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Technical backgrounds of active fault definitions used for nuclear facility siting: a review

H. Lee, C. B. Im, T. M. Shim, H. S. Choi, M. Noh and J. H. Jeong
Korea Institute of Nuclear Safety, Daejeon, Korea (heanu@kins.re.kr)

This paper reviews definitions and technical backgrounds of active fault definitions used for nuclear facility siting in the United States, Japan, China, and IAEA, constraint to age criteria, with an intension to extract a principal backbone dissolved in these definitions, eventually to apply it to the developing regulatory standard for nuclear facility siting in Korea.

	Age criteria of active fault for nuclear facility siting
USA	Evidence of at least one movement in the last 50,000 years, or a recurring nature within the last 500,000 years
Japan	Evidence of movement in quaternary (approximately 1,800,000 year BP)
China	Evidence of at least one movement after late Pleistocene (approximately 100,000 year BP)
IAEA	No numerical age criteria

The United States: Selection of '50,000' and '500,000' years as the criteria for defining an active fault (called as capable tectonic source) is based primarily on the practical ability to date the event history of a fault. The age criterion '50,000' years for defining an active fault is based primarily on the practical ability to date the event history of a fault. The period of 50,000 years represents the generally accepted limitation of the Accelerator Mass Spectrometry (AMS) radiocarbon dating technique, and conservatively brackets the reference probability such that the potential opportunity for a fault to produce an earthquake is incorporated in the assessment of risk implicit into the definition of the reference probability (Level of acceptable risk, 10^{-3}/yr ć¸ 10^{-4}/yr).

The age criterion ‘500,000’ years was developed based primarily on the practical limitations of various dating methods. In particular, at the time these criteria were initially developed, the practical minimum age for K-Ar dating was about 500,000 years and for paleomagnetic dating was about 715,000 years (780,000 years now days). An age of 500,000 years is sufficient to sample the current seismotectonic setting. Any tectonic structure that has been active in the current tectonic setting should be considered ‘active’. The US NRC staff judged that if more than one event has not occurred in the past 500,000 years, the fault likely is not active during the current tectonic regime.

Japan: Nuclear Safety Commission of Japan defines active fault in the regulatory standards as a quaternary fault that has a potential for the reactivation in the near future. It is preferred not to have an active fault at the projected site. An active fault located out of the site but within a certain distance should be considered in the seismic design for the nuclear facility if the fault appears to have moved in the last 50,000 years.

China: The concept of the active fault (called as capable fault) used in China is primarily based on site-specific tectonic characteristics and practical ability to define ages of the event history of a fault. Selection of ‘100,000’ year for defining an active fault is partly because faults showing evidence of last movement occurred before the late Pleistocene tend to be stable, while faults showing evidence of last movement occurred after the time tend to keep moving over the time. Another reason for the ‘100,000’ year being is because there exists a key geologic horizon, obvious, generally accepted, and approximately 100,000 years old in the eastern China where all the nuclear facility sites are located.

IAEA: IAEA uses the definition of active fault rather qualitative and perceptive, and hence acceptable to the member countries.

These concepts of active fault widely used for nuclear facility siting are principally based on practical ability to define age of a fault and site-specific tectonic environment. Concerning the current tectonic regime of Korea has reportedly been the same during Quaternary, it is reasonable to define ‘active fault’ as a fault that shows evidence of recurring nature during quaternary period for Korean sites.