040-07924

DAMES & MOORE A PROFESSIONAL LIMITED PARTNERSHIP
2360 MARYLAND ROAD, WILLOW GROVE, PENNSYLVANIA 19090
(215) 657-5000 FAX NO. (215) 657-5454

December 19, 1991

US Nuclear Regulatory Commission
Region I
King of Prussia, PA 19406

Attention: Mr. Jim Bondick

Re: Radiation Survey Plan
Schott Glass Technologies
Duryea, Pennsylvania

Dear Mr. Bondick:

Schott Glass Technologies, Inc. requested that we forward to you a copy of the "Radiation Survey Plan" for the fill area west of the manufacturing area at the Schott facility in Duryea, Pennsylvania.

If there are any questions, please call.

Very truly yours,

DAMES & MOORE
A Professional Limited Partnership

M. Richard Nalbandian

M. Richard Nalbandian, CPG, AICP
Associate

Pamela K. Pidge

Pamela K. Pidge
Project Chemist

MRN:PKP:ld
AAW01CF7

cc: S. Krenitsky (Schott)
J. Seif (Dechert, Price, & Rhoades)

DAMES & MOORE

November 27, 1991

Schott Glass Technologies, Inc.
400 York Avenue
Duryea, Pennsylvania 18642

Attention: Mr. Stephen P. Krenitsky
Director, Manufacturing and Engineering

Re: Radiation Survey Plan
for Fill Area
Schott Glass Technologies
Duryea, Pennsylvania

Dear Mr. Krenitsky:

Dames & Moore is pleased to present Schott Glass Technologies, Inc. with our Radiation Survey Plan for the fill area west of the manufacturing area at your facility in Duryea, Pennsylvania.

1.0 INTRODUCTION

Schott Glass Technologies, Inc. (Schott), located in Duryea, Pennsylvania (see Figure 1, site vicinity map) is engaged in the production of specialty glass and glass-ceramic components. The basic manufacturing steps include batching (preparing the silica), heating the silica to a molten state, pouring it into molds, cooling, and grinding and polishing. From the late 1960s to the late 1970s, Schott produced a specialty glass that required thorium, a radioactive element, as a raw material. During this period, cut-offs from the casting process and fines from the polishing process of traditional optical glass were disposed of in piles along an area of cleared land southwest of the facility. To level the slope in that cleared area, stockpiled waste glass was spread across the top of the slope and over the hill. Mixed with the waste glass were smaller quantities of thoriated glass, off-specification product, and raw materials, which included an unknown amount of lead oxide. On site disposal of process wastes occurred from approximately the late 1960s to late 1970s.

Previous screening of the fill area by Porter Consultants, Inc. of Ardmore, Pennsylvania, yielded exposure rates ranging from 30 to 350 uR/hr with an average exposure rate of 200 uR/hr. Porter Consultants also determined that background exposure rates ranged from 30 to 50 uR/hr, due to naturally occurring radioactive material in the area.

Schott received approval from the Nuclear Regulatory Commission (NRC) in May 1990 to remediate the disposal area by excavating the top 4 feet of fill, removing the larger pieces of thoriated glass encountered, and covering the area with clean fill. However, after the discovery of lead oxide in test pits and in an erosion washout in a side slope within the fill, the NRC-approved remedial approach was postponed by Schott in order to evaluate the wastes and to design a remedial approach that would be suitable with respect to all of the wastes involved.

After Dames & Moore conducted an engineering/investigative study, it was decided that the best remedial approach with respect to all wastes involved would be a multi-layer, low permeability cover system.

2.0 PURPOSE

The purpose of this plan is to describe the radiation surveys to be conducted before and after placement of the cover system.

3.0 SCOPE OF WORK

Dames and Moore will perform the following tasks:

Task 1 - Survey background gamma exposure rates at undisturbed locations near the site

Task 2 - Establish a site grid system

Task 3 - Perform a gamma exposure rate survey before construction of the proposed cover system

Task 4 - Replicate Task 3 survey after construction of the cover system, using the grid system established in Task 2

3.1 TASK 1 - SURVEY BACKGROUND GAMMA EXPOSURE RATES AT UNDISTURBED LOCATIONS NEAR THE SITE

Dames & Moore will survey gamma exposure rates at a minimum of 12 undisturbed locations near the site. The background locations will be selected based on isolation from heavy traffic and similar ground cover as that on the site. The survey will be conducted with a low level gamma radiation survey meter such as the Eberline ESP-2 Ratemeter/SPA-8 Detector. The measurements will be taken at waist level at the various locations and recorded.

3.2 TASK 2 - ESTABLISH A SITE GRID SYSTEM

Dames & Moore will establish a 10-meter by 10-meter grid system over the fill area. An initial permanent point of reference will be established at a corner point of the fill area. The other corner points of the area will be established by measuring 90° angles from the reference point with a Brunton Pocket Transit. Baseline 10-meter spacings will be designated by letters, and transect lines by numbers. Survey points will be spray painted at 10-meter intervals around the perimeter using a distance wheel. Interior points will be established with the Brunton Transit.

3.3 TASK 3 - PERFORM A GAMMA EXPOSURE SURVEY BEFORE CONSTRUCTION OF PROPOSED COVER SYSTEM

Dames & Moore will survey the fill area to measure external gamma exposure rates. The survey will be conducted with a low level radiation survey meter such as the Eberline ESP-2 Ratemeter/SPA-8 Detector. The system will be calibrated to read in uR/hr. Measurements will be taken at waist level and recorded at each grid node.

If "hot spots" are identified during the survey, the grid will be further divided to assess the extent of the hot area(s).

The results of the survey will be recorded and displayed on the detailed topographic map of the fill area contained in Dames & Moore's Contract Drawings and Technical Specifications, September 27, 1991.

3.4 TASK 4 - REPLICATE TASK 3 SURVEY AFTER CONSTRUCTION OF COVER SYSTEM

The site grid system of Task 2 will be reestablished after construction of the cover system to facilitate direct comparison of the post-construction survey with the pre-construction survey.

The Task 3 survey will then be replicated to the extent feasible. The results will be recorded and displayed in the same manner as those of the Task 3 survey. This should enable us to judge the effectiveness of the cover system in attenuating radiation from the fill area.

If you should have any questions or concerns regarding this radiation survey plan, please do not hesitate to call us.

Very truly yours,

DAMES & MOORE
A Professional Limited Partnership

M. Richard Nalbandian

M. Richard Nalbandian, CPG, AICP
Associate

Pamela K Pidge

Pamela K. Pidge
Project Chemist

AAW01D47

90 East Union Street - [illegible] Floor
Wilkes-Barre, Pennsylvania 18701-3296
(717) 826-2511

0410-07424

May 2, 1991

Schott Glass Technologies, Inc.
400 York Avenue
Duryea, PA 18642

Attention: Stefan Krenitsky, Director
Manufacturing & Engineering Services

Dear Mr. Krenitsky:

This is to notify you that DER approves Schott's request to begin soil removal in the drainage area adjacent to the ball field prior to the completion of DER's review and approval of a closure program for Schott's on-site landfill. The soils must be removed down to background levels in the drainage area. Resampling must be done to verify that soil has been removed to background levels. Please be advised, however, that since the Department has not yet completed its review, additional work may be required in the future.

The Department has concerns that the lower channel and off-site ball field may be negatively impacted by runoff in the future. Schott will therefore be required to provide a detention basin upgrade until a decision on closure has been determined. Schott will also be required to provide positive drainage to a suitable stormwater outlet. By June 30, Schott must provide DER with the results of the resampling and a description of the stormwater control that have been implemented.

Schott should continue to work with the Wildcats Association to insure the satisfactory removal of runoff material from land adjacent to the ball fields. Schott is also responsible for notifying all appropriate federal and state agencies of these activities.

If you have any questions or require clarification regarding this matter, please contact me at (717) 826-2340 or Sanitary Engineer Frank Wanko ((717) 826-5526) or Environmental Chemist Denny Wright ((717) 826-2475).

Very truly yours,

Ed Shoener
Regional Director

cc: Dennis Moore
bcc: Regional Solid Waste Manager
Regional Facilities Manager
Monitoring & Compliance Manager
D. Wright
F. Wanko
Div. of Permits
NRC
Bureau of Radiation Protection
File

CPT-5-4794
D: 4/22/91 /T: 4/25/91 /R: 4/29/91 /R: 4/30/91 /R: 5/2/91(2)

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RETURN ORIGINAL TO
REGION I

IE:07

0210-07924

DAMES & MOORE A PROFESSIONAL LIMITED PARTNERSHIP
644 LINN STREET, SUITE 501, CINCINNATI, OHIO 45203 (513) 651-3440

October 15, 1991

Mr. Stephen P. Krenitsky, Director
Manufacturing and Engineering
Schott Glass Technologies, Inc.
400 York Avenue
Duryea, PA 18642

Dear Mr. Krenitsky:

Task 2 - Proposed Cover
System for Fill Area
Revision 1
Duryea Facility

A revised submittal of the cover system alternatives assessment incorporating consideration of radiological protection by the recommended cover design is attached. If you require additional information, please call at your convenience.

Very truly yours,

DAMES & MOORE

Eric C. Volpenhein

Eric C. Volpenhein, P.E.
Associate

ECV:mc19
21216-001-032

cc: P. Pidge, Dames & Moore
R. Nalbandian, Dames & Moore
J. Seif, Dechert Price & Rhoads

RETURN ORIGINAL TO REGION I

OFFICIAL RECORD COPY

IE:07

DAMES & MOORE A PROFESSIONAL LIMITED PARTNERSHIP
644 LINN STREET, SUITE 501, CINCINNATI, OHIO 45203 (513) 651-3440

August 14, 1991 (original)
October 15, 1991 (Revision 1)

Mr. Stephen P. Krenitsky, Director
Manufacturing and Engineering
Schott Glass Technologies, Inc.
400 York Avenue
Duryea, PA 18642

Dear Mr. Krenitsky:

Task 2 - Proposed Cover
System for Fill Area
Duryea Facility

Dames & Moore is pleased to present this letter describing cover system alternatives for Schott Glass Technologies, Inc.'s (Schott Glass) fill area in Duryea, Pennsylvania. Dames & Moore understands that the primary objectives of the proposed cover system are to inhibit infiltration of precipitation, to restrict the transport of sediment beyond the fill area boundaries, and to minimize potential exposure to radionuclides.

BACKGROUND

Schott Glass produces specialty glass and glass-ceramic components. From approximately 1969 to 1980, Schott Glass produced a specialty glass that required thorium, a radioactive element, as a raw material. During this period, waste glass, thoriated glass, and raw products including lead oxide (batch material) were disposed in an approximate 1-acre fill area southwest of the facility. The fill area is characterized by two general areas. The upper area covers approximately one-quarter acre, is relatively flat, is covered with several inches of rock, and is exposed to truck traffic and/or material storage activities. The remainder of the fill area is characterized by relatively steep side slopes, is predominantly covered with a thin layer of vegetation, and appears susceptible to erosion by storm water runoff.

Schott Glass received approval from the Nuclear Regulatory Commission (NRC) in May 1990 to remediate the fill area by excavating the top 4 feet of fill, removing the larger pieces of thoriated glass encountered, and covering the area with 4 feet of clean material. In June 1990, Schott Glass dug test pits around the fill area to delineate its approximate boundaries. At that time, batch material was discovered in the test pits, and an erosion washout was observed along the side slopes. Consequently, Schott Glass postponed the NRC-approved remedial approach and retained Dames & Moore to evaluate other possible remedial designs that would be suitable for all of the material involved. It is Dames & Moore's understanding that Schott Glass is concerned that the proposed excavation activities in the previously approved remedial approach may increase the potential for airborne emissions and storm water transportation of metals. In addition, the NRC-approved remedial approach incorporates no provision for mitigating the infiltration of water into the fill and the potential consequential mobilization of metals.

In Dames & Moore's report entitled "Recommendations for Remediation - Fill Area" dated June 24, 1991, various remedial options were described. Dames & Moore indicated the installation of a low permeable cover system appeared to be the most appropriate remedial approach. Construction of a low permeability cover system over the fill area requires minimum disturbance of the fill and minimizes the infiltration of precipitation into the fill.

During a June 20, 1991, meeting between the Pennsylvania Department of Environmental Resources (PADER), Schott Glass, Schott Glass' legal counsel, and Dames & Moore, PADER concurred that constructing a multi-layer low permeability cover system over the waste disposal area appears to be the most appropriate remedial approach. PADER suggested that Schott Glass prepare a remediation work plan (including design plans and technical specifications) for the fill area outlining the proposed components and configuration of the cover system and submit it to PADER for review.

SCOPE OF WORK

In order to identify the most appropriate cover system design, Dames & Moore performed the following scope of work:

- Evaluated cover component alternatives and methods to address possible site constraints

- Prepared this report describing the evaluated alternatives and presenting Dames & Moore's recommendations regarding the proposed cover construction

COVER SYSTEM

As previously discussed, the fill can be divided into two general areas--the relatively flat upper area, which is exposed to truck traffic and/or material storage activities, and the relatively steep side slope area. The primary cover system objective for each of these areas is to inhibit infiltration of precipitation and transport of sediment beyond the fill area boundaries. A secondary objective for the upper area cover system is to enable traffic flow and material storage activities to continue following remediation of the fill area. A secondary objective of the side slope cover system is to reduce the impact on facility property adjacent to the fill area.

In order to meet the primary cover objectives, Dames & Moore believes the proposed cover system should be designed as a multi-layer cover, including (at a minimum) a low permeability layer and a protective layer. The primary function of the low permeability layer is to minimize the infiltration of precipitation into the fill. The primary function of the protective layer is to protect the low permeability layer from damage.

The components of the low permeability layer and protective layer can vary based upon site-specific factors. Site constraints (i.e., topography, property limits, etc.), monetary considerations, and desired post-construction land use considerations play a significant role in determining the type, thickness, and number of components of the low permeability layer and the protective layer.

Factors that may affect the selection of multi-layer cover components include, but are not limited to:

- Low permeability layer:
  - availability of low permeability soil materials

- constructability
- cost

- Protective layer:
  - frost depth
  - anticipated future use and loading
  - ability to support vegetation (where applicable)
  - potential environmental effects on the low permeability clay layer
  - cost

The low permeability layer is typically considered the heart of a multi-layer cover. This layer is intended to minimize the infiltration of water into the underlying materials, thus reducing the potential for migration of fill constituents into the surrounding environment. These layers are typically designed to restrict as much infiltration as possible. A commonly used criterion is to limit the hydraulic conductivity of the low permeability layer to a value of 1×10^{-7} cm/sec or less. This value is a practical construction limit for many natural clay soils and typically is estimated to limit infiltration to less than 10 percent of average annual rainfall. Higher hydraulic conductivity limits are occasionally appropriate for low permeability layers when increased infiltration will not have adverse effects to the environment, or other environmental factors (i.e., low average rainfall and/or high annual evapotranspiration rates) assist in limiting infiltration.

In Pennsylvania, it is not believed that environmental factors will significantly reduce the infiltration potential; therefore, Dames & Moore believes that the low permeability layer should be constructed to achieve the lowest possible hydraulic conductivity. Low permeability layers can be constructed using either natural low permeability soils, synthetic membrane liners, or a combination of both (composite liner). A brief summary of the advantages and disadvantages of these materials is presented in Table 1. For the Schott Glass site, Dames & Moore believes that the low permeability layer should be constructed using a synthetic membrane liner. The primary reasons for this recommendation are that synthetic membrane liners can be constructed to achieve extremely low hydraulic conductivities, they are typically easier to construct under varying weather conditions, and they typically require less total fill height. The costs for low permeability layer components are typically similar, provided that suitable local clay soils are available. When local soils are not available, synthetic membrane layers are generally least expensive.

The protective cover layer is intended to protect the low permeability layer from stress due to loading and environmental effects. It must be designed in consideration of the specific low permeability layer construction planned for a site. Factors that must generally be considered in design include the thickness of the layer (to distribute applied loads and/or protect the low permeable layer from freezing), the type of soil materials desired, and the planned erosion mitigation measures. In those areas intended for future traffic and storage uses, the protective layer will most likely consist of a 2- to 3-foot-thick granular soil layer with an asphalt concrete cover. In other areas, the protective soil layer will consist of a 2- to 3-foot-thick fine grained soil layer protected with vegetation and/or other erosion-resistant materials. Both designs will incorporate a drainage medium to transmit collected water from the surface of the low permeability layer. A discussion of the advantages and disadvantages of possible protective soil layer components is also presented in Table 1.

An additional factor that may affect the design of the proposed cover system is Schott Glass' desired to minimize impacts to land located at the base of the fill area slopes. Multi-layer cover slopes are generally limited to grades less than 4 feet horizontal to 1 foot vertical in order to inhibit erosion of the protective layer. Experience has indicated that steeper slopes are subject to excessive erosion potential and may not exhibit adequate factors of safety with respect to slope stability. Alternatives to the construction of a moderately sloped protective cover layer include construction of steeply sloped covers with enhanced erosion protection (e.g., geosynthetic webbing and selected vegetation; rip-rap, gabions, or asphalt covers; etc.), or construction of a perimeter retaining wall at the toe of the slope. In the event that a steeply sloped cover is desired, the stability of the cover component materials underlying the cover system should be thoroughly evaluated. A summary of cover system design alternatives considered for the steeply sloping fill sections is presented in the appendix and summarized in Table 2.

RECOMMENDED MULTI-LAYER LOW PERMEABILITY COVER SYSTEM

Based upon its understanding of the project objectives, Dames & Moore recommends that the multi-layer low permeability cover system consist of a low permeability layer (constructed of a synthetic liner) and a protective soil layer. In the upper portions of the fill area, the recommended protective layer design should consist of granular fill covered with asphalt. In the sloped portions of the fill area, the recommended protective layer design should consist of fine-grained soil with appropriate erosion protection depending upon the required slope.

To construct the proposed multi-layer cover system over the fill area, Dames & Moore believes the existing configuration and topography of the fill area may require modifications. In particular, the stability of portions of the fill area which contain steep side slopes (e.g., 2 feet horizontal to 1 foot vertical) should be evaluated to assure their integrity, or additional measures should be implemented to reduce the possibility of adverse slope stability or surface erosion effects.

Depending on the type, final grade, and stability of the drainage material and cover soils, installation of a grid-like synthetic material (i.e., geogrid) over the low permeability layer may be required to support the drainage and cover layers on the side slopes. During the design phase of this project, Dames & Moore will evaluate whether a geogrid will be necessary to support the weight of the drainage and cover layers in order to minimize the transfer of stresses to the synthetic liner. The synthetic liner's main function is to serve as a low permeability medium, not as a structural member.

RADIOLOGICAL PROTECTION

In regard to the radiological protection afforded by the proposed cover design, it is significant to note that the radiological decay of thorium 232 generally yields low energy, non-penetrating radiation. At the reported activity level (200μR/hr), background levels of external exposure are expected to be achieved within the first foot of soil cover. The primary pathways of radiological exposure are, therefore, limited to inhalation of gaseous radionuclides diffusing through the cover, principally thoron (^{220} Rn), and ingestion of aqueous phase or airborne radionuclides.

The effectiveness of the proposed cover in containing airborne particulates and reducing leachate is recognized. While the permeability of geosynthetic materials to thoron gas has not been specifically researched, the ability of such materials to contain subsurface gases is also recognized. This is reflected in the need for measures to prevent or release trapped air and gases during landfill construction and operation. Well maintained asphalt of high bituminous content is likewise expected to provide superior resistance to gaseous diffusion when compared to soil. The proposed cover is, therefore, anticipated to provide at least equivalent protection from both direct and indirect exposure to radioactivity as four feet of soil.

The long term effects of ionizing radiation on the mechanical properties of the geosynthetic materials were also considered. Materials which have either ionic or covalent bonding, such as dielectrics, plastics, lubricants, hydraulic fluids, and rubber, are among the more sensitive to ionization. In general, rubbers will harden on irradiation. However, some, such as Butyl or Thiokil, will soften with high radiation doses. Radiation resistance of these elastomers is dependent upon conditions for curing and processing curing agents, fillers, and antioxidants. In any event, significant degradation of mechanical properties is usually observed only at dose rates above 10^6 Rads. At the reported average surface dose rate (200 μR/hr), degradation of the geosynthetic material due to radiation damage is not likely to be a contributing failure mechanism.

CONSTRUCTION COST ESTIMATE

The estimated cost to construct the multi-layer cover system over the fill area is on the order of $400,000 to $1,000,000 depending upon the specific cover designs selected. It should be recognized that the cost estimates presented herein are conceptual in nature and are intended to provide a means for comparing the relative magnitudes of potential cover construction alternatives. They are believed to be accurate within +100 percent and/or -50 percent. The conceptual level costs have been based upon an assumed landfill area of 1 acre and assumed crest length of 500 feet for the steeply sloping fill areas.

CONCLUSIONS AND RECOMMENDATIONS

Dames & Moore believes the proposed multi-layer cover system requires minimum disturbance of the fill, eliminates the infiltration of precipitation into the fill, and provides sufficient shielding from the thoriated glass.

Upon Schott Glass' review and approval of the recommended cover system, Dames & Moore will initiate the preparation of the design plans and technical specifications (Tasks 3 and 4 in Dames & Moore's proposal dated July 10, 1991).

If there are any questions please contact the undersigned.

Very truly yours,

DAMES & MOORE

Jeff DeLaet, E.I.T.
Project Engineer

Eric C. [illegible] for
M. Richard Nalbandian, C.P.G., A.I.C.P
Associate

Stuart Edwards, P.E.
Partner (Ltd.)

JDD/RN/SE:mo19
21216-001-032

cc: J. Seif, Dechert Price & Rhoads
T.J. McDonald, Schott Glass