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GB A 2009487
GB A 2003310
EP A 0081403
GB 1598355
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(54) Disposal of hazardous and toxic waste material

(57) A repository for waste packages (14) is in the form of a below-ground tunnel (11) having a filled access shaft (12) and lined borehole (13). A tube (17) passes down through the filling in the access shaft and the tunnel, lined borehole and tube are filled with a plastic substance such as a bentonite clay or bitumen to provide a pressure in the repository greater than the pressure provided by water in the ground around the repository. A trench with a sealing cap (Figure 2 not shown) can be used as an alternative to a tunnel.

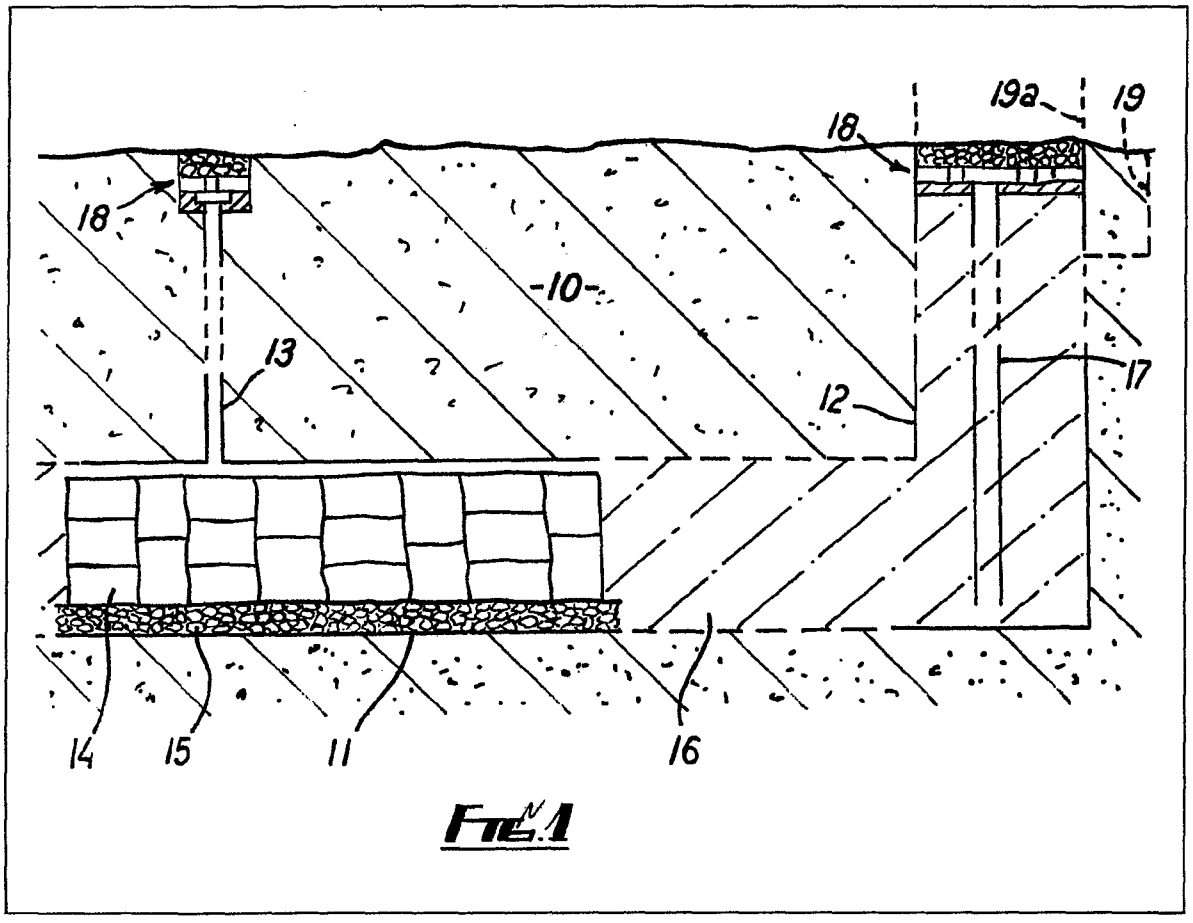

FIG.1

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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

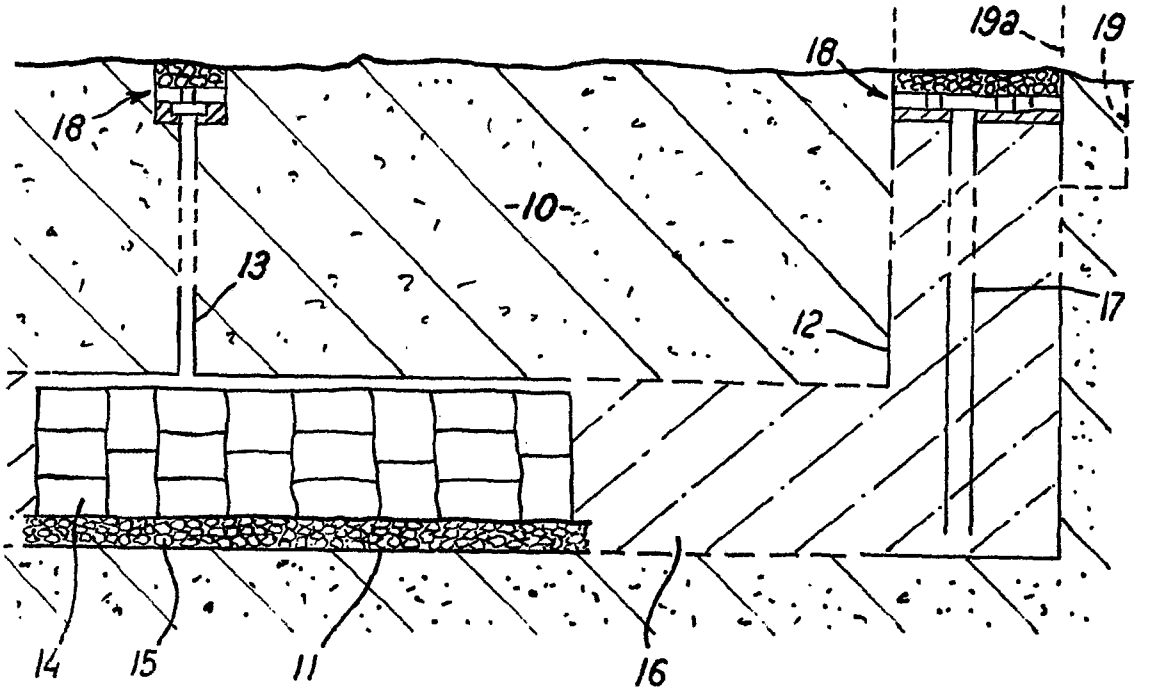
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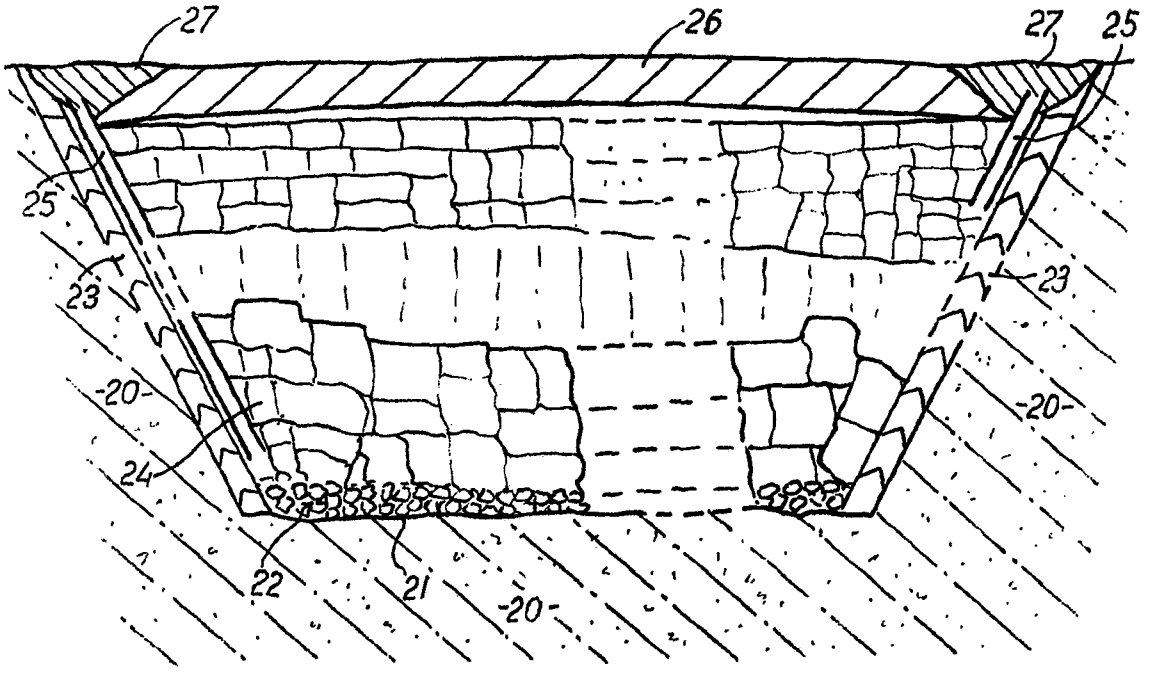
FIG.1

FIG.2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SPECIFICATION

Disposal of hazardous and toxic waste material

This invention relates to the disposal of hazardous and toxic waste material and especially radioactive waste material.

The problem of radioactive waste disposal is that of inhibiting the return of the disposed waste material into the biosphere. The main route by which radioactivity can reach the biosphere and cause a hazard to man is by transport in ground waters. In order to reduce the transfer of activity to these waters the radioactivity is often embedded in a low leach-rate matrix (e.g. glass) and possibly further overpacked. A description of one type of repository is given in Nuclear Engineering International February 1982 pages 41 to 43, where Figure 1 shows an overpack of about one third metre thick iron round a borosilicate glass containing highly radioactive waste. Figure 3 of the same article shows the tunnel system in which the waste is placed, with a deep access shaft. Disposal of less active waste in a solid matrix can also take place into surface trenches which are later covered.

The present invention provides an improved repository arrangement in that it is simpler than known arrangements, has scope for providing information useful in monitoring a repository, and allows relatively simple re-access to the repository.

In accordance with the present invention a below-ground-level repository for toxic waste is characterised in that it is surrounded by a substance of long term (e.g. 100 years) plasticity and of sufficient height relative to the natural water table of the ground to provide a pressure in the repository and around the waste greater than the pressure provided by the water in the adjacent ground, and preferably means are provided for monitoring the continuity of said substance.

The repository could be in the form of one or more tunnels or one of more trenches.

The invention in tunnel and trench forms will now be described further with reference to the accompanying drawing in which both Figures 1 and 2 are sectional elevations.

In Figure 1 host rock 10 is removed to provide a repository tunnel 11, an access shaft 12 and a lined borehole 13. In the tunnel 11 waste radioactive material 14 in solid package form is supported on fist-sized impervious rocks 15 and, when the repository is full, clay 16 of selected plasticity (such as bentonite) is used to fill the tunnel, the access shaft 12, the borehole 13, and a tube (or tubes) 17 which is placed in the shaft 12. One objective in the filling is to avoid contact between packages 14 and pervious rock or ground and thereby avoid the rick of leakage from packages to the rock or ground. As an alternative to a suitable clay for filling, bitumen could be used.

Pits 18 are provided at the heads of tube 17 and lined borehole 13. After filling with clay the levels of clay in the tube 17 and borehole 13 are observed at the pits. They should be of sufficient height with respect to the natural water table so that a positive pressure exists between the clay round the packages and the water in the adjacent rock or ground. In this way water is prevented from flowing towards the material 14. Steady levels of clay indicate that there is no leakage of clay. During the observation period the tube 17 can be subjected to applied pressure and, with continuity in the clay medium, this pressure will be transferred to the lined borehole 13. This transferred pressure can be detected or, alternatively, a loss of level in the tube 17 should be compensated by a corresponding gain in level at tube 13. When the observation of levels and testing of continuity is complete the pits can be closed by large rocks supported by the host rock and covered with a tamper-resistant material such as concrete. Where the clay used, or other material used for filling, has a density lower than that of the ground water then either the level of the water table is lowered, such as by a ditch 19, or the filling is given an added head such as by a filled chimney 19*a*.

In Figure 2 host ground 20 is removed to provide a repository trench 21 having at its base fist-sized impervious boulders 22 and at its sides interlocking blocks of low permeability rock 23. The waste for disposal is shown as packages 24 supported on the boulders 22. The trench has a fill of a plastic clay and tubes 25 (two only of which are shown) dip into the clay. An impervious clay sealing cap 26 is provided together with observation pits 27. The cap could be domed above ground level and the tubes 25 exposed at or near the top of the dome. By topping up the exposed tubes the filling of voids, as the waste deteriorated, would take place.

The cap 26 could be made in the form of a low arch or dome so that it is supported from the ground 20 or it could have columns extending to he base of the trench.

The tubes 25 can be used to demonstrate the filling of the clay in the same way as the tube 17 and borehole 13 in Figure 1.

Existing trenches holding disposed waste could also be provided with a sealing cap as described above. A tube functioning like tube 25 could be inserted through this cap to the base of the repository to allow injection of plastics material.

Arrangements according to the invention allow for the recovery of stored articles, even with the Figure 1 arrangement. First, sufficient of the capping rocks or concrete is removed to expose the plastic substance. Progresssive removal of the latter could then be achieved by, for example water jetting in the case of clay. This is simpler than drilling solid backfill and is operationally safer.

As the clay or bitumen filling prevents water reaching the material 14 or packages 24 the transport of oxygen is also prevented and thus corrosion is avoided. Thus the material 14 or packages could effectively be radioactive gases (such as Krypton 85) in clyinders. If there is a sufficient depth of filling (such as 200 metres) then the pressure exerted by the filling could be greater than the pressure of gases in the cylinders so that, not only is corrosion avoided, but a second seal is effectively provided on the cylinders preventing gas escape from the cylinders.

CLAIMS

1. A below-ground-level repository for toxic waste characterised in that it is surrounded by a substance of long-term plasticity and of sufficient height relative to the natural water table of the ground to provide a pressure in the repository and around the waste greater than the pressure provided by the water in the adjacent ground.

2. A repository as claimed in claim 1 in which means are provided for monitoring the continuity of said substance.

3. A repository as claimed in claim 1 or 2 in which said substance is a clay, such as bentonite, or bitumen.

4. A repository as claimed in claim 1 in the form of a tunnel (11) having an access shaft (12) and lined borehold (13) with a filling of said substance in tunnel, shaft and borehole.

5. A repository as claimed in claim 4 having a tube or tubes (17) also filled with said substance the level of which can be observed.

6. A repository as claimed in claim 1 in the form of a trench (21) having on its base impervious boulders (22) and on its sides low permeability rock (23) with toxic waste supported as packages on the boulders and the trench filled with said substance and having top access tubes (25) dipping into substance and the whole sealed with an impervious cap (26).

7. A repository as claimed in claim 6 in which the cap is domed above ground level and the top access tubes (25) exposed at or near the top of the dome.

8. A repository substantially as hereinbefore described with reference to either Figure 1 or Figure 2 of the drawings.

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