Title: National Report of GREECE
Prepared for the IDNDR Mid-Term Review and the 1994 World Conference on Natural Disasater Reduction

I. OVERVIEW AND EXECUTIVE SUMMARY

1. Composition of National Committee

Ministries:
Ministry of Environmental Affairs, Urban Planning and Public Works
Ministry of Internal Affairs
Ministry of Agriculture
Ministry of Health and Welfare
Ministry of Maritime Affairs
Ministry of National Defense
Ministry of Public Order
Ministry of National Education
Municipality of Athens

Academic & Research Institutions:
National Technical University of Athens
National Observatory of Athens
University of Athens
University of Thessaloniki
Institute of Engineering Seismology and Earthquake Engineering
Institute of Geological and Mineral Research

Public Services:
Earthquake Planning and Protection Organization (EPPO)
The Athens Water and Sewage Co
Natural Meteorological Service
Telecommunication Organization of Greece
The Public Electric Company

Non-Governmental Organizations:
Emergencies Research Center

Media:
General Secretariat for the Press & Information
The Athens Daily Newspaper Editors Union

Insurance:
Association of Greek Insurance Companies

2. Internal organization of the National Committee
The National Committee is under formation. Up to now the President, the Vice President and the Liaison officer are nominated, as follows:

President: Professor P.Carydis, Laboratory of Earthquake Engineering, National Technical University of Athens

Vise President: C.Ioannidis, Director of Earthquake Planning and Protection Organization (EPPO).

Liaison Officer: Dr.N.Petropoulos, Sociology Counsellor, Pedagogic Institute and Director of the Emergencies Research Center

II. RISK ASSESSMENT

In the following the existing natural hazards are exposed in series of severity and recurrence.

A. EARTHQUAKES

A.1 Hazard Assessment
Earthquake is considered as the major Natural Hazard for Greece as far as the occurrence and the magnitude are concerned. In Greece, the 52% of the seismicity of Europe and the 3% of the world seismicity are released. Within the Greek territory 130-200, earthquakes with a magnitude of higher or equal to 4, 20-25 earthquakes with a magnitude of higher or equal to 5, 2 earthquakes, with a magnitude of higher or equal to 6 occur every year, while every 5 to 50 years occur earthquakes with a magnitude of 7 to 8.

A.1.1 Prevailing location of the hazard
Mainly in the Ionian Islands, NW and SW Peloponnese, Northern and Southern Aegean Sea, the Gulf of Patras and Corinth. Most earthquakes have epicenters in the Ocean and affect the less populated areas of the country.

A.1.2 Recent hazards
A.1.2.1 Salonica earthquake (6,5 R) in 1978, Salonica is the second largest city of Greece, with 8% of the population. The earthquake was responsible for the death of 52 people and the wounding of 150. The economic costs are estimated at 30 billion Drachmas.

A.1.2.2 The Alcyonides/Corinth earthquake (6.4 R) in 1981. The epicenter was about 70 km from Athens which was also affected. The earthquake affected about 40-45% of the population of Greece. Twenty people were killed and 500 were wounded. Costs and estimated at 40 billion Drachmas.

A.1.2.3 The Kalamata earthquake (6.3 R) in 1986. Kalamata is a city with a population of less than 20.000 people. Although the earthquake affected a wider area in S.Peloponnese, the damages were mainly restricted in the Kalamata vicinity. The victims included 20 people dead and 82 wounded. The economic costs are estimated at 60 billion drachmas.

Generally, earthquakes cost Greece about 200 billion drachmas per decade. These costs refer to the technical infrastrucutre and structures and do not take account the hidden costs due to disaster-related recessions.

A.2 Vulnerability Assessment
a) Population-Social economic activities
There is an erratic pattern of temporal population density in the adminstrative districts of Greece. The onshore population density varies from 884.7 people/km^2 in

Attiki prefecture where Athens is, to 14 people km^2 in Eurytania prefecture (Pomonis A., 1987: A study on earthquake environment and seismic risk assessment in Greece. Master thesis, Hokkaido University, Japan. Data based on the 1981 population sensus).

The situation is further complicated by irregular redistribution of population between urban and rural areas within individual administration units. There is a great concentration in urban centres. About 40% of the country's population lives in Greater Athens and Thessaloniki and about 75% in the four larger Greek cities.

Greek cities suffer from an over-exploitation of urban space, a confusion between uses of private and public space and an unbalanced and not proper distribution of urban facilities within the city, even of those to be mobilised in case of an earthquake (Aravantinos A., 1983. Interaction between urban planning and earthquake-proof design. UNDRO, Proceedings on earthquake preparedness, Athens, 11-14 January 1983). In some housing urban areas, pre-existing plot ratios of 4.2 to 2.4 still allow the overloading of urban plots with multi-story buildings of mixed uses (housing and central activities in the ground floor), without providing adequate open space within the plot.

The implication of the situation is that even small magnitude earthquakes will produce disproportionally larger overall damage if they occur near regions of high population desnity (Ambrasseys, N. and Jackson, J.A., 1981: Earthquake hazard and vulnerability in Northeastern Mediterranean: the Corinth earthquake sequence of February-March 1981. Disasters, Vol.5, No 4, pp.237-258). This pattern damage began to emerge from the recent earthquakes of June 20, 1978 and February 24, 1981, which caused damage in the two main cities of Greece, Thessaloniki and Athens respectively.

The cumulative number of known deaths associated to the known destructive earthquakes, is shown in Figure 1.

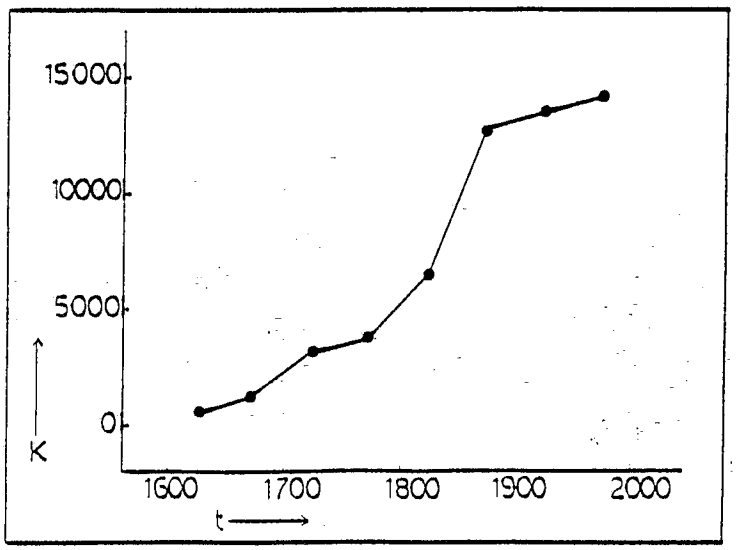

Figure 1. Cumulative number of deaths in Greece due to known earthquakes for the period 1600-1987 (Papazachos, B. and Papazachou K.(1993): The earthquake of Greece. Thessaloniki, 1993 (in greek))

The cumulative number of known deaths is much smaller during the present century in comparison to the past. Within the period year 1950-1988, 690 people were killed and 3,950 were injured. The mitigation of the casualties is attributed to the good structural tradition and the fast modernisation of building stock, due to earthquake destructions and urbanisation.

The relatively low casualty figures associated with some of the earthquakes in Greece is partly the result of fore shock sequences that often preceded larger events (see Ambrasseys, 1981, listed above) and of a good attitude of the people towards these warnings.

b. Buildings and lifelines/infrastructure

The traditional construction practices in Greece consisted of constructing the dwelling houses from available local materials (usually rubble and raw stone masorny). Since about 1950, reinforced brick masonry and gradually reinforced concrete framed structures, became common building practice.

Nowdays, more than 50% of the buildings are reinforced concrete frame structures, fully engineered, built by professional builders, usually under state control. Yet, there is still an estimated number of 1.500.000 weaker dwelling buildings constructed at least 45 years ago. In addition there is a significally large number (about 500.000) of less-engineered squatter house, illegally built, that have shown poor performance in the last earthquakes. To this last paragraph, the squatter housing, an important parameter must be added that increases its earthquake vulnerability is the construction on bad ground conditions, like slopes subjective to sliding, old river beds, drained lakes and generally brought soil material not well consolidated.

Within the period 1950-1986, the average yearly number of damaged buildings is 5.000 and of collapsed or totally destroyed buildings is 2.000 (Papazachos, B. and Papazachou K., 1993: The earthquakes of Greece. Thessaloniki, 1993 (in greek)).

c. Historical buildings and monuments

The impact of earthquakes in cultural and historical heritage of Greece is enormous. The total distruction of Knossos and Festos cities (1980 BC, 1570 BC and 66 BC), the destruction of the temple of the Zeus Temple of Olympia (365 BC), of the Roman Agora of Thessaloniki (620 BC), the damage of many unique exhibits of the Archeological Museum of Heraklion, Crete (1926 and 1935 AC), are only few of the losses.

The vulnerability of ancient monuments is increasing with the elapse of time. This is due to the deterioration of the monuments (weathering, foundation settlement and the difficulty in strengthening or repairing them.

The catastrophe caused by the earthquakes and the issuing fire, in the culturally active and rich, Zakynthos city after the 1953 destructive earthquakes in the Ionian islands, is a more recent example.

The assessment of the earthquake resistance of monumental and historical structures and works of art, presents special problems on account of ways in which they were built and the materials used. Even when the focus is on a limited geographic region of Greece, the number of structures to be considered is large, and they represent a wide range of structural forms, sizes and materials used. On the one hand, there are unique monuments, like those of the Acropolis in Athens. On the other hand, there are many modest and more recent dwellings and public buildings,

both in towns and the country, whom the group cultural or architectural value may be significant.

d. The cost of earthquakes
The total loss due to earthquakes from 1978 to 1990 is estimated at some 1 billion US dollars, which amounts to about 20 billion drachmas per year.

e. Conclusion
The above features cleraly demonstrate the need for a comprehensive risk-reduction programme at national as well as regional and local levels.

B. FOREST FIRES

B.1 Hazard Assessment

B.1.1 Prevailing locations of the hazards
No special location, they occur in rural areas and the outskirts of large urban centers such as Athens, where lives about 30% of the population of Greece.

B.1.2 Recent hazards

B.1.2.1 Forest fires are a reccurrent summer pheomenon in Greece. During the first nine months of 1993, forest fires destroyed 38,000 hectares (or 95,000 acres). The most disastrous during the summer of 1993 and in the history of Greek forest fires was the one of the Island of Ikaria. Ten people lost their lives and the cost of recovery (assistance to the families of the victims, subsidized loans, restoration of animal and olive-tree losses, reforestation and dam construction) was estimated at 2 billion drachmas.

B.1.2.2 Forest fire on the Island of Crete (Lasithi), that destroyed 20,000 stremata (about 5,000 acres) and 10,000 olive trees. The rehabilitation and recovery costs for the destroyed olive groves, hot-houses, infrastructure, and the lost production for the season are estimated at 4.2 billion drachmas (The costs for reforestation are not included).

Since 1955, Greece has had 31, 508 forest fires. These fires have destroyed 10 million stremmata (or about 2.5 million acres). The destroyed area is equivalent to three times the area of Attiki (Athens). In 1928, the forests covered 34% of the country's land area. In 1988, the percentage was reduced to 19%. More in detail, during the last forty years the number of fires in forest and in grazing grounds, as well as the burnt areas in stremmata (four stremmata per acre) are presented in the table given below.

FOREST FIRES AND FIRES IN GRAZING GROUNDS IN GREECE FOR THE PERIOD 1955-1991

YEAR	No of FIRES	BURNT AREA (IN STREMMA=0.25 ACRE)
1955	499	68.566
1956	891	1.110.700
1957	453	23.000
1958	311	242.954
1959	303	22.100
1960	639	150.151
1961	889	117.316

1962	786	79.216
1963	636	126.797
1964	631	113.447
1965	1.187	270.297
1966	695	116.133
1967	515	81.530
1968	607	90.575
1969	705	92.331
1970	558	91.879
1971	525	103.627
1972	378	85.810
1973	610	195.000
1974	768	318.688
1975	768	209.558
1976	590	83.887
1977	1.253	537.632
1978	828	200.025
1979	1.076	211.803
1980	1.207	329.653
1981	1.159	814.173
1982	1.045	273.722
1983	968	196.132
1984	1.284	336.555
1985	1.442	1.054.503
1986	1.082	245.503
1987	1.266	463.150
1988	1.898	1.105.011
1989	1.284	423.635
1990	1.322	385.934
1991	1.041	235.737

C. DROUGHT AND WATER SHORTAGES

C.1 Hazard Assessment

C.1.1 Prevailing locations of the hazard
No special location. Both rural and urban areas are affected. The Athens area also included. The reduction of rainfall during the last 30 years fluctuates between 10% and 35% for various regions of Greece.

C.1.2 Recent hazards
The problem of drought has been exacerbated during the last 3 years, and has affected both agricultural areas and large urban areas such as Metropolitan Athens. The cost to agrigultural production during 1990 has been estimated at 200 billion drachmas. For the Athens area, controls have been imposed on household, industrial and municipal consumption, and there has been a substantial reduction in the amount of green. The costs for solving the problem are astronomical, e.g. repairing the aqueduct system (33 billion drachmas), transporting water from other sources by tankers (90 million a day for 600.000 m^3), seeding the clouds (200 million drachmas for 150 flights), building new aqueduct systems to connect the Athens reservoir with river sources (50 bil. drachmas) and constructing new dams at the foothills.

D. FLOODS-STORMS

D.1 Hazard Assessment

D.1.1 Prevailing locations of the hazard. Numerous urban and other provinces of Greece concentrated on the lower level areas are affected.

D.1.2 Recent hazards
Two serious urban floods, one occuring in November 1993 in an Athens Suburban area and the other occuring in January 1994 in what was originally a squatter settlement, affected the Athens area during the past year. Fortunately, there was only one victim. However, there were extensive damages to household and business property, the road infrastructure and automobiles. The residences and business in the basement and ground levels were most affected.

In August 1990, occured strong storms all over Greece. Six persons were drowned in torrents at Vassilika of Evia . In Elia prefecture one person was lost. In Chania, Crete two persons were lost. In September 1990, strong storms occured in Livartzi of Kalavryta, where four persons were drowned. In November 1990, strong and continuous rains all over Western Greece and the Peloponnese; floods in Leonidio were reported.

In August 1992 extensive floods in Katastari of Zakynthos were reported. In November 1992 floods in Chios and Rodos islands as well as in Komotini were reported. The same month extensive strong rains all over the country occured. Two victims due to floods in Eleftheroupoli of Kavala were reported. In November 1993 st rong storms all over the country were reported.

D.2 Vulnerability Assessment
Urban floods occur in urban regions, where bed rivers are filled with brought material or lakes are drainned over which, buildings are constructed despite of the existing law. Under this law any construction of buildings over old river beds or drainned lakes is prohibited. This type of hazard is related to earthquake hazard.

E. LANDSLIDES

E.1 Hazard Assessment

E.1.1 Prevailing locations of the hazard
The location of landslides has a close correlation with regions exposed to high rainfalls. A characteristic example is the extended landslides in West-Central Greece.

In the table given below the correlation between annual rainfall and landslide frequency is presented.

Distribution of mean annual rainfall and landslide frequency

Mean annual height of rain (mm)	P_1. Frequency of landslides	P_2. Area. %	P_1/P_2	Relative freq. of landslides
< 400	0.99	1.72	0.57	5.45
401-600	7.35	21.76	0.33	3.16
601-800	16.58	32.74	0.50	4.78
801-1000	18.20	17.84	1.02	9.76
1001-1400	33.16	22.32	1.48	14.16
> 1400	23.72	3.62	6.55	62.68
Total	100.00	100.00	10.45	99.99

F. LAND SINKING

F.1 Hazard Assessment

F.1.1. Prevailing locations of the hazard
The village of Kalohori on the Gulf of Thermaikos and in the province of Salonika in Northern Greece is lying one and one-half meters below sea-level.

F.1.2 Recent hazards
During the last two-three years, thevillage has been inundated by sea water following damages to the level resulting from seastorms. Except for the constant threat to theresidents, the destruction of crops and the excessive construction costs, there have not been any human losses reported yet. The Dutch experience could be useful in this regard.

G. OCEAN DISASTERS

G1 Hazard Assessment

G.1.1 Prevailing locations of the hazard
Greece has a disproportionally large share of commercial shipping, while it possesses very long seashores. Large part of the communications are realized by sea. Therefore, there is not a specific location where ocean disasters might be located.

G.1.2 Recent hazards
During the last two years, there have been three shipwrecks, one that occured off the coast of SE Peloponnese in January 1993 (10 Baufort wind storm), and the other two that occured in January 1994 and in international waters (one off the coast of Canada and the other off the coast of Japan). In the first one, 17 people lost their lives and in the other two the combined number of victims was 53. The last two shipwrecks involved reportedly Greek ships under a foreign flag. Most ships in this category are over 20 years of age.

In the following table the total number of shipwrecks of ships sailing the Greek seas for the period of 1984 to 1993, is given. It must be mentioned here that the total number of ships sailing the Greek seas is very large, since a great part of the transportation in Greece is done through sea.

Number of Shipwrecks

Year	No Passanger Ships	Total No	Year	No Passanger Ships	Total No
1984	8	93	1989	10	50
1985	16	109	1990	10	62
1986	13	108	1991	6	66
1987	9	93	1992	7	62
1988	9	80	1993	19	89

In the above given table, the shipwrecks of passenger ships is a small percentage of the total number of shipwrecks. For the period of 1984 to 1993 the mean value of passenger shipwrecks to the total shipwrecks is 14%.

H. HEATWAVES

H.1 Hazard Assessment

H.1.1 Prevailing locations of the hazard
The major Athens area might be considered as a region where this type of hazard has been observed.

H.1.2 Recent hazard
A heatwave struck the Athens area during July 1987, with high temperatures fluctuating between 41C and 44C. According to the Dept. of Hygiene and Epidemiology of the University of Athens, the heatwave was responsible for 926 deaths, mainly of senior citizens.

In Crete island the highest temperatures were reported of the last 40 years in April 1993.

In N.Filadelfia (major Athens district) the maximum temperature reached 42.6° C in August 1993.

I. FIELD-MICE EPIDEMIC

I.1 Hazard Assessment

I.1.1 Prevailing locations of the hazard
There were observed in various agricultural regions all over Greece.

I.1.2 Recent hazard
Following the reduction of the population of foxes, and during 1992, a field mice epidemic was observed in eight provinces throughout Greece. Although no estimates are available, the mice caused extensive crop destruction. Besides the enactment of legislation to protect thefox, an experimental three year program is underway at the University of Patras Zoological Laboratory to discover ways for a better biological and chemical control of the pests.

III. MITIGATION ACTIVITIES

A. EARTHQUAKES

A.1. Earthquake reduction policies, planning and implementation

A.1.1 Policy

A.1.1.1 Social
Since ancient times, mankind has recognised his weakness in facing the consequences of earthquakes. Ancient Greeks created Egelados-the God of earthquakes to whom people prayed and asked for protection and help. This is the first indication that there had to be a holy body to protect them from unforeseen catastrophes.

Lessons learned from past earthquakes show that the action for life and property protection during an earthquake is a processs which has to start long before the occurrence:

- In order to avoid social destruction during an earthquake, the objective of seismic risk reduction must be among the top priorities, especially in places located in high risk industrialized or/and urban zones. Better education, housing and health care are among the decisive parameters for achieving such an objective.
- In Greece, after the last destructive earthquakes (1978, 1980, 1981, 1986), the social sensitivity was intensified and resulted in an increasing demand for better social protection. Unfortunately the awareness is not a continuous function but rather a stepwise one due to the fact that people are accustomed to forget bad things very quickly....

A.1.1.2 Technical
The level of technical capability is obviously a key-parameter in risk reduction policy. The progress of technology and the introduction of new methodologies opened new routes of approaching the problem.

Due to the experience gained from the recent earthquakes and to the political will after an earthquake, the level of technical capability in Greece is rather high. The importance of such a capability has been recognised. However, the economic component involved also plays an important role in establishing the priorities. Nevertheless, the technical experience gained is a result of a tradition of thousands of years of written history. The technical knowledge due to the long written history is extended to any type of structure and any kind of material (raw and baked bricks, rubble stone masonry (with any type of connecting or not connecting material and with any type of stones), megalithic masonry, pipelines, bridges, earthworks).

1.1.1.3 Administrative
The degree of success of any kind of programme for seismic risk reduction is heavily based on the existence of a proper mechanism capable of materializing them. Such a mechanism involves an administrative infrastructure which should cover the whole spectrum of actions needed for risk reduction, starting from the national and going down to the local level. Its role must be clearly defined in order to avoid conflicts with other bodies and must be well legislated. The latter is very important since it needs flexibility and the necessary capacity for quick action.

In Greece, during the last ten years or so, an administrative infrastructure and several managing institutions have been created in order to manage long-and short-term pre-or post-event actions to reduce seismic risk. These institutions deal with preparedness and emergency procedure in case of an earthquake, seismic code application etc. Greek experience from recent earthquakes shows that there are some problems in the coordination among different institutions working in this field. Furthermore, there is a need for decentralization at local level, giving thus the ability to local authorities to cope efficiently with the problems which arise during and after a moderate earthquake but also to implement certain preparedness and risk mitigation policies.

A.1.1.4 Political
As it has been mentioned above, the level of political awareness and will is directly linked to the prevailing level of seismic activity. Thus, although in the previous years, due to destructive earthquakes, the State paid more attention to this specific target of reducing seismic risk, other more immediate needs attract the State's attention. It is the community's duty to furnish convincing evidence to keep political awareness at a high level.

A.1.1.5 Legal
The need for legislation is based not only on past experience but also on principles that define a well-organized society. The existence of specific laws,, regulations and guidelines characterised by simplicity is the only way to put theory into practice and to ensure efficient risk reduction mechanisms.

In Greece there is a continuous effort to improve the existing legislative framework by taking into account the lessons learned from the recent earthquakes concerning the public response, behaviour of structures and lifelines. The effort is coupled with the international progress made in relevant scientific and technical fields.

A1.1.1.6 Economic
Since the results of a disastrous earthquake can cause devastating effects on the national economy, economic factors are among the ones which have to be considered seriously on every step leading to risk reduction programs. However, for economically weak countries such as Greece, this is fulfilled to a certain degree. Hence multinational solidarity and close cooperation remains all important.

A.1.1.1.7 Land users and urban structure
The aseismic protection of our cities is an item of first priority for the Ministry of Environment Affairs, Urban Planning and Public Works. Despite the unsteady seismic conditions of our country and the strong trend of urbanization manifested particularly during the postwar period, no State concern was ever demonstrated for the protection of urban areas.

As a matter of fact, the problem is accentuated by the way Greek cities have expanded to date, due to arbitrary construction. Quite naturally, therefore, the seismic problem has never received proper attention within the framework of urban planning.

In the new urban planning, however, the subject of the aseismic protection of Greek cities has been incorporated, and proper consideration is presently given to the following aspects:
- Aseismic protection becomes now an essential part of the general urban planning and a relevant legal frame is under preparation. No urban planning studies are being accepted, unless the following three conditions are met:

a) full evaluation of the state of the prevailing ground conditions
b) land use is defined on the basis of the suitability of various areas for urban growth and other activities
c) the urban planning and building regulations are respected in order to provide the complete protection of people against disasters in urban areas.

Particular emphasis should be placed on the fact that, in the new urban planning policy for aseismic protection, the participation of the public is considered a must. As a result:
- Folk experience and wisdom become useful supplements to scientific research and data
- Informing citizens, prior to the implementation of any protection plan, will enable them to fully grasp the advisability of new policies.
- The public, being fully informed, will be in a position to exercise criticism at any stage and express their opinion on critical problems.

The town represents not only a technical and urban planning system; it is also a social and political organization. Its social and political side is of vital importance.

In this respect two most-significant points should be stressed:
- The so-called "temporary accommodation" of earthquake victims has proven to be permanent.
Experience teaches that such accommodation has played a decisive role in the expansion of cities and towns. It is, therefore, important that a special provision for such settlements be made in the urban planning process.
- An earthquake shakes not only the ground and the buildings but has a shaking effect also on ideas and conceptions, and quite often stirs up even the natural "sluggishness" of societies towards change.

In other words, an earthquake affects the psychology of the people of an area and makes them ready to accept a radical change.

Certain cities face serious problems. For example, if the state had been prepared to intervene in the planning of earthquake-affected cities, essential changes could have been made, and lessons learned.

In conclusion, we would stress the necessity for our country to take immediate steps and to make the best of world experience, as it faces the acute problems that have accumulated and which have been awaiting solutions for so many years.

A.2 Issues

A.2.1 Planning
A.2.2.1 Social
The social component, when planning for seismic risk reduction, aims at strengthening public awareness and providing all the necessary services in order to be able to cope with the earthquake phenomenon as efficiently as possible.

Some of the actions/programmes which are helplful towards this target as documented by national and international experience are listed below:
a. Education of the public in order to be familiar with the problem, diminishing, thus, the psychological effects such as panic, fear, loneliness, etc. Furthermore, by properly informing the public about the present limited capability of predicting earthquakes it is possible to limit the spreading of rumours and associated disinformation about "forthcoming" earthquakes which may cause social unrest.
b. Exercises based on certain earthquake scenarios adapted according to the seismic hazard and vulnerability of the specific area. This will increase the confidence of the local community for handling problems expected to arise during an emergency situation.
c. Plans for safe evacuation and effective rehabilitation.
d. Inspection of existing lifelines, hospitals, churches and other important structures as well as monuments.

Special attention must be paid to the problem of countries which have frequent earthquakes of moderate magnitude, such as Greece, where there is a danger of lessening of public alertness which may, in turn, affect the effectiveness of the measures.

A.2.1.2 Technical
The translation of seismic risk reduction programmes into action requires a high level technical support. This mainly comprises:

a. Data-banks with geological, tectonic, seismological and technical data which will serve as input parameters for assessing seismic hazard and the degree of vulnerability at national, regional and, if necessary, local level.
b. Methodologies for microzoning, seismic hazard and vulnerability analysis, signal processing, aseismic design of new structures, retrofitting and/or reinforcement of existing structures and monuments.
c. Identification of areas with high probability of future strong earthquakes where attention should be focused.
d. Equipment such as modern seismological networks, strong motion recorders, geophysical instruments, material testing apparatus, shaking tables, in-situ structural testing devices etc.
e. Educational isntitutes with fully equipped laboratories.

- As always, the determining factor remains the level of financial resources, the availability of which depend on priorities set by the State.
- Greece has a very good technical background in databanks, methodologies, equipment and facilities. Specific institutions have also been created.

A.2.1.1.3 Administrative
The existence of an administrative infrastructure capable of coordinating the whole operation for risk reduction is among the most important factors. Ministerial bodies and specialised institutions with clearly defined and non-over lapping targets and hierarchy have to be created and covered by rigorous legislation.

The institutions are responsible for the formulation of plans aiming at risk mitigation, preparedness and emergency operations. Such plans have to be updated regularly, as new data is received in the relevant databank.

The coordinating bodies are responsible for the implementation of the risk reduction policy. The effectiveness of those bodies depends on the degree of clarification of their duties.

A2..1.1.4 Political
Since political will is, under certain circumstances, not enough to set up plans for earthquake risk management because of the considerable financial component involved, efforts to engage international cooperation and joint projects with countries facing similar problems must be encouraged. In this respect, Greek scientists and institutions participate in numerous, mainly of the European Union, projects.

A.2.1.1.5 Legal
The proper execution of any project is heavily based on the completeness and effectiveness of the legislative framework. National building codes, specific guidelines for strengthening and reconstruction of affected buildings, contemporary emergency plans at all levels, specialized institutions and any other similar tool need to be elaborated.

A.2.1.1.6 Economic
Since the results of a disastrous earthquake can cause devastating effects on the national economy, the economic factors are, as mentioned previously, among the ones which have to be considered seriously on every, step aiming at the reduction of the seismic risk.

A.2.1.1.7 Land use and urban structure
Within the frame work of the operation "1982-1984 Urban Reconstruction", studies were prepared for more than 270 cities and towns in Greece along the above lines. The Institute of Geological and Mining Research, in co-operation with the Institute of Geodynamics of the National Observatory of Athens, has completed all the necessary basic studies. Participation of earthquake specialists in various teams working on urban planning projects was important.

A3 Implementation

A.3.1 Social
The implementation of policy and planning is the most critical point in the procedure of reducing seismic risk and realizing certain measures for the protection of life, property and infrastructure.

In accordance with the social dimension of policy and planning mentioned above, efforts should be focused on activities such as:
a. Organization of seminars, meetings and discussions where experts and authorized persons will analyse, in simple terms, the dimensions of the problem, explain the scientific methodology and give advice to the people who are interested and involved in the educational procedure (e.g. teachers, pupils, students, volunteers, social workers etc.). This is a responsibility of State services and it is taking place continuously in cooperation with universities and relevant institutions.

b. The organization of press conferences at the appropriate time, when rumours for a "forthcoming" earthquake, are causing problems. Also, experts should explain to the people the problem in its actual perspective whenever an earthquake occurs;

c. The preparation and execution of training exercises on regional and local levels. In this way, the competent authorities improve their experience;

d. Programmes of social interest dealing with risk reduction should be encouraged and supported by the central and local authorities;

e. Publication of informational material (e.g., posters, pamphlets, leaflets etc.) should be distrsibuted in the schools, universities and Public Services.

The Greek experience shows that the above activities, if well organized, can contribute positively towards social awareness and preparedness.

A.3.2 Health
In protection of human life and the prevention of fatalities and injuries consitutes the central aim of all disaster plans. For this reason, the Greek emergency plans for natural disasters (e.g. earthquakes, floods, heatvaves, etc.) make special reference to the role of the hospital system (public, private, civil, military, medical and nurses associations) in disaster prevention and mitigation. Greek emergency plans for earthquakes provide for the formation and deployment of Doctors' and Nurses' detachments to the disaster site, where they can engage in triage/assessment as well as immediate and shortterm intervention.

Progress has been made in the are of prevention and public education through the publication of pamphlets and leaflets. The pamphets give instructions to the public with regard to the management of emergency situations (decongestion of communication system, handling of the wounded, etc.). Specifically, the pamphlet addressed to the public in the event of a heatwave makes special reference to

measures before and during the heatwave as well as to the groups particularly vulnerable such as the chronically ill, the newborn and the senior citizens.

During the past 10 years, there has also been progress in the area of medical personnel training (mainly seminars) for emergency situations. An analysis of the relevant materials reveals a sufficient awareness and sensitivity with regard to social, psychological, medical, epidemiological and sanitation problems attendant to natural disasters; to the types of immediate, short-term and middle-term medical intervention that must be made during the various phases of an emergency situation; and to the importance of the triage assessment system and the communication/coordination of medical intervention.

Nonetheless, there is a lot of room for improvement in the medical management of disasters. A recent colloquium organized by the Emergencies Research Center on the occasion of the 1993 International Day revealed shortcomings in hospital backup p systems (energy, water, disposal); possible access problems due to a history of poor urban and land use planning; potential problems in emergency vehicle operation, communication and coordination systems; the absence of hospital emergency plans, emergency drills and systematic training for emergency situations. To these may also be added the essential absence of an emergency social insurance consciousness and system on the level of households, businesses and organizations. It is of utmost importance that the progress made on the concepual (emergency plan) level be matched by corresponding progress on the operational level.

For the other disasters that follow, the health measures are similar to the ones mentioned above, and therefor are not repeated.

A.3.3 Technical
The new possibilities and technologies offer us the capability to create and share data-banks through computer networks (such as Internet, Bitnet), combine and test different methodologies and exchange knowledge, experience and ideas. Advantage of these capabilities to the maximum extent, must be taken.

Such possibilities also give engineers the possibility to make more refined analyses to achieve safer earthquake-resistant design.

C. DROUGHT AND WATER SHORTAGES

The intense drought during the period, 1989-1993, necessitated the imposition of emergency measures for the reduction of water waste and the increasing of inflow sources. Among the short-term measures taken are the following:
1. The reduction of water consumption with the imposition of price increases as well as the undertaking of a public education campaign (several leaflets sent along with the bill, spot TV/radio announcements, posters, etc.). The price increases included primarily the establishment of varying price levels on the basis of past patterns of water consumption. Prices increased with increased water consumption.
2. Reduction of losses/leakages in the aqueduct system through the implementation of a reparations program and by restoration of the aged distribution network, in view of the fact that the observed losses of processed water amount to about 15-18%.
3. Drilling for new water sources in the Attica region by the Municipalities and the local Communties. The new drilling had as an aim the location of water sources for irrigation purposes and the economizing for public consumption water.

As a result of the water shortage, the Municipality of Athens faced considerable difficulty in irrigating the green areas and parks within the City limits. In order to

SUMMARY TABLE OF HYDROLOGICAL BALANCE FOR THE MORNOS AND YLIKIS RESERVOIRS SERVING THE ATTICA REGION (million m^3)

Mornos	1983	1985	1987	1989	1990	1991	1992	1993
Inflows	223	267	238	149	165	190	77	136
Consumption	211	312	312	227	208	177	162	112
Irrigation	11	18						
Losses/Leaks	70	10	11	10	2	1	1	1

YLIKIS	1983	1985	1987	1989	1990	1991	1992	1993
Inflow	196	372	337	155	90	274	122	69
Consumption	66	10	54	202	150	146	143	55
Irrigation	42	52	42	16	18	18	16	7
Losses/Leaks	176	345	212	106	45	68	58	74
Total Inflow	419	639	575	304	255	464	199	205

Note: Drought and water shortages for the years 89-90 and 92-93, the changes in water usage, and the reduction of losses.

Source: The Athens Water and Sewage Company, 1994.

WATER CONSUMPTION IN THE ATTICA REGION BY CALEDAR YEAR

(Million of m^3)

General Consumption				
1989	1990	1991	1992	1993
376	327	324	330	246

Differences in Consumption(%)				
89-90	90-91	91-92	92-93	90-93
-13.3	-0.82	2.01	-25.41	-24.54

Source: The Athens Water and Sewage Company, 1994.

circumvent this difficulty, the Municipality of Athens performed-in cooperation with the Institute of Geological and Mineral Research-a hydrogeological evaluation of 51 sites in green areas followed by 48 boreholes in the seven sectors of the Muncipality.

The majority of the boreholes (38 of 47) are considered appropriate for the purposes of the Municipal program and are at present fully exploited. At the same time, the Municipality has exploited 11 water springs and water wells which had been abandoned for years. The overall performance of the boreholes reach 16,000 cubic meters per day and fully covers the needs of the municipality in terms of the required amount of water for the green areas.

The Municipality of Athens is currently proceeding with the densification of the borehore network and at the same time applying automatic irrigation systems connected to the boreholes and water wells in all the principal green areas.

4. The drilling for new water sources and the implementation of the corresponding projects for the transportation of water to the reservoirs and aqueduct systems. Without the new drilling, the Attica Region would not have had any water reserves during 1993.

5. A continuous maintenance and reparations program of the unprocessed water aqueduct system in order to minimize water losses.

6. Intensification of efforts to reduce water losses and leakages from the reservoirs themselves (e.g. Ylikis).

7. Accelerating the projects for increasing the inflow of water from the River Evinos to the Attica Reservoirs.

In addition, the Athens Water and Sewage Company is undertaking a number of long-term measures, including:
1. Rational management of water resources transported from other Administrative Regions of Greece with the aim of reducing waste in irrigation water and economizing on water for consumption.
2. Exploitation of water streams adjacent to the aqueduct system, taking into account the negative impacts on the environment and the ecosystem.
3. Research and implementation of projects involving the reduction of water losses/leakages from the reservoirs.
4. Continuation of the research projects of the Institute of Geological and Mineral Research for new water sources in other regions and monitoring of the existent water wells.

G. OCEAN DISASTERS

The relevant naval authority (Ministry of Maritime Affairs) has established criteria refering to the speed of the wind, under which the sailing of ships is allowed or not. The displacement, the type, the category and other parameters are foreseen in the respective legislation.

A special emergency center is functioning in order to give help to any sailing ship in any location of the Greek sees.

IV. WARNING

According to the hazard, the existing warning infrastructure varies in extent, detail, location and effectiveness.

A. EARTHQUAKES

An impressive progress is under way in order to minimize the uncertainties in earthquake prediction and warning.

In addition to the longstanding research projects on earthquake prediction using the VAN electric signals, there are several new ones under way, like a research on the detection of precursor phenomena in the South-Southwest Part of the Greek Trench.

There is a special procedure for public information, that is under evaluation.

B. FOREST FIRES

There is an extended infrastructure for remote detection and Assessment of Forest Fire Conditions with the purpose of early intervention and suppression.

There are, also, teams organized by the Local Communities during the most dangerous periods of the year. These teams are on a voluntary basis.

C. DROUGHT AND WATER SHORTAGES

A permanent monitoring system is functioning in order to estimate the water content of the various reservoirs and to predict potential future water shortages.

The dissemination of the information is realized by the media and special issues of the involved organizations.

D. FLOODS-STORMS

The Meterological Agency issues permanent and special warnings for the information of the public about the weather conditions for the coming week, three days, and one day, special bullettins are also issued for weekends.

E. LANDSLIDES

In the most vulnerable areas (above high-ways and above villages) special monitoring systems are functioning and the information is disseminated to the people who may be affected by special issues (indicative labels and information through the media).

F. LAND SINKING

See E.

G. OCEAN DISASTERS

The specialized Ministry of Maritime Affairs in collaboration with the Meteorological Agency maintain on a 24 hours basis a permanent and continuous warning service. Also, during stormy weather, according to the type and capacity of the vessel, the local port authorities permit or no their travel.

H. HEAT WAVES

See D.

V. INTERNATIONAL COOPERATION

There is an infrastructure which already functions in the domains of earthquakes, forest fires, river floods and the relevant subjects concerning the Meteorological Agency, and the Ministry of Maritime Affairs.

Greece participates actively in the EC's Committee for IDNDR and is also a member of the Council of Europe Open Partial Agreement on the Prevention, Protection and organization of Assistance in the cause of Major Natural and Technological Disasters. The Center on Prevention and Forecasting of Earthquakes is located in Athens and is functioning within the context of the Council of Europe Open Partial Agreement.

Special reference must also be made to the Greek Fireservice

Special Disaster Response Unit (EMAK) that was set up in 1987 and since then has taken part in several national and international rescue missions involving natural and technological disasters.

VI. RECAPITULATION AND PROPOSALS FOR ACTIONS IN THE COMING YEARS, WITHIN THE FRAMEWORK OF IDNDR

Much work has already been done in Greece with respect to the assessment of the seismic hazard, the management of earthquakes, the modernization of the aseismic building code and the education/preparedness of the public. Also, significant work has been done with regard to the development of disaster plans for other natural disasters. Nonetheless, there remains much work to be done in the practical management of the meteorological and ecological disasters (such as forest fires, urban floods, etc.), the training of civil defense personnel and the education of the public. As indicated earlier, there is a need to develop synthetic vulnerability indices in order to facilitate the incorporation) of natural risk assessments in the regional and national development plans.

The internal organization and the exchange of information among the various organizations within the country will be strengthened. Also, the cooperation within the neighbor countries and the European Union will be enforced and encouraged, by various means.