

The Mw 9 Sendai, Japan Earthquake of March 11, 2011

Japan was hit by the largest earthquake ever recorded in the region on Friday the 11th March, 2011. The original magnitude of Mw 8.9 has been now revised to Mw 9.0, making it globally the 5th largest recorded earthquake. This great mega-thrust earthquake occurred at 05:46 UCT, 130 km off the east coast of the Oshika Peninsula. The earthquake caused a massive tsunami, which hit the Japanese coast with in minutes. The heights of waves reached 10 m, which traveled up to 10 km inland. At the time of writing this note (March 16, 2011), the Japanese National Police Agency has officially confirmed 2772 deaths, 1892 injured and 3742 missing human beings. The actual loss of lives could be much more, running into 10s of thousands. There was heavy damage to houses, roads, railways, airports and ports. Live coverage of tsunami waves destroying and moving buildings, roads, aircrafts, ships and cars was heart breaking. About 5 million household in north eastern Japan were left with out electricity. There has been partial melt down in at least three nuclear reactors and chemical explosions have occurred. Within 20 km radius of Fukushima I Nuclear Power Plant and 10 km radius of Fukushima II Nuclear Power Plant, residents were evacuated. The estimates of economic losses are up to US \$ 200 billion. Japanese Prime Minister Naoto Kan declared “In the 65 years after the end of the World War II, this is the toughest and the most difficult crises for Japan”.

It must be realized that Japan is the most advanced country in the world as far as the earthquake research is concerned. The Sendai earthquake tragedy would have been several fold more severe, but for the scientific and technological interventions and implementation of the defensive mechanism by Japanese scientists, engineers and administration. For example, the Earthquake Early Warning systems are being operational in Japan. These systems determine the location and magnitude of an earthquake on the basis of recording the P (longitudinal) waves. Longitudinal waves travel at a velocity of about 7 km/sec. Maximum damage is done by S (transverse) waves that are slower and travel with a velocity of about 4 km/sec. About one minute prior to effects of the Sendai earthquake being felt in Tokyo, the Earthquake Early Warning System connected to over 1000 seismometers in Japan sent out a warning message on television about the anticipated accelerations in Tokyo region to millions. It is believed that this early warning saved many thousands of lives.

Earthquakes in Asia- Pacific Region

The Asia- Pacific region accounts for one- half of the global population and about 80% of all losses due to natural hazards globally. Earthquakes and the resultant tsunamis are one of the worst natural hazards and the impact is seen with in a short time. The secondary effects can continue to distress the region for months. The largest human lives lost in any natural disaster were in January 23, 1556 Shanxi Province, China earthquake (M 8.0) which claimed 830,000 lives. The Kanto earthquake (M 8.1) of September 1, 1923 claimed 142,800 lives mostly in Tokyo and Yokohama. A 12 m high tsunami was generated, horizontal displacements of up to 4.5 m were recorded and the fires continued

for weeks. The official loss of human lives in the July 27, 1976 Tangshan earthquake (M 7.5) of China is 255,000, although some believe that as many as 655,000 lives were lost.

However, none of these earthquakes were any where close to Mw 9. The 26 December 2004 Sumatra earthquake was of Mw 9.2. This earthquake and the resultant tsunami claimed an estimated 228,000 human lives. The total number of lives lost in the Sendai Mw 9.0 earthquake is not likely to exceed 20,000. The credit goes to Japanese scientists, engineers, administration and disciplined citizens to limit the human life losses.

Situation in India

After the December 26, 2004 Mw 9.2 mega-thrust Sumatra earthquake and the havoc created by the resultant tsunami, India has successfully set up a most modern Tsunami and Storm Surge Warning Centre. This was made functional in a record time of 30 months. Over the past 3 and half years, this has performed very successfully. This success encourages us to do the needful to warn citizens of the anticipated high accelerations in Indian big cities after a major earthquake occurs in the near by region.

As of now, earthquake forecast is not available for practical application. However, it is known that major damage by an earthquake is due to transverse and surface waves which travel slower (3- 4 km/s) compared to the longitudinal waves (~7 km/sec). If a major earthquake occurs some 300 km away from a big city, and there is a good network in the vicinity of the epicenter of the earthquake, its focal parameters can be determined in 15 to 20 seconds. This would provide a lead time of about a minute to warn the public. For example, the source of major earthquakes in central Himalaya is 200 to 300 km away from the National Capital Region of India. This provides an excellent opportunity of deploying Earthquake Early Warning system. The efficacy of such a system has been proved in the recent Sendai earthquake. Such systems are already operating in many parts of the world such as Japan, Mexico, Romania and Taiwan. To implement such a scheme, a lot of infrastructure and training is required. However, the results of successful implementation are overwhelming, as seen in case of the recent Sendai earthquake.

Fortunately, all India's nuclear installations are in zones of low seismicity and the maximum credible earthquake is estimated not exceed M 7. So, a situation faced by the Fukushima and other nuclear power plants in Japan is not likely to be faced in India.

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