

The sheer number of seismic events aside, some small detected events may be poorly recorded, rendering accurate epicentral and focal depth determinations impossible without strenuous effort. Generally speaking, source identification requires a higher signal-to-noise ratio (S/N) (cleaner signal quality) than epicentral location, which in turn requires a higher S/N than the mere event detection. Past experience with teleseismic signals suggests that, the source identification threshold is about 0.5 magnitude unit larger than the detection threshold. The threshold gap may be larger than 0.5 for regionally recorded events with m_b less than 3.5.

The most efficient way of handling such a large number of events is to begin with a winnowing process. About 90% can be identified as earthquakes simply because their focal depths are too large, or their epicentral locations are deemed too implausible, or both, for underground nuclear tests. The location information can be used to weed out a large fraction of chemical explosions for mining and construction, rockbursts, vehicular traffic, and other sources. Treaty provisions requiring advance notification of these man-made activities could help make the winnowing process even more efficient.

The identification of the remaining events, still numbering in the hundreds per year, if not in the thousands, is a challenging task. Moderate-sized (m_b in the vicinity of 4.0) and small earthquakes are poor generators of long-period surface waves. Even less surface waves are produced by underground explosions in this magnitude range. As a result, the m_b versus M_s discrimination method which works so effectively for larger events ceases to be useful. Source identification based on observed differences in spectral make-up at high frequencies (greater than 1 cycle per second) between earthquakes and explosions is a topic of active research.

Explosion Yield Estimation

If all nuclear tests are to be banned, as under a CTBT, there will be no need for yield estimation. At present, there are still differing opinions about the verifiability of militarily significant clandestine tests which are carried out using elaborate evasion schemes. This grey area covers clandestine nuclear tests with yields of several kilotons. As a result, a low yield threshold test ban treaty (LYTTBT) may appear to be a more widely acceptable option in the near future.

For any threshold test ban treaty (TTBT), including the 1974 Treaty signed by the U.S.A. and the U.S.S.R. limiting the maximum allowable yield to 150 kilotons, it is necessary to measure nuclear explosion yields in order to determine if they stay below the threshold permitted by the treaty. Seismic yield estimation is accomplished by establishing an empirical (seismic) magnitude versus yield relationship using explosions of known yields. Once established, such a