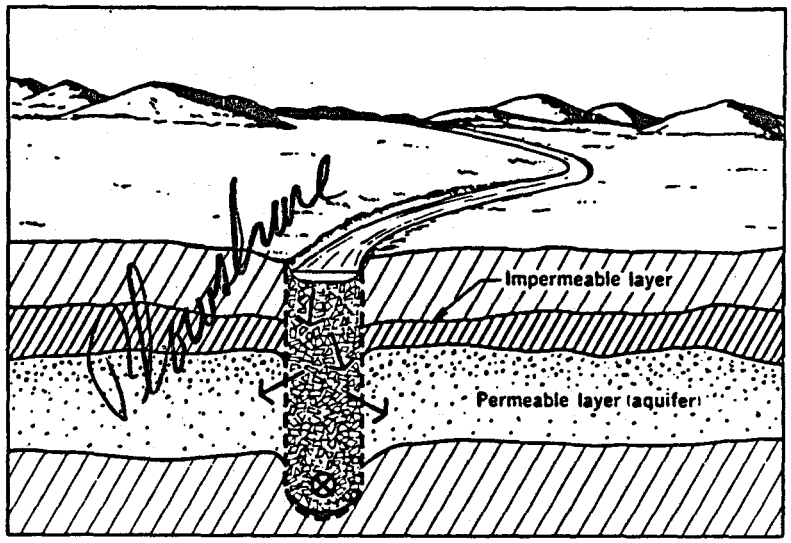

Figure 10. Nuclear explosion used to break through a barrier to permit run-off water to be used to recharge underground aquifers.

Ideas and schemes for scientific research are many and varied. No one could hope to list all the possible scientific applications of nuclear explosions, but the following examples are the more widely known.

In recent years man has succeeded in creating at least 11 elements heavier than uranium, the heaviest naturally occurring element. In fact, one of the most important nuclear fuels, ^{239}Pu, is artificially produced. The major portion of the isotopes of these transuranium elements have been produced by nuclear reactor irradiations and charged particles, including heavy-ion bombardment. However, two of the elements, einsteinium and fermium, were discovered in the products of the world's first thermonuclear explosion in 1952. These elements were formed by successive neutron capture in the parent uranium atom.

Heavy isotope production in a nuclear reactor follows the capture–decay–capture chain, whereas the target nuclei in the nuclear explosion successively absorb up to 18 or more neutrons almost instantaneously, becoming neutron rich. These nuclei subsequently decay to elements of higher atomic number by beta particle emission. Thus, despite the fact that ultraheavy isotopes become increasingly unstable and have exceedingly short half-lives as their mass numbers increase, the possibility