An on-site inspection (OSI) constitutes the final verification measure under the Comprehensive Nuclear-Test-Ban Treaty (CTBT). OSIs are launched to establish whether a nuclear explosion has been carried out. During such an inspection, facts are gathered within a limited investigation inspection area of 1000 Km2 to identify possible violation of the Treaty. Other challenges that the inspection team has to face are: the size of the team, which is limited to 40 inspectors; the duration of the inspection, below 60 days from the date of approval if no extension is approved; and political limitations imposed by the Treaty in the use of allowed techniques. It is evident that generic search logic and well-developed methodology for each one of the techniques are necessary in order to fulfil the requirements of the OSI mandate under such constraints. Throughout the years, the On-Site Inspection Division of the Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organization has conducted field exercises in order to build up the mechanism that will allow the Commission to successfully conduct OSIs once the Treaty enters into force. In this paper we present examples of the geophysical and seismological data collected during such exercises that are relevant for a better understanding of the signatures that can be associated with an underground nuclear explosion, inter alia high-resolution geophysical data collected at a former nuclear test site, seismic aftershock measurements collected using a network of seismic mini-arrays, and the techniques applied to select locations for underground sampling for noble gas detection.