LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87545
Telephone Ext.

OFFICE MEMORANDUM

TO Miguel Salazar, H-7, MS-592 DATE October 22, 1979

FROM B. W. Burton, LS-6 BWB

SUBJECT GROUTING MATERIAL FOR FRACTURES IN DISPOSAL PITS, AREA G, TA-54

SYMBOL LS6-79-62

MAIL STOP 495

0593 TA-54

This memo is in response to your request of October 18 for recommendations concerning possible grouting material for open fractures in disposal pits at Area G. After consulting with a number of people with a wide range of expertise I have considered several options. Evaluations of these are presented below. Further options (eg: various organic compounds such as plastics) were not considered because of time limitations.

Recommendations

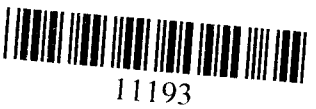
I recommend a montmorillonite or bentonite clay as a grouting material for the fractures. This kind of clay pack is more desirable than a cement mixture because of its ability to swell and completely fill fractures when wet and it's high cation exchange capacity (CEC) when wet. It will crack upon dessication but these cracks are repaired next time the clay gets wet and swells. It is conceivable that the swelling property of these clays may irreversibly dilate small fractures, but since the fractures in question are relatively large this should not be of major concern. Montmorillonite is the clay which is formed in fractures at Area G by natural weathering processes.

Cement mixtures, while they may seem attractive at first, may crack under stress or with age, leaving an open channel to fluid flow.

None of the options mentioned below will retard the flow of any gases generated by the wastes but these gases would diffuse through the pit walls anyway.

Application

If montmorillonite or bentonite clay is to be used I would like to make some further comments as to application. Due to the thixotropic properties of the clay (ie: the gel becomes reversibly fluid when shaken) it would seem advisable to apply the clay at or below saturation to avoid fluidization of the mixture, which may then flow out of the fracture like water. The easiest method may be to spray the mixture into the fractures under pressure, after the manner of gunite or stucco.



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Dry pack cement

1. It would be difficult to apply such a dry mixture uniformly in fractures. It would have to be applied by hand, resulting in a nonuniform surface layer.
2. Very low CEC
3. Permeable to gases
4. Being rigid, it may crack under stress or with age.

Gunite

1. Very low CEC
2. Permeable to gases
3. May crack under stress or with age

Crushed tuff

1. Crushed tuff is immediately available at Area G.
2. Permeable to gases
3. Permeable to water
4. May settle, leaving large void spaces

Caliche

1. Caliche is already present in fractures at Area G near the ground surface.
2. Permeable to gases
3. Low CEC
4. Highly soluble

Montmorillonite clay

1. This is the brown clay found in fractures at Area G below the caliche horizon.
2. Permeable to gases
3. Highly expansive and would completely fill fractures when wet, creating a good seal. May possibly dilate small fractures.
4. High CEC (80-150 meq/100g at pH 7)

Bentonite clay

1. This clay forms naturally from volcanic ash (tuff) and consists chiefly of montmorillonite.
2. Permeable to gases
3. Good CEC, depending on the montmorillonite content
4. Bentonite clays are commercially available at various mixtures.
5. These are swelling clays and the amount of expansion depends on the montmorillonite content. The more highly expansive varieties have Na^{+} as the exchangeable cation (as apposed to Ca^{++} or Mg^{++}) but exhibit thixotropic properties above saturation.

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LS6-79-62

As co-workers and interested parties, the following LS-6 group members have reviewed this memo and concur in its recommendation: M. A. Rogers (SM), W. V. Abeele (SM), V. L. Christie (consultant).

BWB:tj

xc: John Warren, H-7, MS-518
W. D. Purtymun, H-8, MS-490
M. L. Wheeler, LS-6, MS-495
F. G. West, G-9, MS-983
J. G. Steger, LS-6, MS-495
W. R. Hansen, H-8, MS-490
M. A. Rogers, LS-6, MS-495
W. V. Abeele, LS-6, MS-495
V. L. Christie, LS-6, MS-495