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(54) **Method of Treating Radioactive
Waste Material**

(57) A method of treating radioactive waste material, particularly a radioactive sludge, comprises separating solid material from liquid

material, compressing the solid material and encapsulating the solid material in a hardenable composition such as cement, bitumen or a synthetic resin. The separation and compaction stages are conveniently effected in a tube press.

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SPECIFICATION

Method of Treating Waste Material

The present invention relates to a method of treating radioactive products for disposal purposes.

A number of processes and operations performed in the nuclear industry produce waste products which comprise solid matter in a liquid phase, usually water. Such products frequently comprise fine particulate matter dispersed in water, and it is difficult to dispose of these products because their radiation level is too high for the product to be passed to an active drain and they contain too much liquid to be disposed of in the manner known for radioactive solids. A particular example of such a product is that known in the industry as "radioactive sludge". This sludge is produced as a waste product in reprocessing of fuel elements. The fuel elements are cooled in ponds and the metal casings of the elements inevitably corrode with the result that fine particulate oxide materials are formed in the water. The particulate matter is removed from the pond water by continuously circulating the water through sand pressure filters which are periodically backwashed with water. The mixture of backwash water and particulate matter is collected and constitutes the radioactive sludge which has a viscosity similar to that of water.

It is an object of the present invention to provide a method of treating radioactive products.

According to the present invention there is provided a method of treating a radioactive product of the type comprising a solid phase and a liquid phase, the method comprising effecting a separation of solid from liquid, compressing the solid admixing the compressed solid with a hardenable material, and hardening the resultant mixture.

The method of the invention allows radioactive waste products comprising for example, a fine particulate suspension to be treated in a manner which allows for subsequent, safe disposal of unwanted material.

Separation and compression steps of the above method are preferably carried with a tube press which enables the two operations to be performed in a single apparatus. The tube press for use in the preferred method of the invention will comprise a cylindrical filter element which locates within a cylindrical housing lined with a flexible sleeve, particularly of neoprene. The material to be treated is pumped into the tube press between the filter element and flexible sleeve and liquid passes radially inward of the filter element for discharge from the apparatus. The filtered material collected on the outside of the element is a semi-solid state and once the input flow of waste material has been terminated the compression operation is conducted by building up pressure behind the sleeve so that the solids are pressed against the filter element to remove further liquid. Optionally, prior to pressure build up behind the sleeve, a compressed air line

65 may be connected to the waste input line and air blown into the press to remove additional liquid from the semi-solid product by evaporation.

Once the pressure build up behind the sleeve has been relieved, the filter element may be withdrawn from its housing and the remaining cake like material, which may contain 40—60% water, removed for disposal.

The obtained solid product when broken into small pieces is eminently suitable for blending with a hardenable composition, e.g. cement, bitumen or synthetic resin system so that the product is ultimately encapsulated in a hardened matrix. Such a matrix will generally be formed by admixing the solid product and hardenable material in a protectively lined vessel e.g. a concrete lined drum and allowing said material to harden. The drum may finally be given a protective concrete capping. With the material packaged in this way, the radiation level emitted from the drum will be below the levels prescribed in safety regulations so that the drum may be dumped at sea.

For the purpose of packaging the waste material in the manner described above, the tube press will be provided at one station of a suitable packaging system and will be associated with a pneumatic hammer or the like so that the solid material produced may be broken into small pieces for passage into a concrete lined drum which will previously have been filled with the hardenable composition. Subsequently the contents of the drum will be mixed, capped and allowed to harden.

It is essential that a known quantity of solid material is filled into the drum otherwise the radiation levels emitted by the drum may be too high to allow disposal of the drum.

To allow for this metering operation, the tube press will firstly be tested under operating conditions to evaluate the length of time it takes for the press to produce the required amount of solids for a given input pressure of the waste material. In subsequent operations for treating waste, the press will be operated at this input pressure for the required time to give the desired quantity of solids. The life of the tube press will be determined by the life of the filter element, which is for preference stainless steel, under the radiation conditions. At the end of its life, the tube press cannot be reclaimed, due to irradiation, and it is envisaged that the press will be releasably mounted in the packaging apparatus which will have suitable sized trap doors or the like through which the press may drop into a drum of hardenable material (preferably concrete) for disposal purposes.

The invention is particularly applicable to the treatment of radioactive sludge so as to convert it into a form in which it may readily be disposed.

The invention also offers the advantage that it will be possible to eliminate the expensive sand pressure filters and circulate the cooling pond water directly to a tube press since this apparatus would be capable of filtering and compacting the

particulate solids at the concentrations in which they are present in the pond water.

The invention is also applicable to treatment of other radioactive particulate matter/liquid mixtures. For example, it is applicable to treating mixtures of water and beads of ion exchange resins or molecular sieves having absorbed or adsorbed radioactive species.

Claims

10 1. A method of treating a radioactive product of the type comprising a solid phase and a liquid phase, the method comprising effecting a separation of solid from liquid, compressing the solid, admixing the compressed solid with a hardenable material, and hardening the resultant mixture.

15 2. A method as claimed in claim 1 wherein said separation and said compression are effected in a tube press.

20 3. A method as claimed in claim 2 wherein compressed air is blown through the compressed

solid before removal thereof from the tube press.

25 4. A method as claimed in claim 3 wherein the tube press is associated with means for breaking up the compressed solid.

5. A method as claimed in claim 4 wherein said means is a pneumatic hammer.

30 6. A method as claimed in any one of claims 1 to 5 wherein the radioactive product comprises fine particulate material in water.

7. A method as claimed in claim 6 wherein the radioactive product is radioactive sludge.

35 8. A method as claimed in any one of claims 1 to 7 wherein the hardenable material is selected from cement, bitumen, and a synthetic resin.

9. A method as claimed in any one of claims 1 to 8 wherein the admixing is effected in a protectively lined vessel in which the mixture is then hardened.

40 10. A method as claimed in claim 9 wherein said vessel is a concrete lined drum.

11. A method of treating a radioactive product substantially as hereinbefore described.