DRAFT RESPONSES TO U.S. EPA's JANUARY 16, 1997 LETTER OF COMMENTS REGARDING THE DECEMBER 1996 REVISED DESIGN ANALYSIS REPORT FOR THE AREA A LANDFILL DESIGN NAVAL SUBMARINE BASE NEW LONDON GROTON, CONNECTICUT

February 21, 1997

1. Cover Letter, page I, 2nd. paragraph:

Comment: Based on the proposed design, the thickness of the final cover will expose the geocomposite liner ("GCL") to freeze-thaw cycles. Final cover for the plateau consists of a 21-inch thick composit pavement/drainage layer overlying the geomembrane/GCL low permeability barrier system. The report indicates that the GCL is below the depth of frost penetration. According to Groton City Engineers, depth of frost penetration in the area of the site is 42 inches. This places the GCL well within the frost zone, thus exposing the material to freeze-thaw cycles.

Response: According to the manufacturer, exposure of the GCL to freeze-thaw cycles, if it occurs, will not adversely affect its performance. Additionally, since the GCL will be placed beneath the impervious LDPE geomembrane, the amount of moisture which it will contain, and which could be subject to freeze and thaw, will be minimal. Finally, the GCL will lie below the "average" frost penetration which has been determined to be 20 inches at the site, as compared to the 42-inches indicated by the Groton City Engineers which is the "extreme" frost penetration.

2. Cover Letter, page I, 3rd. paragraph:

Comments: On side slopes, the GCL will be replaced with a 6-inch thick cohesive backfill material consisting of silty sand or clayey sand. I assume that the material will be used as an infiltration layer with a permeability of not more than 1×10^{-5} centimeters per second ("cm/sec"). To achieve this permeability, a minimum compacted thickness of at least 18 inches is necessary. To support this recommendation, the report states that the GCL for the plateau area is a direct substitution for a 2-foot thick infiltration layer (permeability less than 1×10^{-5} cm/sec).

Response: The replacement of the 2-foot thick infiltration layer with a 6-inch thick layer of cohesive backfill material on the side slope of the landfill cap was made in response to a specific request by Mr. Yoon-Jean Choi of U.S. EPA during a design review meeting held on March 9, 1995.

3. Cover Letter, page I, 4th. paragraph:

Comment: The factor of safety against sliding was determined using interface friction from literature and available data. EPA recommends that these assumed interface strength parameters, especially the geomembrane interface strength parameters, be verified using strength parameters determined from actual site soil materials and geosynthetics specified in the design. This would verify the critical interfaces assumed for the plateau and side slope areas.

Response: Literature values are based upon extensive past testing under a wide range of design conditions and their use for slope stability analysis and determination of the factor of safety against sliding is a well established practice for the design of landfill caps in all but the most critical conditions. For the Area A Landfill, since no peculiar loading conditions or materials exist, the use of literature values is entirely acceptable.

4. Cover Letter, page ii, 1st. paragraph:

Comment: The report indicates "the low shear strength and interface characteristics of a reinforced GCL render the material undesirable for a steep side slope application." The apparent concern is the creep effects relative to long-term performance, as indicated in Reference 19 of the report. Additional concerns include the effects of swelling and the need for more refined shear test methods for defining shear strength parameters. The use of GCLs on slopes is currently in a state of debate for the reasons indicated above. In recent years, designers have used GCLs on side slopes as steep as 3 horizontal to 1 vertical with no reported failures. However, when considering their use, I recommend that actual test parameters be used in the design, in addition to conducting a cost versus risk evaluation.

Response: See response to Comment No. 2 above. The purpose of this comment is not clear since the design of the Area A Landfill does not include a GCL on the side slope.