

第一章 Chapter 1

白皮書緣起
Origin of White Paper

❖ 前言

台灣的地理環境特殊，恰位於歐亞大陸板塊與太平洋菲律賓海板塊交界處。由於地殼運動關係，板塊在交界處的相互碰撞、擠壓與張裂，衍生地表破碎、地塊隆升，使得台灣島造山運動迅速，讓台灣成為世界上有感地震最頻繁的地區之一。另外，台灣亦處於副熱帶季風區，每年五、六月間會有梅雨來臨，六至十月間則為颱風好發季節，此等特殊氣候，常帶來豪雨與強風，造成大量農作物損毀；加上台灣地形陡峻、河川短急，易引發嚴重水災，導致可觀之經濟損失與人員傷亡。

除了無法避免的天然災害外，有人類活動的行為發生，就會有人為災害產生的可能性。一般而言，除了居家及人為惡意所造成的災害，意外災害的發生就屬工廠及實驗場所為最頻繁之區域。國內近年來發生許多的重大災害事件，包括火災、爆炸、毒氣外洩、工程施工意外等，所造成的原因不外乎人為的疏失及人為的不當操作、儀器的老舊故障、化學藥品的不當使用及儲存、廢棄物品處理不當、缺乏落實有系統的管理規定、缺乏適當的災害預防與應變的教育訓練等，其所造成的損失則會直接影響國家產業的發展。



火災為常見之人為災害種類之一。

❖ Introduction

Taiwan has unique geographical features. The island is located at the boundaries of Eurasian Plate and Pacific-Philippine Plate. Due to Plate Tectonics, collision, subduction, and spreading are frequent in the boundaries, which cause crust fracture and uplift of the stratum, are frequently happened in the boundaries. In turn, the mountain building process in Taiwan has very fast movement, which makes this island one of the area in the earth with the most frequent sensible seismic. In addition, Taiwan is also located at the sub-tropical monsoon zone with plum rains during Mays and Junes and typhoons during Junes through Octobers. Such unique features in climate often bring heavy rains and strong winds that cause serious agricultural damages. The steep landforms and jet streams in the island make the situation even worse because floods usually arise that cause considerable losses in the economy and human lives.

In addition to the unavoidable natural disasters, where there are human activities, there are possible man-made disasters. Generally speaking, except for man-made malicious disasters, accidents occur mostly in factories and laboratories. There have been some serious recent disasters, including fire hazards, explosions, leakage of hazardous gases, accidents at construction sites, and etc.

The causes of the above disasters include negligence, improper manipulation, obsolescence and malfunction of machines, improper usage and storage of chemicals, improper waste disposal, lack of practicable and systematic administrative regulations, lack of adequate education and training of disaster prevention and handling. The overall losses are eventually affect developments of industries in our country.



Fire hazard is a common man-made

隨著我國教育體制的改變、教育普及化，使得校園內實驗室的數量大幅增加，更由於申請研究計畫內容趨於多元化以及部分學術研究也傾向於計畫導向，所以實驗的製程設計上相對複雜化且困難性增加。實驗過程中往往必須經常變更操作流程或研發新的製程，使用的機械、儀器、設備及原物料多樣化；再加上實驗室學生及相關人員的流動率甚高，以及忽略或漠視安全衛生管理之規定，種種因素導致實驗場所的危險因子擴大，因此意外事故的發生率大大的提高，不僅是大學實驗室有意外發生，國中、小學生的課外理化教室亦有火災與爆炸的意外發生。

從各國防災教育工作推展經驗來看，學校的防災教育重點在於：對災害的認知、防災的態度、事前準備、合宜的緊急應變措施、定期演習、建立社群為單位的防災系統、家長的參與、學校行政人員及教師的防災訓練、建築物安全訊息、防救災相關研究以及國際防災合作等等。從這些重點來看，國外的防災教育著重的是具體行動的實踐，雖然對災害的知識層面之認識也是要點之一，然而防災系統的建立進而維護生命財產安全，才是防災教育的最終目的。

Following changes of educational system in our country and popularization of education, the number of laboratories in campuses increases dramatically. Due to diversification and project oriented research interests, lab procedures have become increasingly difficult and complicated. In turn, more and more materials, equipment and apparatus are involved, adding up the high circulation rate of lab personnel, negligence and ignorance may lead to fire hazards and explosions in labs, which occur not only in universities, but even found in junior schools.

Based on experience of other countries, the education of disaster prevention in schools shall be focused on the following: awareness of disasters, attitude toward prevention, preparation beforehand, appropriate countermeasures, scheduled drills, establishment of community based prevention units, parental participation, training programs for teachers, safety warning signs for public buildings, research on disaster prevention and international collaboration. The key of the above emphases is action and practice. Although knowledge of disasters is important, how to set up prevention units in order to safeguard lives and property is the utmost goal of education of disaster prevention.

❖ 第一節 災害產生之影響

依據國內學者對台灣地區降雨量變化趨勢之研究顯示，近百年來台灣的降雨量有逐漸增加的趨勢，但降雨日數卻逐漸降低，顯示降雨強度日漸提高，因而發生洪災的機率大為增加。同時，從1980年以後，台灣地區各氣象測站降雨量的紀錄屢創新高，單次降雨量亦不斷創新，造成都會區淹水、山區土石流成災的機率將大為提高。因此，不論治山、防洪或都市區域排水的難度將愈來愈高，若未能妥為考慮氣候變遷及降雨量變化趨勢，往後的洪患將更為嚴重。

台灣在地震災害方面，因歐亞大陸板塊與太平洋菲律賓海板塊推擠效應，於板塊交界附近逐年累積能量，台灣地區平均約三十年發生一次重大地震，平時亦常有致災地震，可能造成嚴重的傷亡與財產損失。以八十八年九二一地震為例，全國共有二四五五人死亡，五十人失蹤，重傷七五五人，三萬八千九百三十五戶房屋全倒，四萬五千三百二十戶房屋半倒。」（資料來源：重建會生活處）。不僅造成人民生命財產蒙受重大損失，災民身心與生活深受衝擊，亦導致包括水電維生系統、學校、醫院、道路、橋樑等公共設施大量毀損；自然環境的驟變、產業生產設施的破壞，造成災區產業巨大損失；失業率驟升，整體經濟發展亦受到重創。估計可以貨幣化的有形直接損失超過新台幣三千六百億元，如果加上間接損失，總損失達新台幣一兆元。此等重大災害所造成之損失與衝擊，將隨都市化程度之提高而增加，是以如何強化防救災工作，實乃刻不容緩之事。



1 Impact of Disasters

According to the study on the precipitation in Taiwan made by domestic scientists, the rainfall in Taiwan tends to increase in the past century; however, it means days of precipitation drops gradually, which suggests a rise in the intensity of the rain and strong probability of floods. In addition, starting 1980 record-breaking precipitation data from various weather stations have caused floods in metropolitan areas and disastrous debris flows in mountains. Inundation will become more serious in the future if we ignore the transition of climate and fail to tackle mountain treatment, river regulation, and water drainage issues.

Taiwan is located at the boundaries of Eurasian Plate and Pacific-Philippine Plate. Due to Plate Tectonics, energy is accumulated in the boundaries, which will induce major seismic, which happen once every 30 years in average and cause serious losses in lives and properties. Take the Chi-Chi Earthquake in 1999 as an example, 2405 people lost their lives, 52 were missing, 701 were seriously injured. More than 100,000 houses were collapsed or damaged. Earthquakes not only cause losses in lives and property but also cause mental impact on victims and massive damage to the infrastructure of the society. The abrupt changes of the natural environment eventually heavily struck the industry in the disaster area as well as whole nation. The total losses caused by Chi-Chi Earthquake is up to NT\$ 1 trillion with NT\$ 360 billion tangible direct losses. The figures may be even higher as a result of high urbanization. Disaster prevention and rescue now demands immediate attention and great urgency.



災害的產生影響國家產業發展甚巨。

由於台灣所處之區域，無法避免颱風、地震等天然災害的發生，必須盡可能設法減輕災害造成之損失。上述颱風、豪雨、地震等天然災害，對社會造成之直接財物損失，平均每年即高達新台幣三百億元。若平時做好減災預防工作，災時採取有效因應措施，強化社會整體抗災能力，假使每年可減少30%因天然災害造成之損失，則相當於每年可產生約新台幣九十億元之直接經濟效益，對社會之繁榮與安定有相當大之助益。

其次就人為災害而論，少數的意外災害是發生在居家環境及校園內，絕大多數的人為災害的案例發生在產業工作中，以1998年為例，國內全國產業勞工罹災人次有29095人次，平均每小時就有三名勞工因工作而受傷、殘廢或死亡，勞工保險給付高達68.5億元，造成的直接與間接損失更難以估計，所以行政院勞工委員會先後研訂「加強勞工安全衛生方案」、「工作安全災害歸零方案」、「勞動安全產業升級方案」等，作為勞工安全衛生政策推行之主軸，使得職業災害率有明顯的下降，當時我國職業災害千人率雖從1987年5.91降至1998年的3.86；可是與其他先進國家比較，我國勞工職業災害率仍屬偏高（例如：1998年我國勞工死亡千人率為0.084，同年美國為0.050，日本為0.024，英國為0.008），顯示我國在職業災害的防治工作仍有待努力。



Disaster hinders industrial development

Typhoons, earthquakes, and natural disasters are unavoidable in Taiwan because of her unique geographical features. It is estimated the annual loss of properties caused by typhoons, torrential rains, and earthquakes reach NT\$30 billion. If disaster prevention and mitigation could be well done beforehand, if efficacious measures could be taken offhand, if the capacity for combat disasters could be strengthened, the annual losses would be reduced by 30%, or NT\$9 billion in terms of economic benefits, which will aid prosperity and stability to our society.

Man-made disaster is the next threat. Only few accidents happen at homes and campuses. Most of them happen in the industrial working environment. In 1998, there were 29095 person-time meeting disasters, about three persons got injured, maimed, or killed in every one hour. Insurance benefits reach as high as NT\$6.85 billion. Actual losses are beyond estimation. In order to tackle this issue, Council of Labor Affairs of Executive Yuan drafted three programs: Improving Labor Safety and Health Program, Work Safety and Zero Disaster Program, and Work safety and Industry Upgrade Program, and carried out labor safety and health policies based on these programs. Results are encouraging. The occupational disaster rate per thousand workers dropped obviously to 3.86 in 1998 as compared with 5.91 in 1987. However, such figure is still higher than that of some foreign countries. For example, the labor mortality per thousand workers in our country in 1998 is 0.094. In the same year, the figure in USA is 0.045, in Japan 0.037, and in UK 0.001, which suggests that there is still plenty room for improvement.

❖ 第二節 防災教育之推廣沿革



平時做好防災教育，便可於災時發揮自救及助人的技能。

我國民眾對於災害的問題一向非常關心，而政府部門也都很重視災害防治工作，歷年來投入相當多的人力與財力於防救災業務上，防災科技研究工作亦逐年增多。但由於經濟發展與社會變遷快速，使得防災工作有跟不上的情形，特別是大眾防災教育普及方面。由於社會大眾缺乏對災害的認識，致事前災害預防不足，災害發生時應變處理上又缺乏相關的輔導與諮詢，種種盲點均亟待消除。

因此行政院為健全國內災害防救法令及體系、強化災害預防、執行搶救及促進災後復原、加強教育宣導、提升全民災害應變能力，於民國八十三年七月二十八日行政院第二三九一次會議通過之「災害防救專案」；又於八十九年七月十九日公布「災害防救法」，將防救災體系修正為中央；直轄市、縣（市）；鄉鎮（市）三級，所囊括的災害種類包括風災、水災、震災、旱災、寒害、土石流災害、重大火災、爆炸、公用氣體與油料管線、輸電線路災害、空難、海難與陸上交通事故、毒性化學物質災害等。

民國八十四年行政院核定通過教育部所提之「土木工程防災教育中程改進計畫」，以加強土木學門有關災害防救之教育課程及內涵，並培育出更具防災、減災與緊急災害處理觀念之工程師。



Getting prepared in peacetime enables us to save ourselves as well as others.

Our people always concern themselves with disaster-related issues and the government also places the importance on disaster prevention and put in considerable manpower and financial resources. The number of research projects in technological aspect increase gradually in recent years. However, disaster prevention does not seem to keep pace with the fast transition in economic and social development, especially in the education programs to general public. Due the lack of knowledge, people will not be able to take precautions beforehand. When disasters occur, there are little guidance and consultations. All these need be eliminated in order to secure our lives and properties.

The Executive Yuan approved on July 28, 1994 □Disaster Prevention And Rescue Project□ in Council Meeting No. 2391 for the following purposes: establishing regulations and legal systems for disaster prevention and rescue, strengthening precautions to disasters, taking urgent steps for rescue and restoration, enhancing education and promotion, and improving capabilities of coping with disasters. On July 19, 2000 The Executive Yuan promulgated □Disaster Prevention Act,□ in which the disaster prevention system was amended as three levels: Central Government, Municipals/Counties, and Townships/Cities. Wind disasters, floods, seismism, drought, frigid disasters, debris flows, fire hazards, explosions, disasters of gas/oil pipelines for utilities and power transmission, air crashes, shipwrecks, land traffic accidents, and toxic chemical disasters are included in this Act.

The Executive Yuan ratified in 1995 □Intermediate Improvement Plan for Education of Disaster Prevention in Civil Engineering□ proposed by Ministry of Education in the aim of strengthening education program and contents of disaster prevention in Civil Engineering and fostering engineers with strong concepts of disaster prevention, mitigation, and handling.

民國九十年元月的第六次全國科技會議中，作成「加強推動防救災教材編訂與出版、建立推動機制等相關工作」的建議。同年五月九日行政院第二七三三次會議通過之「國家科學技術發展計畫（九十至九十三年）」，亦將該項建議列為重要實施方案。另外，八十九年十一月二十日國科會第一五〇次委員會議核定之第二期防災國家型科技計畫規劃報告中，教育部亦列為參與的主辦單位，負責推動防救災體系之評估與強化對策課題，主要工作包括：各級學校防救災教育內容課程安排之研擬、各級學校防救災教育課程執行方式之建立、各級學校防救災教育支援體系之建立。

於目前止，教育部顧問室依據第六次全國科技會議建議、國家科學技術發展計畫實施方案及第二期防災國家型科技計畫規劃報告，特詳予規劃相關工作與課題，提出白皮書，期能訂定妥善的防災教育政策，透過相關教材的編撰及教育的推廣等策略，將防災的理念深植於社會各階層，讓民眾認識台灣本土性天然災害與人為災害特性，並增加災害防治的知識，進而提升大眾防災意識與整體防災工作效能。



火災災害一般以建築火災最為常見。

The 6th National Technology Conference held during January 2001 concluded to propose the following from the government: giving impetus to the compiling, editing, and publishing of teaching materials for disaster prevention and rescue, establishing promotion mechanism. The Executive Yuan Council meeting No. 2733 held on May 9, the same year approved □National Development Scheme for Scientific Technology (2001~2004),□ in which the above proposal was included as the main focus. In addition, the Council Meeting No. 150 of National Science Council held on November 20, 2000 also included Ministry of Education as one of the auspices in their planning report of 2nd stage national disaster prevention technology projects, to be responsible for the analysis of disaster prevention and rescue system and strategy, which includes the design of education programs for disaster prevention and rescue for schools of all levels, the establishment of the execution methods, and supporting systems.

The Advisor Office of Ministry of Education is now planning the relevant jobs and issues in details and proposes this White Paper based on the recommendation made by the 6th National Science and Technology Conference, the practicing plan of national science and technology development, and the planning report of 2nd stage national disaster prevention technology projects. The aim is to set up appropriate educational policies, and to embed disaster prevention concepts deep into all social levels through the compiling of materials and education programs, in order for all people become familiar with the characteristics of disasters in Taiwan, and to have extensive knowledge in prevention and rescue. The overall efficacy will be improved by then.



Conflagration of buildings is most common