea. The President of the European Council also expressed the readiness of the EU to provide assistance to the areas affected by the earthquake, while the European Commissioner for Crisis Management stated that the European Emergency Coordination Center is in close contact with the civil protection authorities in order to assist if necessary.

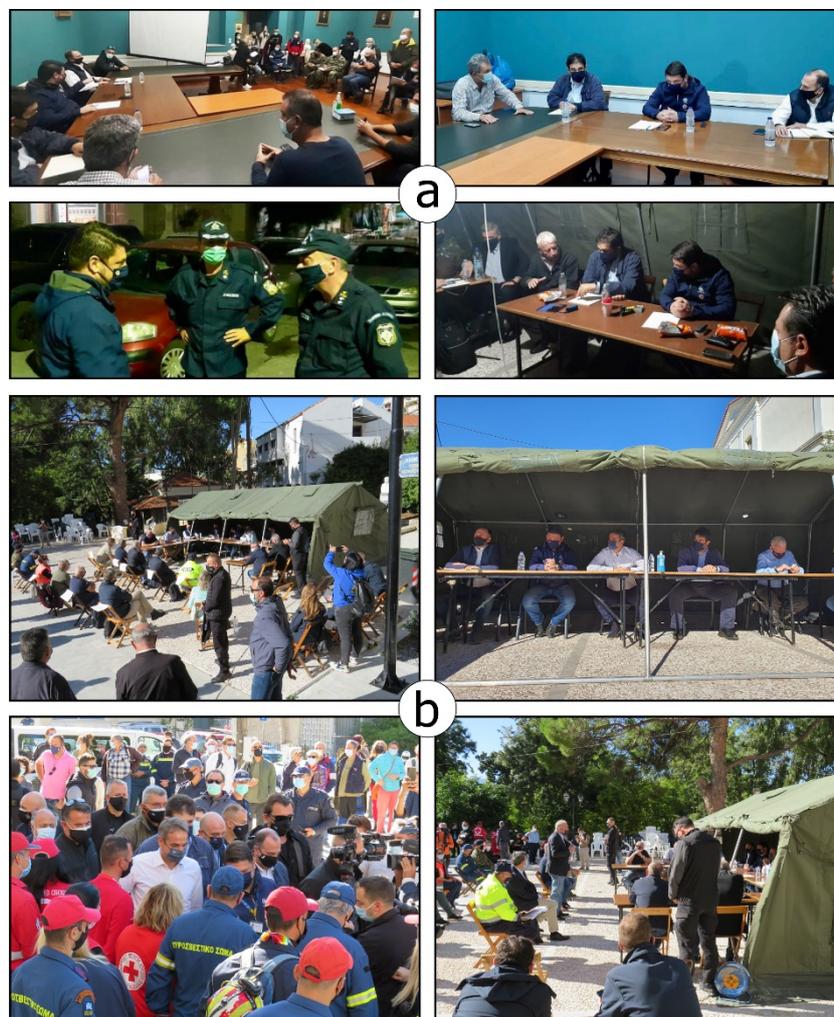
Early in the afternoon after the generation of the earthquake, a coordination meeting was held with the participation of the Mayors and all the involved authorities and services at the City Hall in Karlovassi town located at the northwestern part of Samos Island (Figure 14). It was decided that if affected residents have to stay away from their damaged houses, they were going to stay in hotels, tourist facilities and tents in order to comply with the protection measures for the limitation of the transmission of the new virus SARS-CoV-2 amid pandemic. Also, the municipal authorities remained in the disposal of residents throughout the night in order to record effects and difficult situations from the earthquake. During the coordination meeting, the emergency shelters were announced. Tents were set up in these sites for the safe accommodation of residents, whose houses were damaged by the earthquake ground motion.

The Prime Minister of Greece chaired a meeting with the participation of the Deputy Minister for Civil Protection and Crisis Management, the Deputy Minister of Interior, the General Secretary of Infrastructure, the General Secretary of Reception of Asylum Seekers, the Regional Governor of Attica and First Vice President of the Union of Regions of Greece, the Deputy Regional Governor of Samos, the Mayor of Eastern Samos and Professors of Disaster Management from the National and Kapodistrian University of Athens and the Technical University of Crete (Figures 14, 15). During this meeting, the authorities expressed their



satisfaction for the immediate mobilization of the state mechanism and discussed the damage to infrastructure and businesses by both the earthquake and the subsequent tsunami.

The Municipalities of Eastern and Western Samos submitted a request to declare a state of emergency in order to address the emergencies and to manage the adverse effects of the October 30, 2020, Samos earthquake. By mandate of the Deputy Minister of Civil Protection and Crisis Management and the General Secretary of Civil Protection, the request was immediately accepted and the Municipalities of Eastern and Western Samos of the Samos Regional Unit of the North Aegean Region were declared in a State of Civil Protection Emergency. This declaration is valid from the occurrence date of the earthquake (October 30, 2020) and for the next 6 months (until April 30, 2021).



**Figure 14.** (a) First meeting of the Deputy Minister for Civil Protection and Crisis Management with local authorities for the assessment of the post-earthquake situation and the coordination of the emergency response phase in Karlovassi (Source: (a) General Secretariat of Civil Protection, <https://www.civilprotection.gr/el/simantika-themata/seismiki-donisi-sti-samo-diloseis-yfypoyrgoy-politikis-prostasias-diaheirisis>). (b) Second meeting the day after the earthquake in Vathy with the Prime Minister of Greece (Source: NKUA).



**Figure 15.** The President of EPO informed the Prime Minister about the first scientific results of the October 30, 2020, Mw=6.9, Samos earthquake. Moreover, he participated to several meetings with national, regional and local authorities and field inspections for a more effective disaster management.

As regards the Hellenic Armed Forces, their response and their mobilization was immediate under the command of the Chief of the General Staff of National Defense (GEETHA). The Hellenic Armed Forces assisted the management of the earthquake disaster in Samos Island with actions comprising the following (Figure 16) among others:

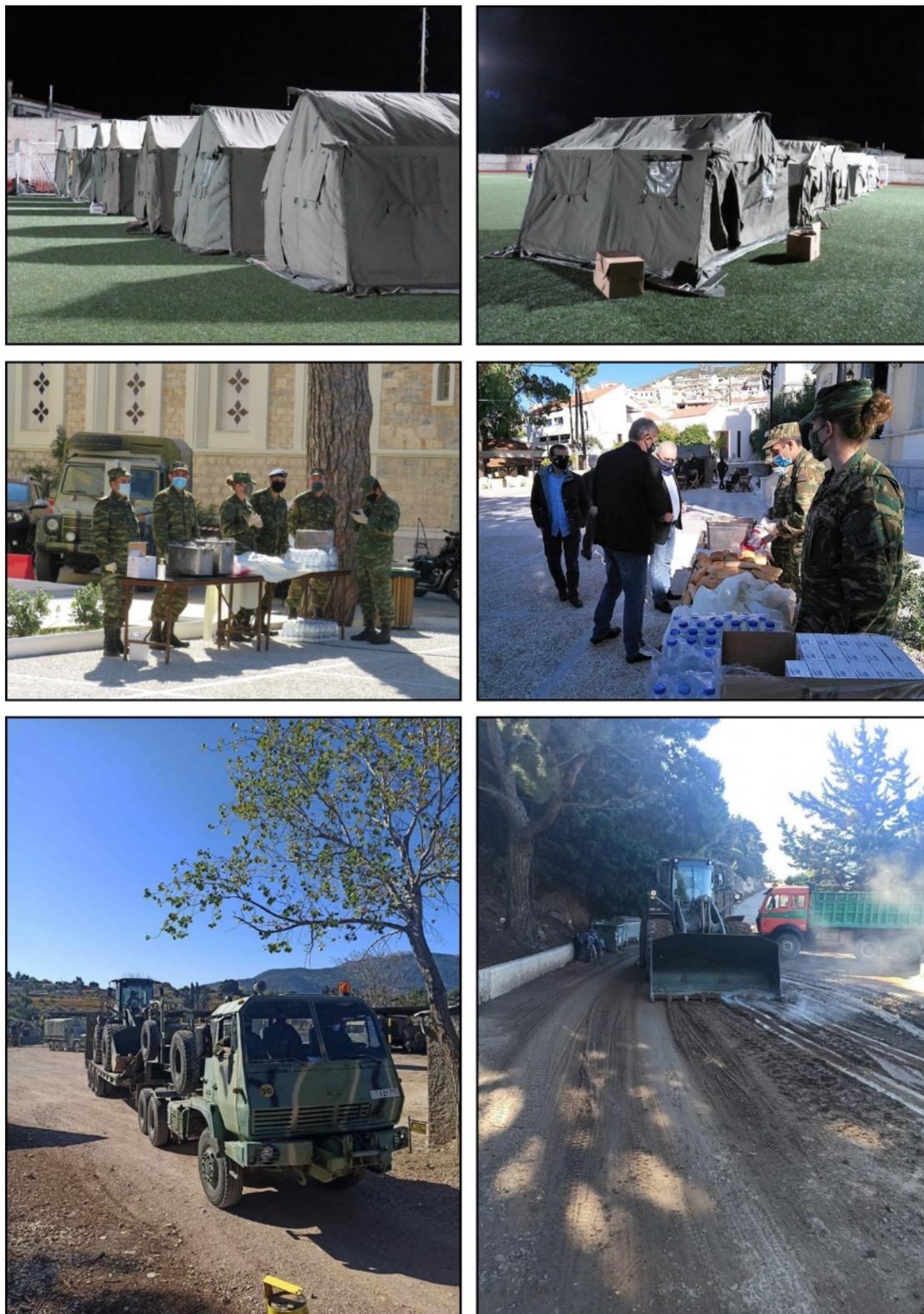
- The Hydrographic Service issued a warning NAVTEX for tsunami in the Aegean, based on the responsibility area of the Hellenic Armed Forces, which coincides with the Search and Rescue Area of Greece.
- All Units of the Hellenic Armed Forces were put on alert in the earthquake-affected Samos, Ikaria and Chios Islands, while the Unit Commanders were in constant communication and cooperation with the staff of the affected municipalities of the Eastern and Western Samos in order to assist if and where necessary.
- Operators and drivers of the Engineer Directorate were put on alert for immediate intervention. Moreover, vessels of the Hellenic Navy stayed on standby in Salamina Island and C-130 military transport aircrafts and CH-47 Chinook helicopters of the Hellenic Air Force at Elefsina and at Megara Airports respectively.
- A vessel remained in Vathy Bay in order to be used for temporary housing, if necessary.
- The DEFKALION units of the Hellenic Army, Navy and Air Force comprising rescue teams along with special trained dogs and appropriate equipment were put on alert for immediate intervention.
- Teams of civil engineers were also ready to contribute to the damage assessment throughout the earthquake-affected island of Samos.



- Special flights were organized over the affected area in order to initially assess the extent of damage in Samos Island.
- Moreover, staff of the Hellenic Armed Forces contributed to the setting of the emergency shelters. They set up sturdy military tents, they provided meals and they operated for the restoration of the road network in several sites mainly affected by rockfalls and landslides.

As regards the immediate actions conducted by the municipal authorities after the generation of the mainshock, the following actions were taken:

- Suspension of operation from 2 to 4 November until the control of the statics of the facilities of municipal and private Kindergartens, Primary and Secondary Schools, including Kindergartens, Primary, Secondary and High Schools, Private Music Schools, Private Music Schools, and chamber music.
- The operation of municipal and private nursery schools, creche and kindergarten, school units of the Elementary and Secondary education including elementary, middle and high schools, private music institutions, conservatories, music schools, choirs, and orchestras was temporarily suspended from November 2 to 4, 2020 until the completion of the first post-earthquake building inspection for assessing possible structural and non-structural damage.
- The operation of municipal and private nursery schools, creche and kindergarten was further suspended from November 5 to 20, 2020.
- As regards the higher education, the University of the Aegean decided to temporarily suspend its educational, research and administrative activities in its facilities located in Samos and Chios from November 2 until the completion of the first post-earthquake building inspection for the safety of all staff members and students. The entrance to all university facilities was forbidden without permission except for student residences.
- Since November 1, 2020, the affected residents had the opportunity to electronically submit damage assessment reports for their houses through digital application specially designed for this situation.
- Sampling checks were conducted in order to assess water quality and suitability.



**Figure 16.** The Hellenic Armed Forces were put on alert of immediate intervention during the response phase. They assisted several actions comprising set up of temporary emergency shelters, distribution of food supplies and restoration of roads affected by slope failures (Source: NKUA; Hellenic National Defense General Staff).



#### 6.4. Search and rescue operations – First-aid treatment and medical care

The demand for search and rescue operations in the earthquake-affected Samos was minimal, because there was no extensive collapse of inhabited residential buildings induced by the October 30, 2020, Mw=6.9, Samos earthquake.

However, the Fire Service in Samos received a call shortly before 17:00 for assistance in the Vathy town, located in the northeastern part of Samos, after a partial collapse of an old and abandoned masonry building. Part of its masonry collapsed, trapping two young people. Minutes after they were located, the trapped people were pulled unconscious and immediately transported to the General Hospital of Samos. The final report of the impact of the earthquake on the local population of Samos comprised 2 fatalities from the collapse site of Vathy town and 19 injured residents.

The search and rescue operations were conducted by members of the 1st Disaster Management Special Unit of the Hellenic Fire Service. The operations were supported by staff of the Hellenic Fire Service, the National Center for Emergency Assistance, the Hellenic Police and civil protection volunteers.

As regards the provision of first-aid treatment and medical care, a patient airlift was required from Samos to Athens for a 14-year-old child, who was seriously injured (multiple fractures), and for a 63-year-old woman with a fracture of the cheekbone and a partial rupture of the spleen. The patient airlift was implemented with a C-130 military aircraft. The child has been transported to the General Children's Hospital of Athens "Panagiotis and Aglaia Kyriakou" and the woman to the KAT General Hospital of Attica.

At the Samos Hospital, 7 injured residents were treated and remained, all out of danger. 10 residents went to the Health Center of Karlovassi, located at the northwestern part of Samos. They were given first-aid treatment and returned to their homes. All health centers and related medical units remained in a state of maximum readiness.

Particular reference should be made to the Disaster Management Special Units of the Hellenic Fire Service (DMSU, Greek acronym EMAK). They are regional special services and belong to the Hellenic Fire Service regional command. They operate whenever this is required, either in Greece, or worldwide. There are 8 units: the 1st with its base in Elefsina, the 2nd in Thessaloniki, the 3rd in Heraklion Crete, the 4th in Komotini, the 5th in Ioannina, the 6th in Patras, the 7th in Lamia and the and 8th in Larissa. Their mission comprise dealing with special fires, oil refinery, tanks of liquid fuels, chemical products, explosives, in high buildings and industrial facilities, tackling with earthquakes and provision of help, as well as seeking disappeared persons, encountering extensive disasters from floods and various types of accidents and the rescue of persons in danger, dealing with leakage and release of hazardous materials and other environmental accidents, assisting other fire services, in order to deal with large scale urban and wild fires.

These special units are composed of a scuba (under water) rescue team, a mountaineering search and rescue team, a dog search and rescue team, and a chemical, biological, radiological



and nuclear threats and technological accidents team. Their equipment includes rescue vehicles, special CAT vehicles with trailer, chemical protection vehicles collecting and separating chemical and toxic substances, earthquake vehicles, search and rescue dogs' vehicles and scuba vehicles.

Greece has two teams within the European Mechanism of Civil Protection, GR - Medium Urban Search and Rescue Team (MUSAR) 1 (1st EMAK) and GR - MUSAR 2 (2nd EMAK), which are direct intervention units of constant readiness with a worldwide deployment radius. Their mission is to search and rescue trapped victims in debris and provide first aid until their treatment.

### 6.5. Immediate housing in emergency shelters

The first phase of immediate housing in emergency shelters can be implemented after approval by the Ministry of Health in few hours or few days after the earthquake and can last from few days to few weeks. Tents, ships, house cars and hotels are usually used as emergency shelters for the temporarily homeless. The provision of emergency shelters and supplies including tents, blankets and bedclothes is responsibility of the Ministry of Health (Royal Decree 972, GGHR 1966; Presidential Decree 93 GGHR 1993). For this purpose, the Ministry of Health maintains 10 storage centres in 10 cities around Greece (Athens, Thessaloniki, Larissa, Ioannina, Komotini, Patras, Tripolis, Heraclion, Mytilene and Rhodes). The Athens storage centre serves also as back up warehouse supplying the other storage centres. The Ministry of Shipping can also support the immediate housing of the affected population under the request of the Civil Protection Operational Center for finding ships available to citizens for overnight use or more (Law 4442, GGHR 1929; Law 3536, GGHR 2007).

Immediately after the occurrence of the earthquake, citizens evacuated their homes due to building damage or fear of continuous aftershocks and upcoming strong events and stayed in open air sites that they considered safe for overnight use or more. During the first phase of emergency response, the personnel of Samos municipalities in cooperation with the officers of local police departments collected information about the number of citizens who evacuated their homes and stayed outdoors. In cooperation with the Hellenic Armed Forces and volunteer teams, they assisted in the installation, organization and operation of emergency shelters in open air sites for the immediate housing of the temporary homeless. Due to the fact that the earthquakes occurred in the middle of the autumn season, the affected people also had to face bad weather conditions including low temperatures especially during the night.

More specifically, the Municipality of Eastern Samos set up temporary emergency shelters in the Kokkari, Vathy and Chora, while the Municipality of Western Samos in Karlovassi (Figure 17). Temporary emergency shelters were also set up in communities of the affected municipalities. Homeless and vulnerable people stayed in hotels. It is significant to mention that the setting up of the temporary emergency shelters was significantly supported by the



Hellenic Armed Forces and volunteer teams. The temporary emergency shelters included military, emergency rapid deployment tents and sanitary and personal hygiene facilities. The Ministry of Migration and Asylum has also provided tents, sleeping bags, blankets and beds to affected residents, while the United Nations High Commissioner for Refugees sent 100 tents to the island.



**Figure 17:** Temporary emergency shelters with military tents in the earthquake-affected island of Samos. The shelters were created in safe fields and open football stadiums (Source: NKUA).

## 6.6. Psychosocial support for the affected population

A natural disaster, such as the October 30, 2020 earthquake in Samos, in addition to fatalities, injuries and property damage, can have adverse effects on the mental health of the affected population. Feelings of loss, grief, anger, anxiety, fear and sadness can occur in the days after the event or even weeks or months after. These feelings may be accompanied by symptoms such as: nightmares or disturbing memories of the earthquake, intense mental pain at the slightest reminder of the earthquake, disturbed sleep or lack of sleep, irritability and feelings of anger, panic attacks, anxiety, anxiety accompanied by physical symptoms such as difficulty breathing or "tightening" of the body, lack of interest in activities or social life, lack of appetite or overeating and increased use of substances such as alcohol. Thus, the psychological support of those affected by the above symptoms has been considered necessary and very



important in order to deal with the earthquake disaster and its mental health effects. Such psychological support actions were undertaken by the psychological service of the Social Welfare Department of the Samos Municipalities, with which someone who was experiencing significant psychological stress could contact. It is important to note that due to the evolving SARS-CoV-2 pandemic, sessions were also available via skype or telephone.

Psychosocial support was also provided by voluntary organizations that acted in the earthquake-affected Samos, such as the Regional Department of the Hellenic Red Cross and the Samos Department of the Hellenic Rescue Team, always in excellent cooperation with the state and the local authorities. Psychological support and counseling was provided free of charge to affected residents in specially designed spaces. In order to apply social distancing practices including avoid overcrowding in order to limit the spread of SARS-CoV-2 virus, the sessions were held took place after making an appointment, while the remote communication via teleconference or videoconference was also available. In each meeting, wearing mask and keeping the appropriate distance was mandatory both indoors and outdoors.

### **6.7. Awareness and education for the earthquake effects and protective measures due to the continuous aftershock sequence**

Awareness and education activities for the earthquake effects and protective measures due to the continuous aftershock sequence were implemented by the EPPO. Five days after the earthquake, an EPPO team arrived in Samos in order to implement meetings with members of local authorities and workshops for teachers etc (Figures 18, 19).

The educational activities that took place by EPPO after the earthquake were crucial, because they helped the local community to mitigate the effects of earthquake, gave hope for the future and provided a sense of normality to people. In addition, these activities gave the opportunity to the participants to discuss the lessons learned from the earthquake and the tsunami management, to become familiar with the idea of dealing with multiple disasters at the same time (earthquake and tsunami amid pandemic) and to continuously apply the protocols against the spread of the new SARS-CoV-2 virus.

More specifically, EPPO implemented meetings with Eastern Samos and Western Samos Municipalities' members, workshops for Directors of primary and high schools, one in Vathy and one in Karlovassi (Figures 18, 19), a workshop for child care centers' personnel of Eastern Samos Municipality and distribution of specific educational material per target group.

As already mentioned, EPPO's distributed in Samos area:

- a specific leaflet concerning the protection measures that should be taken during the aftershock period on individual and family basis, and the initiatives to mitigate the psychosocial effects on the family members, especially on children. This leaflet is available for free, both on line and print.



- the new EPPO's poster "Earthquake and Protection in Workplaces in case of Pandemic" that focused on prevention, preparedness, mitigation, and response to an earthquake event in case of pandemic (Figure 20).

As a result, it should be mentioned that the occurrence of Samos earthquake coincident with the SARS-CoV-2 pandemic, it was a challenge for the local authorities and Samos' community to have effective management and to cope better with future crises. The trainings and exercises in 2017 allowed to competent authorities and individuals to better identify, coordinate, and correct gaps of the emergency planning, problematic behavioral or physical reactions. Building earthquake preparedness takes a lot of effort, which EPPO intends to continue along with the local authorities because preparedness is important for the resilience of every community.



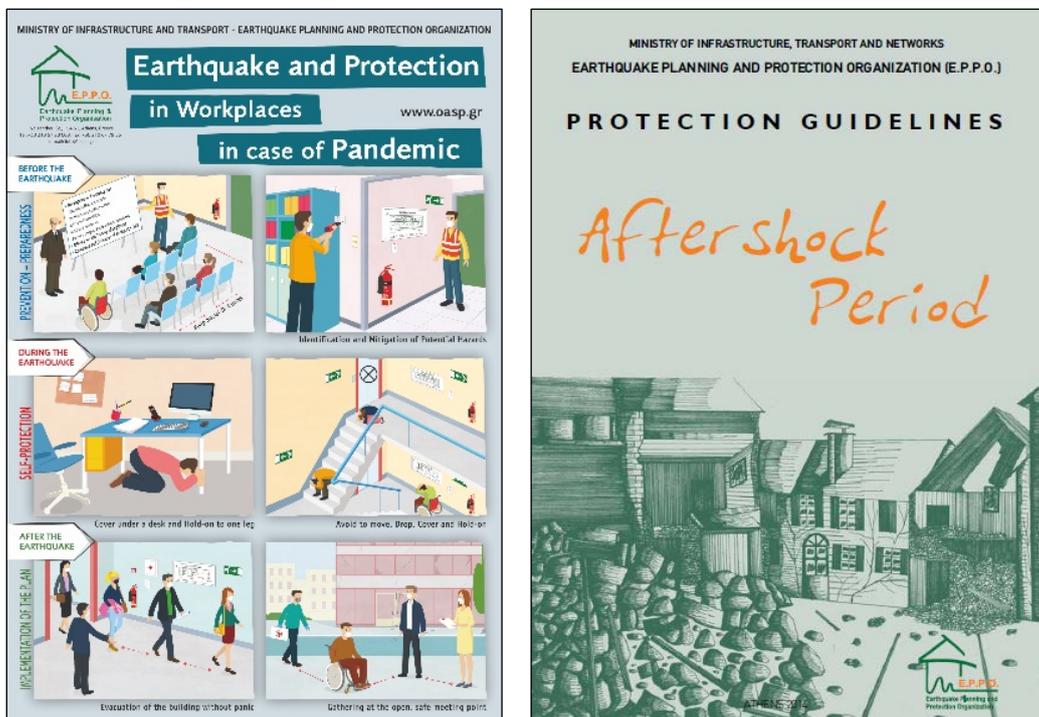
**Figure 18.** Workshops for Directors of primary and secondary schools in Karlovassi town, located at the northwestern part of Samos (Source: EPPO).



## THE 2020 SAMOS EARTHQUAKE PREPAREDNESS & EMERGENCY RESPONSE



**Figure 19.** Workshops for Directors of primary and secondary schools, in Vathy town, located at the northeastern part of Samos (Source: EPPO; Municipality of Eastern Samos).



**Figure 20.** Educational material of EPPO for earthquake and protection in workplaces amid pandemic (EPPO, 2020) and protection guidelines during the aftershock period (EPPO, 2016).



## 6.8. Participation of volunteer teams

Volunteers not only from the regional units of Samos, but also from the surrounding regional units of the North Aegean Region assist the local authorities in the management of the earthquake disaster during the first critical hours and days of the emergency response phase. The main actions carried out by the volunteer teams included (Figures 21, 22):

- participation in search and rescue operations,
- participation in teams competent to damage assessment of buildings and infrastructure including port facilities among others
- sending humanitarian aid including equipment for the homeless (blankets, aluminum blankets, sleeping bags, ranches, etc.), long-lasting food supplies and personal hygiene items (toothpaste, shower gel, soap, cotton swabs, etc.)
- distribution of humanitarian aid, gathered from various sources, including equipment for the homeless, long-term food and personal hygiene items,
- participation in the organization of temporary emergency shelters for the affected population and especially in the cleaning of the sites, in setting up of tents, in the transportation of humanitarian aid and basic necessities to the emergency shelters,
- meeting health needs of the affected people gathered in the emergency shelters,
- distribution of meals and humanitarian aid to affected people in the emergency shelters and elsewhere necessary
- assistance in organized evacuation actions from dangerous areas of towns and villages during the aftershock period,
- assistance in actions for the safe removal of religious items from temples severely affected by the earthquake
- relief actions to organizations, churches, institutions and individuals, where requested,
- providing support and guidance, especially for people with special needs and reduced mobility,
- assessment of needs of the affected population,
- daily visits to hotels and tourist facilities for homeless and affected people in order to assess health needs, provide pharmaceutical / medical supplies and train staff and guests on measures for the prevention of the spread of the new SARS-CoV-2 virus
- provision of psychological support and counseling to residents with significant psychological stress attributed to the adverse effects of the earthquake,
- information on earthquake prevention measures and
- information on protection measures against the spread of the new SARS-CoV-2 virus.

At this extraordinary moment, the entire voluntary mechanism was immediately mobilized, proving its readiness and at the same time expressing its full and practical support to the earthquake-affected population of Samos, who lost their properties in just a few seconds. Volunteers have always been on the side of the vulnerable groups of the population and are ready at any time to offer help not only within the country, but also where there is a need.



The following voluntary organizations mainly participated in the above actions: the Hellenic Red Cross, the Hellenic Rescue Team Samos Department, the Association for the Protection of the Environment of Agios Kirikos Ikaria, the Association of Volunteer Firefighters of Pythagorion, the SOS Kokkari Volunteer Team, and the Samos Scuba Divers Association among others.



**Figure 21.** The Hellenic Red Cross assisted the local authorities and the Hellenic Armed Forces in several short-term response activities comprising distribution of long-lasting food supplies and personal hygiene items (toothpaste, shower gel, soap, cotton swabs, etc.) to the earthquake-affected people of Samos and setting up temporary emergency shelters, among other activities important for the effective disaster management. Their contribution has been acknowledged by the government and the state authorities (Source: Municipalities of Western and Eastern Samos; NKUA).



**Figure 22.** The Samos Department of the Hellenic Rescue Team participated in various short-term response actions comprising (up) the distribution of humanitarian aid, gathered from various sources, including equipment for the homeless, long-term food and personal hygiene items, (in the middle) assistance in actions for the safe removal of religious items from temples severely affected by the earthquake and (down) assistance in organized evacuation actions from dangerous areas of towns and villages during the aftershock period ((Source: Municipalities of Western and Eastern Samos).

### 6.9. Donations and provision of essential emergency supplies

There was a nationwide mobilization for emergency supplies concentration after the 2020 Samos earthquake. Emergency relief supplies including bottles of mineral water, emergency food supplies, clothing, blankets and bedclothes were distributed to those in need. Several sites across Samos were converted into concentration, packaging and distribution centres of



emergency supplies provided by governmental authorities and donated by individuals, volunteer teams, non-governmental organizations, charitable organizations, big supply chain companies and shipping companies. With this nationwide mobilization, Greeks sent a strong message of humanity, solidarity and hope to the earthquake-affected population of Samos Island. Despite the difficult situation due to the evolving SARS-CoV-2 pandemic, the collective effort paid off, as thousands of packages of long-lasting food and basic necessities were collected.

#### **6.10. Issue of Government Gazette of the Hellenic Republic for defining the affected areas**

The regional units of Samos, Ikaria and Chios of the North Aegean Region were formally declared affected by the earthquake generated on October 30, 2020 with the Government Gazette of the Hellenic Republic issued on December 2, 2020. This Government Gazette comprises details about processes that are going to be applied for granting housing assistance for the restoration of the damage induced to buildings after the destructive earthquake. The task of the restoration of damage to buildings from the earthquake is undertaken by the GDNDR.

#### **6.11. Post-earthquake building and infrastructure inspections**

Shortly after a destructive earthquake in Greece with impact on the built environment, the engineers involved in the disaster management. The rapid visual inspections, performed immediately after the earthquake last ten up to twenty days, depending on the intensity and the damage extent and aim primarily to protect the residents, to contribute to the continuation of the basic functions and the identification and definition of the affected area. The post-earthquake assessment procedure consists of two degrees of inspections:

(a) the first degree inspection is a rapid visual inspection that evaluates the buildings and classifies them into two categories: usable or unusable (should not be used until re-inspection is performed) and

(b) the second degree inspection (re-Inspection) that is performed only to the buildings characterized unusable during the first stage. The buildings that are re-inspected, are classified in three categories regarding their usability and damage: buildings suitable for use, buildings temporarily unsuitable for use or buildings dangerous for use, depending on the observed damage. The duration of the secondary inspection is proportional to the intensity of the earthquake and the extent of the induced damage.

Shortly after the earthquake in Samos, the Ministry of Infrastructure and Transport sent a team of 8 engineers to conduct inspections and assess the damage induced to the affected



structures (public buildings, residential and commercial buildings, monumental and special structures) and infrastructures (port facilities).

The day after the earthquake, the team was further strengthened with 47 engineers of the Ministry. The new team comprised 16 engineers from the GDNDR of Northern Greece, 21 engineers from the GDNDR of Central Greece, 5 engineers from the Building Infrastructure SA (former School Buildings Organization S.A.) as well as 4 engineers and a designer of the General Directorate of Hydraulic, Port and Building Infrastructure.

The day after the earthquake, the engineers conducted inspections in 215 buildings in the towns of Vathy and Karlovassi, in 14 school buildings in Vathy and Ano Vathy, in Vathy and Karlovassi ports, in churches and in 5 buildings of Karlovassi student residence. The buildings affected by the October 30, 2020 earthquake and characterized as temporary unusable exceeded 1000 in the most affected Island of Samos. Building inspections were conducted not only in Samos Island, but also in the other affected islands of the North Aegean Region including Chios, Ikaria, Fournoi and Thymaena.

The GDNDR announced that the beginning of the second inspection of buildings in the earthquake-affected Samos started on November 16. It is important to note that the second building inspection will be carried out in all the buildings that have been designated "unusable" by the first inspection without requiring an application from the owners of the affected buildings, as well as in the buildings for which the owners had applied and their buildings were not checked in the first inspection.

As regards the mobilization of EPPO, scientific staff consisting of two civil engineers, arrived in the affected area by an exclusive flight operated by Greek Civil Protection along with personnel of other competent authorities, such as firefighters, rescuers, staff from emergency medical teams, civil engineers from the Ministry of Infrastructure and Transport and Civil Protection's personnel.

EPPO's team, under the guidance of the Head of the Technical Department of the Municipality, carried out focused inspections to public buildings (Hellenic Fire Service building, in several buildings in the port of Vathy, such as the Customs Building, Port Authority building, the Chemistry, etc), joining forces with the civil engineers from the Ministry of Infrastructure and Transport, who carried out the inspections of all the buildings (public and private) and critical infrastructures, as mentioned previously (Figure 23).

Damage on the island occurred mainly in old masonry buildings and monumental structures, temples and churches, constructed mainly in the beginning of the 20th century. In general, considering the magnitude and the intensity of the earthquake, the buildings on Samos Island behaved well. The majority of the building stock in the island suffered minor damage, even though the vast majority of the buildings were constructed before 1985, and thus, with low earthquake-resistant design (seismic code of 1954) compared to the post-1985 codes. Damage of non-structural components was also evident in the areas of Samos Island with the maximum observed intensities.



**Figure 23.** Staff of the GDNDR and the EPPO in the earthquake-affected Samos for building damage assessment (Source: EPPO, GDNDR).

## 6.12. Hazard mitigation during the emergency response

Numerous hazards are present during the initial earthquake response and subsequent recovery and clean-up efforts (Figure 24). The most common hazards the affected population and workers will likely encounter in the aftermath of an earthquake comprise partially collapsed or dangerously unstable buildings, exposed and energized electrical wiring, natural gas leaks resulting in explosive environments, water system breaks and flooded areas, exposure to hazardous materials, exposure to airborne dusts including asbestos, lead, crystalline silica and mold, confined space work that may include insufficient oxygen and toxic environments, struck-by hazards from falling objects, sharp objects from glass and debris as well as other health and safety exposure risks specific to the response site among others (Figure 24).



**Figure 24.** The most common hazards the affected population and workers will likely encounter in the aftermath of an earthquake (Source: <https://workersafety.3m.com/blog/wp-content/uploads/2017/10/Potential-hazard-blog-asset-1.jpg>)

Immediate actions should be taken by qualified safety professionals and be completed prior to approach or even move in any response area presenting an adverse exposure risk. Such actions were designed and implemented by response workers in several sites throughout the earthquake-affected Samos. These actions comprise mainly (Figure 25):

- Identification of damage induced to electricity, water supply and regional and municipal road networks by the earthquake and repair.
- Identification of hazards and placement of markings and protective barriers in order to avoid approaching
- Identification of hazards related to partially collapsed and unstable buildings by GDAEFK engineers and subsequent exclusion of the areas by the Hellenic Police.
- Organized evacuation of the population from several heavily affected parts of Samos, comprising Samos town and the communities of Vathy, Kokkari, Chora and Pyrgos) and hosting of residents, who evacuated, in hotels and tourist facilities. The temporary staying in hotels is free for the residents due to the fact that the accommodation expenses are covered by the competent ministries according to their relevant announcements. This decision has been considered necessary in order to ensure the safety of residents from the risks of earthquake-induced phenomena including mainly landslides and rockfalls and from extensive collapse of buildings or parts of them during the aftershock period. The well-organized evacuation of population was designed and applied by the joint teams comprising staff of the Hellenic Police, the Disaster Management Special Units of the Hellenic Fire Service, the Hellenic Fire Service, the Municipality Departments of Civil Protection in Samos, the Hellenic Red Cross and volunteers.
- Activation of a memorandum of cooperation of the General Secretariat for Civil Protection with the Hellenic Authority of Geology and Mineral Exploration aiming to the



assessment of the geodynamic phenomena and their impact to buildings and infrastructures and indicating protective measures for the mitigation of the adverse effects.

- Cleaning of regional, municipal and community roads and removal of debris accumulated on the roads after landslides and rockfalls.
- Cleaning of regional, municipal and community roads and removal of debris resulting from partial and total collapse of buildings.
- Demolition of unstable and dangerous buildings after the final consent of the owners as well as abandoned buildings.

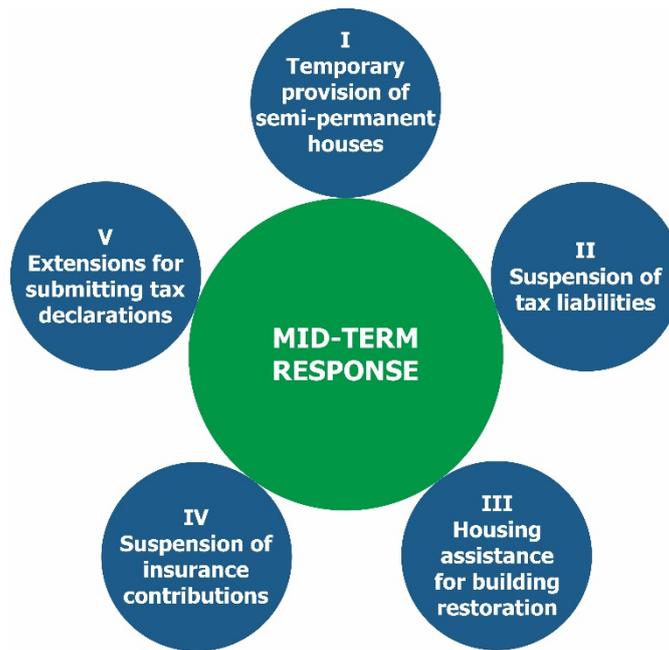


**Figure 25.** Actions for the mitigation of hazards the affected population and workers will likely encounter in the aftermath of the earthquake in Samos. Supporting of buildings, removing debris from roads and pavements, placement of markings and protective barriers to severely affected buildings in order to avoid approaching, demolition of unstable buildings dangerous for cars and passersby (Source: Municipalities of Western and Eastern Samos).



## 7. FURTHER ACTIONS AND FINANCIAL MEASURES FOR DEALING WITH THE ADVERSE EARTHQUAKE EFFECTS

Further actions and financial measures for dealing with the adverse earthquake effects referred to strengthening and reinforcement of structures, services and systems, whose weaknesses had previously contributed to vulnerability in the communities (Figure 26).



**Figure 26.** Activities associated with mid-term response after the generation of the October 30, 2020, Mw=6.9, Samos earthquake and conducted by the authorities, agencies and services competent to civil protection and earthquake disaster management.

### 7.1. Registration of old unstable and severely earthquake-affected buildings in priority areas

The Ministry of Environment and Energy will proceed with the implementation of a seven-point plan for the immediate response to the problem related to old, abandoned buildings, which were severely affected by the earthquake (partially collapsed and dangerously unstable) and those that have construction problems and thus are considered dangerous for residents, passersby and response workers. This project has been decided on November 3, after an agreement of the Prime Minister with the Minister of Environment and Energy, the Minister of Culture and Sports and the Deputy Minister of Environment and Energy. The conference was also attended by the General Secretary of Spatial Planning and the Urban Environment, the General Secretary of Culture, the President of the Special Scientific



Committee for Climate Change, the President of the EPPO, the President of the Technical Chamber of Greece and the President of the Central Union of Greek Municipalities.

A new legislative framework and immediate registration for old, abandoned, unstable and dangerous earthquake-affected buildings has been prepared immediately after taking in account the adverse effects of the earthquake on buildings of Samos and on the local population.

The registration and labeling of the unstable and dangerous buildings throughout Greece started the week after the agreement. This procedure is going to be executed in cooperation with the Technical Chamber of Greece. Civil engineers from the Technical Chamber of Greece, the Ministry of Infrastructure and Transport and the Ministry of the Environment are going to start the recording from priority areas.

The cost of the interventions will be covered directly from public resources and then the intervention agency will be able to undertake the management and operation of the property until the cost is repaid by the owners of the building. The regulation will be included in the draft law for the modernization of the spatial and urban planning legislation.

After the registration of buildings and the adoption of the new regulations, the municipalities will undertake the operation of demolition of the unstable and dangerous buildings. For this purpose, their financing will be covered by the state.

The EPPO is going to conduct educational and information campaigns and activities for the population in priority areas.

The progress of this project will be monitored by the Deputy Minister of Infrastructure and Transport.

## 7.2. Community housing and support

The selection of types and procedures of housing restoration after a disaster is based on (a) the type of disaster, (b) the percentage of the affected population, (c) the disaster periodicity, (d) the available housing stock in the affected area, (e) the legislative framework and (f) the socio-economic conditions in the affected area. Housing restoration in Greece typically comprises three subsequent phases that are (a) immediate housing in emergency shelters, (b) temporary housing in semi-permanent structures and (c) permanent housing after repairing the damaged buildings or constructing new ones in case of collapsed or demolished buildings.

The recovery from the adverse effects of the earthquake disaster and especially the second phase of the temporary housing in semi-permanent structures can last from few months to few years. This type of housing restoration is one of the main factors that can help the affected local population re-establishing a sense of normality in their lives in the chaotic and



unpredictable post-earthquake situation. The third phase of repairing or reconstructing can last years after the earthquake disaster.

During the second phase of the temporary housing in semi-permanent structures, the Municipalities set up semi-permanent container-type structures in order to be used for classrooms due to the severe damage to school facilities in Samos and as temporary houses for the homeless people (Figures 27, 28). The Municipality of Eastern Samos used container-type structures for temporary school facilities. These container-type structures were transported from the Municipality of Mytilene (Regional unit of Lesvos, northern part of the North Aegean Region), which proved immediately, in practice, its support to the efforts made by the affected municipality, in order to find a solution for the housing of the school units that suffered serious damage. It is significant to highlight that Lesvos suffered a destructive Mw=6.3 earthquake on June 12, 2017 with considerable impact on the natural and built environment of Lesvos Island.

Since the occurrence of the destructive earthquake, the Municipality of Western Samos has received 21 container-type structures for temporary housing of homeless residents. 18 structures were provided by the Ministry of Migration and Asylum and placed in properly designed and safe sites in affected villages. The rest of them along with 2 more container-type structures from the Municipality of Mytilene were used as temporary school facilities and 1 as temporary warehouse. All structures are electrified and water-supplied, and connected to the sewerage network. The Municipality of Western Samos proceeded with the purchase of additional 4 container-type structures since the available ones were not enough to cover the housing needs.



**Figure 27:** Container-type structures used as temporary housing for the homeless, for class rooms and warehouses in the earthquake-affected Samos Island. They were transported to Samos after cooperation of the Municipalities of the Western and Eastern Samos with the Municipality of Mytilene (Lesvos Island, North Aegean Sea) and the Ministry of Migration and Asylum.



**Figure 28:** Container-type structures on the Malagari area located at the southwestern coastal part of Vathy Bay (first four images) and in villages of the western part of Samos (last two images). (Source: Municipalities of Western and Eastern Samos; NKUA).

### 7.3. Financial assistance to the affected population and other related financial measures

The day that the earthquake struck Samos, the Independent Authority for Public Revenue announced financial measures for the relief of the affected population of Samos. The deadlines for (a) the submission of the declaration and payment of VAT which expired on October 30, 2020 and (b) the submission of the withholding tax returns, which expired on November 2, 2020, were extended.

Few days after the earthquake occurrence, on November 3, the automatic update of all unemployment cards that expired in the period from October 30 to November 30 in the regional units of Samos and Ikaria, was completed, as announced by the management of the Manpower Employment Organization (MEO, Greek acronym OAED).



Almost 300 grants of subsistence allowances were approved until November 23, 2020 through the economic committee for affected people, the main residence of which has been affected by the earthquake of October 30, 2020. The first payments in the declared bank accounts started on November 20, 2020 and continued the following days. This was a process that continued until the final approval of all the submitted applications. The deadline for submission of applications by potential candidates was November 30, 2020.

One month after the earthquake, with the primary task of supporting the earthquake victims and restoring security conditions for the functioning of society at all levels, the Municipalities of Samos proposed measures for the residents directly affected by the earthquake, for business and employment to the central administration. The proposal comprised horizontal financial-social measures for all residents, for the education in all levels, for the municipalities, for the public services, for the cultural heritage and for the reconstruction of Samos.

The Ministry of Finance, in collaboration with the competent Ministries and the Independent Authority for Public Revenue, announced interventions to help and support legal entities and individuals affected by the earthquake of October 30, 2020 and the accompanied geodynamic phenomena.

In particular:

- **Suspension of tax liabilities:** For the regional unit of Samos, the payment of all confirmed and overdue tax liabilities was suspended for both companies and individuals, for a period of six months.
- **Supporting affected companies:** Under the current institutional framework, the Ministry of Finance is responsible for compensating earthquake-affected companies. More specifically, it is responsible for subsidizing 30% - 70% of the earthquake-induced damage, equipment, raw materials, goods, trucks for public and private use, means of production, including land and stored products, which were recorded damaged. The amount of the grant will be covered by the Public Investment Program and is paid to the beneficiaries by the General Directorate of Financial Services of the Ministry of Development and Investments. According to the existing framework, after the necessary regulatory interventions at the regulatory level, which were recently carried out by the Ministry of Finance, in exceptional cases where there is significant and extensive damage to both the number of affected companies and the extent of the damage, an advance may be provided against the total amount of the grant.
- **Provision of housing assistance for the restoration of buildings:** With the Joint Ministerial Decision for the official declaration of the affected areas, housing assistance is provided to natural and legal persons for the repair / reconstruction of the buildings affected by the earthquake. Housing assistance is provided to individuals and legal entities and covers the entire estimated damage, with 80% free state aid and 20% interest-free loan. In the same context, - with another relevant Joint Ministerial Decision - the provision of housing assistance to natural and legal persons for the repair / reconstruction of the buildings affected by the subsequent tsunami is also included. This housing assistance also covers the total estimated damage and it is distributed in 60%



free state aid and 40% interest-free loan. In both cases the state aid is covered by the Public Investment Program.

- **Protection of jobs and businesses:** Employers of the private sector, regardless of industry and business activity, in the areas affected by the earthquake of October 30, 2020 may suspend the employment contracts of part or all of their employees, until the restoration of the losses caused due to the earthquake and not beyond 3 months. Employees, whose employment contract is suspended, according to the present, are entitled to the emergency financial assistance, as special purpose compensation, amounting to 534 euros. At the same time, a provision of employee support will be introduced for the cases of those, who lost their jobs after the earthquake of October 30, 2020.
- **Suspension of insurance contributions:** Businesses affected by the natural disaster of October 30, 2020 and suffered losses, following a relevant Joint Ministerial Decision delimiting the natural disaster, may be included in a process of regulation and suspension of insurance contributions of companies to the Ministry of Labor and Social Affairs. This regulation provides (a) capitalization of insurance contributions, (b) suspension of payment of current insurance contributions for 6 months, and (c) 12-24 monthly installments of the contributions after 6 months.
- **Exemptions for property owners in the earthquake-affected areas:** The buildings along with the corresponding plot of land, which are located in areas that have been declared in a state of emergency due to the natural disaster of October 30, 2020 and have been proven to be completely destroyed or suffer operational damage that makes them unusable, are completely exempt from ENFIA of the year in which the disaster occurred.
- **Suspension of auctions and seizures on properties:** A relevant decision promoted by the Ministry of Finance suspends for one year the execution of any auctions, seizures and expulsions on the real estate of natural or legal persons who have been proven to have been affected by the earthquake of October 30, 2020 and its subsequent geodynamic phenomena.
- **Extensions for submitting tax declarations:** By decisions of the Director of the Independent Authority for Public Revenue, extensions were decided for the affected people, who have their registered business office and belong to the territorial jurisdiction of the Tax Office of Samos, until November 30, 2020, regarding the time of submission of fees and other taxes, the time of submission of VAT returns and payment of tax resulting from them, as well as the time of submission of income tax returns of legal persons and legal entities and withholding tax returns.

The Ministry of Finance, together with all the competent Ministries, is in close cooperation with the local authorities, but also with the productive bodies, in order to proceed with intensive pace the process of implementing the support measures of the area affected by the destructive earthquake of 30 October 2020.



#### 7.4. Measures to repair damage to buildings and compensate affected people

The Government Gazette of the Hellenic Republic that declared Samos, Ikaria and Chios earthquake-affected was published. This refers to the definition of the earthquake-affected areas, the required deadlines, the housing assistance and its general conditions, the reconstruction of buildings, the self-housing - completion, the repairs of buildings, the way of granting housing assistance, the payments of engineers and the reservations, the inaccessible areas, the buildings affected by the earthquake of June 20, 2009, the competent credit institutions, the terms of lending, mortgage loans and the case of non-compliance. The relevant decision were cosigned on November 27, 2020 by the Deputy Minister of Finance, the Minister of Development and Investments, and the Minister of Infrastructure and Transport.

The publication of the Government Gazette of the Hellenic Republic was accelerated in order to speed up and facilitate procedures of damage repair and compensation of the affected people.

- **Housing assistance:** In the areas defined by this decision, the Housing Assistance is granted for the reconstruction or repair of the buildings damaged by the earthquake of Samos. The above calculated Housing Assistance, can be used for self-housing (purchase of a finished or under construction building) or for completion of a privately owned building. In the areas affected by the earthquake and tsunami disaster, which are defined by a relevant joint ministerial decision, the granted Housing Assistance calculated in accordance with the provisions of this decision, includes the repair of tsunami damage. Beneficiaries of Housing Assistance are the owners, who on the day of the event have full or partial ownership of buildings that have been damaged and need repair or reconstruction. The Housing Assistance consists of 80% free state aid granted by the competent Service and 20% interest-free loan, granted by credit institutions to the eligible borrowers.

As an exception to the above, the owner is entitled to free state aid and interest-free loan for all his independent properties in the following cases: a) for the reconstruction of Holy Temples (not private Holy Temples), buildings of public use, which belong to the State, or in public benefit or in charitable or in benevolent institutions, buildings, which are characterized as preserved or monuments in their entirety, as well as facades of buildings which are characterized as preserved, and (b) for repairing of structural and non-structural elements of buildings.

- **Reconstruction of buildings:** Beneficiaries of Housing Assistance for reconstruction of buildings are the owners of the buildings: a) which have been characterized by the GDNDR as dangerously unstable or totally destroyed, b) which were demolished immediately after the earthquake by order of public or municipal authorities, for reasons of public safety, without prior demolition autopsy by the GDNDR.
- **Self-housing:** The Housing Assistance is approved for reconstruction of a building, which has been damaged by the earthquake of Samos, to be used by the beneficiary for self-housing (purchase of a ready-made or under construction building). The purchased



building should: (a) be within the same Municipal Unit where the affected building is located or within the same Regional Unit, (b) be legally existing before 1955 or have been constructed with an implemented building permit, (c) be characterized as suitable for use by the GDNDR.

- **Building repairs:** For the repair of all buildings, the Housing Assistance is calculated according to the damage induced to the building by the earthquake of October 30, 2020 and the subsequent tsunami and according to the respective Repair Invoice.

## 7.5. Earthquake insurance data

### 7.5.1. Earthquake insurance data in Greece

The recent earthquake in Samos has once again highlighted the need for insurance coverage of the Greek houses against natural disasters, an issue that has been raised by the Association of Insurance Companies of Greece for several years. Earthquake insurance is not mandatory for residential or commercial structures, unless specified by the bank issuing the mortgage. For critical facilities, insurance is required for a fire event, but not for an earthquake. According to data from the Insurance Agencies Union, only 10-15 % of residential housing stock in Greece had earthquake insurance, mostly due to mortgage requirements.

Although Greece is located in one the most seismically active regions in the world, Greek homeowners typically opt out of earthquake insurance, which is symptomatic of a poor understanding of what earthquake insurance actually is, and what benefits it provides in the occurrence of a catastrophic event. Since the market is very small, earthquake insurance is not viewed as priority by the insurance companies. As a result, adding the earthquake risk factor in a homeowner's insurance does not increase the premium significantly. In simple terms, if an insurance premium is on the order of 0.2% of the value of the structure, and there is a deterministic hazard of a significant earthquake happening every 25 years, the total cost to the owner for this insurance would be  $0.2\% \times 25 = 5\%$  of the value in these 25 years of life. The repair costs for damage caused by one event may be smaller, damage however might be detrimental to the structural integrity due to event sequences in areas like Samos.

Insurance reimbursement is based on the earthquake magnitude. In general, insured houses are reimbursed for damage caused by an earthquake of magnitude 6 or less. In the case of multiple events, if damages are evaluated by inspection of the insurance company and the house is deemed habitable, the insurance can adjust the premium and reimburse the owner for damages caused by the next event in the same sequence.



### 7.5.2. First analysis on damage and losses induced by the Samos earthquake

In the frame of the investigation of the 2020 earthquake impact on the economy of the affected, the Hellenic Association of Insurance Companies (HAIC) conducted a first analysis on damage and losses induced by the Samos earthquake. The study focused on the first assessment of the losses (in number and amount) of property and car insurance, which had been announced to the Insurance Companies – members, due to the specific earthquake. In particular, the investigation included the geographical determination of the insured risks and losses (at the city or district level) using the postal code of the insured property or the place of damage (for a car). The properties were further categorized into residential, commercial and industrial facilities.

22 Insurance Companies - members of the HAIC contributed to this study. They constitute the 94.4% of the production of property insurance. The first estimate of the above companies from the announcements of property and car damage refers to 191 losses, the amount of which is estimated at a total of € 3.5 million. Of these, 180 losses related to property insurance (estimated compensation of € 3.46 million) and 11 losses related to car insurance (estimated compensation of € 21300).

As regards the spatial distribution of the affected properties reported to the HAIC, most of the affected properties were located in the regional unit Samos, but damage was also reported in the regional units of Chios, Ikaria and Fournoi in the North Aegean Region and in the administrative region of Attica.

A total of 180 losses on property insurance were declared with a first assessment amount for compensation of € 3462790. The average declared loss (before exemptions) is estimated at € 19238. For these losses, the estimate of the compensation after the exemptions (where existed) was € 2220032. It is pointed out that the exemption is an international practice that reduces by a certain amount the insured risk (hence the compensation), which is offset in the long run by a corresponding relief of the insurance premiums, depending on the terms of the insurance contract.

In addition to the above data of the declared losses, the investigation of HAIC comprised also information of the number of total insured risks and total insured funds, whether or not affected by the specific earthquake, in the above affected regional units based on the postal code.

The following is a separate table by breakdown by type of insured risk, the number of total insured risks and total insured funds, for the Regional Units affected.

The distribution of the number of total insured risks and total insured funds for the affected regional units, per type of insured risk are also presented on the following tables derived from the study of HAIC (2020). In different columns, the indices resulting from the combination of losses and insured risks comprising the average frequency (%) of losses and the average percentage (‰) of compensation on total insured funds.



As regards car insurance, a total of 11 losses were declared to the insurance companies participating in the analysis with an initial assessment amount of compensation of € 21300 and the average declared loss reaching € 1936 (HAIC, 2020). The total compensations after the exemptions reach € 20100 and the total insured value of the affected cars amounts to € 64800 (HAIC, 2020). All the declared damages are located in the regional unit of Samos.

**Table 1:** Property insurance losses and the corresponding insured value of the specific facilities by type of insured risk (from HAIC, 2020).

Type of insured risk	Amount of losses		Compensation before exemptions (€)		Compensation after exemptions (€)		Insured fund (€)	
Industrial	8	4.5%	1414974	40.9%	864900	39.0%	34990808	30.6%
Commercial	67	37.2%	1167390	33.7%	671345	30.2%	63452007	55.5%
Residential	105	58.3%	880426	25.4%	683.87	30.8%	15877823	13.9%
<b>Total</b>	<b>180</b>	<b>100%</b>	<b>3462790</b>	<b>100%</b>	<b>2220032</b>	<b>100%</b>	<b>114320638</b>	<b>100%</b>

**Table 2:** The geographical distribution of total losses and their insured funds, for the most affected regional units of the North Aegean Region (from HAIC, 2020).

Regional Unit	Amount of losses		Compensation before exemptions (€)		Compensation after exemptions (€)		Insured fund (€)	
Samos	150	83.3%	3266752	94.3%	2144277	96.6%	94765059	82.9%
Chios	19	10.6%	165568	4.8%	61664	2.8%	16460939	14.4%
Other	11	6.1%	30470	0.9%	14091	0.6%	3094640	2.7%
<b>Total</b>	<b>180</b>	<b>100%</b>	<b>3462790</b>	<b>100%</b>	<b>2220032</b>	<b>100%</b>	<b>114320638</b>	<b>100%</b>

**Table 3:** The distribution of the insured funds for the most affected regional units per type of insured risk along with the average frequency (%) of losses and the average percentage (%) of compensation on total insured funds (from HAIC, 2020).

Industrial type / Regional Units	Number of insurance contracts		Insured funds		Average frequency	Average percentage (%) of compensation on total insured funds
Samos	35	74.5%	55648419	84.2%	14.3%	25.28%
Chios	11	23.4%	10172341	15.4%	27.3%	0.82%
Other RU	1	2.1%	246387	0.4%	0.0%	0.00%
<b>Total</b>	<b>47</b>	<b>100%</b>	<b>66067147</b>	<b>100%</b>	<b>17.0%</b>	<b>21.42%</b>

Commercial type / Regional Units	Number of insurance contracts		Insured funds		Average frequency	Average percentage (%) of compensation on total insured funds
Samos	353	59.3%	150699240	66.0%	16.4%	6.96%
Chios	204	34.3%	65909963	28.9%	3.9%	1.75%
Other RU	38	6.4%	11731770	5.1%	2.6%	0.26%
<b>Total</b>	<b>595</b>	<b>100%</b>	<b>228340974</b>	<b>100%</b>	<b>11.3%</b>	<b>5.11%</b>

Residential type / Regional Units	Number of insurance contracts		Insured funds		Average frequency	Average percentage (%) of compensation on total insured funds
Samos	1314	58.8%	190517959	59.6%	6.6%	4.26%
Chios	701	31.4%	101798933	31.8%	1.1%	0.41%
Other RU	220	9.8%	27360738	8.6%	4.5%	1.00%
<b>Total</b>	<b>2235</b>	<b>100%</b>	<b>319677630</b>	<b>100%</b>	<b>4.7%</b>	<b>2.75%</b>



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Municipality of Eastern Samos: <https://www.islandofsamos.gr/>, <https://el-gr.facebook.com/islandofsamos/>

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