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The Challenges Relating to International Monitoring System Station

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Abstract: *Myanmar has 676,578 square kilometres of surface area available within its boundaries including 1,930 km of coastline. Myanmar signed the CTBT on November 25th, 1996 and the ratification on September 21st, 2016 at the United Nations. It is noted that the list at Annex I of treaty has no Myanmar's facility agreement. Although neighbouring countries such as Bangladesh, Thailand and China have the International Monitoring System (IMS) stations, Myanmar without having any station, is making challenges for national security, civil and scientific applications. Also these challenges may invite the political and governmental leaders' interests and attention of Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) to be persuaded because India and China listed on Annex II States are close boundaries with Myanmar. Myanmar is a site of potentially large earthquakes as indicated by historical records and recent findings. Cyclone Nargis hit the southern part of Myanmar on May 2nd and 3rd 2008 and more than 100,000 people died as a result and several hundreds of thousands lost their homes in the disaster. If an IMS station is established with the challenges of technical, financial and human resources, it will create the society safer and more secure from earthquake and tsunami hazards.*

Keywords: *International Monitoring System, Myanmar, seismic, infrasound, and hydroacoustic waves.*

1. INTRODUCTION:

Myanmar is the 24th most populous country in the world, and the 40th largest country by area with a 2018 estimated population of 53.86 million. It has 676,578 square kilometers of surface area available within its boundaries including 1,930 km of coastline [1]. It is a sovereign state in South East Asia, bordered by China, India, Bangladesh, Thailand and Laos. Myanmar is a developing country and has transformed to a Democracy since 2011. Myanmar signed the treaty on November 25th, 1996 and the ratification on September 21st, 2016 at the United Nations. It is found that the list at Annex I of treaty has no Myanmar's facility provision.

Now the government is serving the development of reconciliation of national races for internal peace. Besides, it is carrying out the developments of education in accordance with international standards, the economics improvement for local people etc.

2. ORGANIZATIONS AND HUMAN RESOURCE DEVELOPMENT:

The Division of Atomic Energy interacts with IAEA and CTBTO. Myanmar's legislative framework consists of the Atomic Energy Law (1998), Disaster Management Law (2013) and Counter Terrorism Law (2014), as well as international conventions and legal instruments. Now, the Division of Atomic Energy (DAE) is drafting a new Nuclear Law which is in the final state to be submitted to the parliament. Myanmar, a developing country, has been initiating the human resource development (HRD) for Nuclear Technology (NT) in the university system since 1997. The three universities such as Yangon Technological University (YTU), Mandalay Technological University (MTU) and Technological University (Kyaukse) employ 580 persons including diploma, graduate and post graduate level for NT from 1997 to 2017. Currently, approximately 120 NT graduate level staff work at MTU, TU (Kyaukse), DAE and other departments. Now the MTU and TU (Kyaukse) has been implementing the HRD for graduate and post graduate programmes every year [2].

3. CTBTO NETWORKS AND NUCLEAR EXPLOSIONS:

The CTBT prohibits nuclear test explosions and any other nuclear explosions in all environments: underground, in the oceans, and in the atmosphere [3].

The International Monitoring System (IMS) network forms the basis of the CTBT's global monitoring regime. This network provides real-time monitoring and data processing of geophysical events to identify nuclear explosions anywhere in the world. It consists of 337 monitoring facilities including 50 primary seismic stations and 120 auxiliary

seismic stations, 11 hydroacoustic stations (6 hydrophone stations and 5 T-phase stations), 60 infrasound stations, and 80 radionuclide stations and 16 radionuclide laboratories [3,4].

Each new facility is certified and added to the IMS network once it is built and passes the certification process, in which it is demonstrated that it meets all technical specifications, including requirements for data authentication and transmission through the Global Communications Infrastructure (GCI) link to the IDC [3].

The need for timely tsunami warnings became abundantly clear following the 2004 tsunami in the Indian Ocean, which killed over 230,000 people. IMS data is especially useful in this respect because it is greater in volume and available more rapidly, accurately, and from more diverse locations than data derived from national networks [4].

A nuclear explosion releases a tremendous amount of energy. Part of this energy can travel through the Earth, atmosphere, and oceans as seismic, infrasound, and hydroacoustic waves, respectively. It also generates tremendous amounts of radioactive particles and gases, known as radionuclides. The primary role of radionuclide monitoring is to provide unambiguous evidence of a nuclear explosion through the detection and identification of fission products. Moreover, it is possible to distinguish between fission products from a nuclear explosion and those arising from atmospheric releases from civil nuclear power and reprocessing plants [3].

4. NATURAL DISASTERS IN THE LOCAL REGION:

Cyclone Nargis hit the southern part of Myanmar on May 2nd and 3rd 2008 and more than 100,000 people died as a result and several hundreds of thousands have lost their homes in the disaster [5, 6].

Myanmar is a site of potentially large earthquakes as indicated by historical records and recent investigation [7]. Myanmar indeed is earthquake-prone (see Figure 1) as it lies in one of the two main earthquake belts of the world, known as the Alpide Belt, that starts from the northern Mediterranean in the west, and then extends eastwards through Turkey, Iran, Afghanistan, the Himalayas, and Myanmar to finally Indonesia.

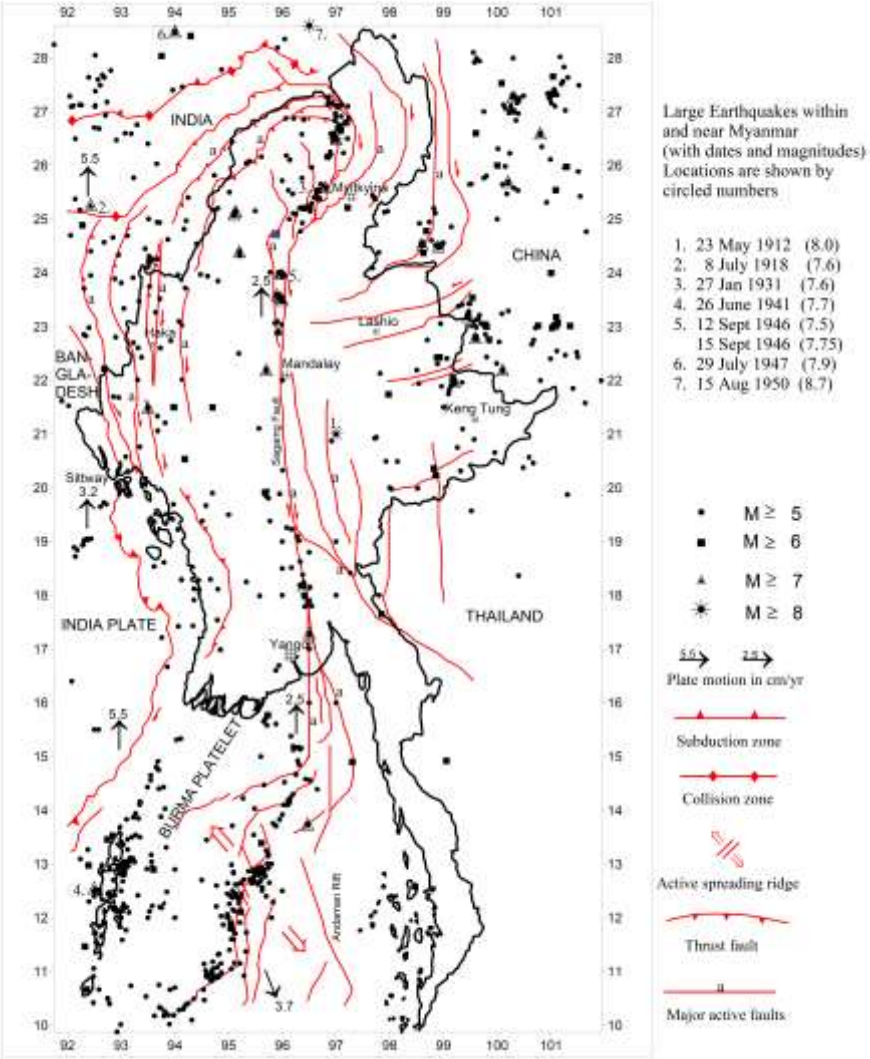

Figure.1 Seismotectonic Map of the Myanmar Region [8]

Earthquakes in Myanmar have resulted from two main causes: (1) the ***continued subduction*** (with collision only in the north) of the northward-moving Indian Plate underneath the Burma Platelet (which is a part of the Eurasian Plate) at an average rate of 4.0 – 6.0 cm/yr; and (2) the ***northward movement of the Burma Platelet*** from a spreading centre in the Andaman Sea at an average rate of 2.5 – 3.0 cm/yr. ***Very large overthrusts*** along the Western Fold Belt have resulted from the former movement, and the ***Sagaing and related faults*** from the latter movement [8].

The Sagaing fault is a major right-lateral strike-slip fault which has long and straight traces across the entire length of Myanmar for approximately 1000km. If a fault is 100km long, the earthquake would be closer to magnitude 7.5 and it is important for modern earthquake assessment. Many large urban centres lie on or near the Sagaing fault [7,8].

Since ancient times, a series of earthquakes occurred along the Sagaing fault zone. In the last 100 years, significant earthquakes occurred in Myanmar are as follow: Innwa (1839, M>7.0), Maymyo (1912, M=8.0), Bago (1927, 1930, M=7.3), Sagaing (1956, M=7.0), and Bagan (1975, M=6.8), Phyu (1930, M=7.3), Swa (1929, M=7.0), Pyinmana (1931), Amarapura (1855), Mandalay (1871, 1931), Tagaung (1991, M=7.3), Wuntho (1946, M=7.5), Myitkyina (1931, M= 7.6), and Putao (1906) Phyu (1930, M=7.3), Swa (1929, M=7.0), Pyinmana (1931), Amarapura (1855), Mandalay (1871, 1931), Tagaung (1991, M=7.3), Wuntho (1946, M=7.5), Myitkyina (1931, M=7.6), Putao (1906), Kamaing (1931, M=7.6), Tarlay (2011, M=6.8), Thabeikyn (2012, M 6.8), Chauk (2016, M=6.8) [7,8,9].

5. CHALLENGES AND REQUIREMENTS:

Each state party (Myanmar) shall have the right to participation in the international exchange of data and to have access to all data made available to IDC by cooperating with IDC through National Authority (NA) (Treaty, Article IV, Paragraph 18) [10].

Myanmar needs to designate a NA to legally interact with the organization and other states parties. Additionally, the NA will inform the organization upon entry into force of the treaty (Treaty, Article III, Paragraph 4) [10].

In the future, having an IMS station may support the information for On Site Inspection (OSI), one of the verification regimes of treaty. But also, it is provided by any relevant technical information obtained by national technical means (NTMs) (Treaty, Article IV, Paragraph 37) [10].

Myanmar also needs to establish a National Data Center (NDC) which may be supported by NTMs with the help of the NA in parallel with any station consideration.

If Myanmar has a station, there would be data available about a possible nuclear test that may be done within the neighbouring countries and it can provide information and data to the IDC. China and India are bigger countries than Myanmar and they are existing in the list of Annex II. Therefore, it is a very important point to establish any station not only for national security of Myanmar but also for the attention of CTBTO.

Myanmar needs to negotiate and cooperate between Division of Atomic Energy, Universities under Ministry of Education and the Department of Meteorology and Hydrology under the Ministry of Transport and Communication for national security and scientific applications in results of the establishment of any station.

It is the biggest challenge on the political and governmental leaders' interests to be persuaded for a station among the other sectors.

It is an important challenge who will initiate, negotiate and submit the station proposals from ministry to Parliament so that any station can exist in Myanmar. Only after that, the NA will submit a facility agreement (getting a station) to the organization with consultation and discussion.

It has found that lives and houses have been lost in Japan and Indonesia due to tsunami waves. So Myanmar needs to prepare and protect local peoples living along the coastal regions by hosting any station.

Furthermore a lot of earthquakes have been found nationwide due to the Sagaing fault in recent and historical records. People and religious buildings will be protected from notifications of seismic hazards if any station prepares in advance in Myanmar.

If Myanmar has an IMS station, tsunami warnings and notices about earthquakes, any nuclear or explosive tests will be known in advance.

If a station will be constructed, a developing country such as Myanmar has limited financial budget and it may need help with organization or the other assistance. It may be a challenge to develop the station because there is no technology and technical expertise in local community to undertake such a project.

Myanmar needs to produce human resources for technology with the implementation of National Capacity building. At present, there is a limited human resource for nuclear technology development in DAE and universities. On the other hand, the two universities such as MTU and TU (Kyaukse) have gradually produced human resource development so that future generations can be involved in any such station operation, with some nuclear radiation applications and other sectors concerned with nuclear technology.

If Myanmar were to host any station, it will be expected that the technical knowledge and professional field skills and job opportunities will be obtained for future generations holding bachelors and advanced degree level qualifications.

If the stations are considered for Myanmar, Radionuclide and seismic stations will be recommended because our country has human resources including nuclear technology graduates and graduates from seismic fields.
If the CTBTO offers to host a station in Myanmar, it will need the permission of the parliament according to our national rulings. Thus Myanmar may consider to making a decision about facility agreement upon whether a station should be accepted or not.

6. CONCLUSIONS:

The International Monitoring System (IMS) network forms the basis of the CTBT's global monitoring regime. This network provides real-time monitoring and data processing of geophysical events to identify nuclear explosions anywhere in the world. In the future, having an IMS station may support the information for On Site Inspection (OSI), one of the verification regimes of treaty. If Myanmar has a station, there would be data available about a possible nuclear test that may be done within the neighbouring countries and it can provide information and data to the IDC. It has found that lives and houses have been lost in Japan and Indonesia due to tsunami waves. So Myanmar needs to prepare and protect local peoples living along the coastal regions by hosting any station. If Myanmar has an IMS station, tsunami warnings and notices about earthquakes, any nuclear or explosive tests will be known in advance. If Myanmar were to host any station, it will be expected that the technical knowledge and professional field skills and job opportunities will be obtained for future generations holding bachelors and advanced degree level qualifications. It is an important challenge who will initiate, negotiate and submit the station proposals from ministry to Parliament so that any station can exist in Myanmar.

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