



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION III  
841 CHESTNUT BUILDING  
PHILADELPHIA, PENNSYLVANIA 19107

August 14, 1991

Mr. John Hammond, P.E.  
Roy F. Weston, Inc.  
Weston Way  
West Chester, PA 19380

Re: Tybouts Corner Landfill  
Review of Pre-Design Documents

Dear Mr. Hammond:

A final review has been completed for the following reports:

- Main Landfill Grading and Cap Design Alternative Conceptual Evaluation Report
- Permits and Access Requirements Report
- Predesign Groundwater Quality Report

All review comments are attached. No comments have been received from the State of Delaware at this time. Please provide a written response to each concern one week prior to our next meeting. If comments have been resolved through telephone conversations simply state that.

A meeting is requested to discuss both our comments and your responses as soon as possible. I will talk with you on Monday (August 19) to schedule a meeting here in Philadelphia.

Sincerely,

*Paula L. Retzler*  
Paula L. Retzler  
DE/MD Section

cc: Chen-yu Yen/ Gannett Fleming, Inc.

AR002585

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION III  
841 Chestnut Building  
Philadelphia, PA 19107

SUBJECT: Tybouts Corner Landfill  
Cap Design

DATE: August 14, 1991

FROM: Mary *M. Beck* Beck (3HW52)  
General States Permits Section

TO: Paula Retzler (3HW25)  
DE/MD Section

DLP Consultants have placed an over reliance on the results of the HELP model and its prediction of infiltration through the cap in their cap design evaluation for Tybouts Corner Landfill. Their recommended design appears to be 6 inches of top soil over 6 - 18 inches of "buffer" soil over a 24-inch composite low permeability layer, i.e., a 30-mil PVC membrane over 10" cm/sec clay. The consultant recognizes that lack of a drainage layer will result in a near saturated or saturated soil but says they have selected compatible vegetation for that soil condition.

The consultant has neglected several other design factors.

The reported vegetation for the saturated soil conditions are Crownvetch, Birdsfoot trefoil and tall fescue. Although all three are suitable for the area, Crownvetch requires a well-drained soil<sup>1</sup>, Birdsfoot trefoil grows better on poorly drained soil than most legumes but is not as draught- or heat-tolerant as Crownvetch, and tall fescue will tolerate somewhat poorly drained soil. Using the HELP model, the consultant's soil groups, and 24 inches of top soil and buffer soil without a lateral drainage zone, indicates the cap will be saturated for weeks at a time. Therefore, Crownvetch and tall fescue may not thrive on the cap.

The consultant has identified an appropriate upper layer of soil, 6 inches of topsoil. Information presented July 29, 1991 indicates that the consultant is considering a range of 6 to 18 inches below the top soil. Eighteen inches is the absolute minimum thickness of soil to be used in order to retain moisture for vegetation. The soil identified on July 29 is a loamy sand very low in fines for moisture retention. Research has shown that 24 inches of sandy loam (a soil with a higher percentage of fines) underlain by a lateral drainage zone will retain moisture for plants. Therefore, the total thickness of soil needs to be 24 inches.

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<sup>1</sup>Conservation Plants for the Northeast, Soil Conservation Service, U.S. Dept. of Agriculture, Program Aid No. 1154, Nov. 1977.

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The consultants has recommended a cap design without a lateral drainage zone. The drainage layer serves to reduce the head on the low permeability layer, therefore reducing flow through that layer, and may even help retain moisture in the overlying buffer zone<sup>2</sup>. However, the soil identified as a buffer soil ( $k=1.7 \times 10^{-3}$  cm/sec), while not meeting the currently recommended permeability, ( $1 \times 10^{-6}$  cm/sec) does exceed the Agency's earlier recommendation of  $10^{-3}$  cm/sec. The appropriate design of a lateral drainage zone includes interceptor pipes where necessary. Even using the currently recommended drainage material, interceptor pipes are required because of the long slopes for this cap.

The consultant has identified a 20-mil PVC membrane as part of the composite low-permeability layer. While 20 mils is the recommended minimum thickness, it may be too thin for PVC. PVC has the disadvantage of poor puncture resistance, and therefore, damage during construction, and is susceptible to attack by soil microorganisms<sup>3</sup>. The infiltration through the cap is governed largely by the leakage factor specified for the membrane and, although the consultant selected an appropriate number, the HELP model does not model ageing of the membrane and any deterioration caused by aging.

The recommended 24 inches of  $10^{-7}$  cm/sec clay is an appropriate soil component of the barrier layer.

The total thickness of the soil and lateral drainage serve to protect the barrier layer, specifically the clay, from damage by freezing. Less than ten freeze/thaw cycles will damage the clay. Early (1982) Agency guidance identifies a 10-inch frost depth at the site as the appropriate depth below which the low-permeability layer would be protected from frost damage. More recent guidance (1989) states that the low-permeability layer should be below the maximum depth of frost penetration. Extreme frost penetration at the site is about 35 inches<sup>3</sup>. Therefore, the 24-inch soil layer and 12-inch drainage zone are necessary to provide adequate protection from frost damage.

At the July 29 meeting, the consultants discussed settlement of the cap resulting from consolidation of the waste. The consolidation of the waste, a largely unpredictable factor for uncontrolled waste sites, will result from any additional weight imposed on the waste, and if dewatering of the waste occurs. The consultants recommend a phased construction where the fill underlying the cap is placed several months prior to actual cap construction in an effort to have waste consolidation occur prior to cap construction. While this is appropriate, it should be noted that the waste can be expected to exhibit considerable secondary consolidation (may take a long time to reach equilibrium under the imposed load) and the weight of the

<sup>2</sup>Covers for Uncontrolled Hazardous Waste Sites, EPA/540/2-85/002, page 4-105.

<sup>3</sup>Soil Mechanics, NAVFAC DM-7.1, May 1982, page 7.1-42.

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constructed cap will start a new round of consolidation. One way to try to reduce the consolidation under the weight of the cap would be to add a surcharge load after the foundation soil is place to bring the waste to final grade, e.g., add extra soil to increase the load on the waste, especially in the areas of greater waste thickness. The soil to be used in the soil layer of the cap may be used for the surcharge. And, of course, the rate of settlement should be monitored. In areas where monitoring indicates considerable consolidation of the waste would be expected, the final cap construction could incorporate a geogrid within the clay layer to aid in bridging soft areas.

The consultants indicated that they intended to include a geotextile within the soil layer as an aid to stability resulting from consolidation of the underlying waste. However, inclusion of a geotextile is not the appropriate remedy, the above mentioned geogrid is more appropriate.

AR002588

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION III  
841 Chestnut Building  
Philadelphia, Pennsylvania 19107

SUBJECT: Tybots Corner Landfill RD/RA      DATE: 8/5/91  
Statement of Work Plan Comments

FROM: <sup>DK</sup> Dave Kargbo, Geologist  
Technical Support Section (3HW15)

TO: Paula Retzler  
DE/MD Section (3HW25)

I have reviewed the several documents relating to the RD/RA Statement of Work Plan for the Tybots Corner Landfill and provide the following comments.

**I. Main Landfill Grading and Cap Design Alternatives  
Conceptual Evaluation**

The PRPs have gone to great lengths to provide arguments against the ROD design concept of a cap for this landfill, which provides for a drainage layer. The thrust of their argument relies heavily on achieving an acceptable percent percolation using the HELP model. While I must commend them for their efforts, there are several potential problems with their alternative.

First, the SCS curve method employed by the HELP model does not consider the length and slope over which overland flow occurs. The interactive effect(s) of this limitation and constant ponding cannot therefore be quantified by the model.

Secondly, the HELP model requires a design in which the segment in a subprofile has a hydraulic conductivity (K) that is greater than or equals to that of the segment directly above it to prevent ponding. The geomembrane without a drainage layer has a potential of generating a permanent 2' head of over the cap and membrane. The inherent assumption in the model design is to prevent such ponding in the first place.

Landfill membranes (especially as thin as the proposed 2 ml geomembrane) have been known to sometimes fail. This water over the cap may change the structural integrity of the clay. Consequently, the specification of a K of  $1 \times 10^{-7}$  cm/sec clay may not always be adequate especially with acid sulfate clay soils that could easily react with incoming infiltrated water. Hence, in addition to the concerns of ponded water eventually coming in contact with the underlying clay, any soil used as a barrier should be checked for its chemical integrity.

AR002589

Also given the fact that the model assumes flow through the soil to be Darcy flow, flow through channels (such as root holes, animal burrows, or cracks) is not accounted for. The presence of these soil features could accelerate water flow in ponded situations beyond that predicted by the model.

Further concerns with allowing constant ponding over the barrier membrane and soil liners includes:

1. the potential for sheet erosion and barrier shearing when that amount of head is allowed to saturate soils for extended periods of time;
3. the effects that several cycles of freezing and thawing may have on the integrity of the barriers underneath;
4. the problems of trafficability over a saturated cover; and
5. difficulties in selecting an appropriate vegetative cover using plants that cannot withstand extended periods of saturation, in addition to possible periods of drought.

Consequently, I would recommend that the drainage layer as specified in the ROD, or some modification thereof, be installed at this landfill.

As regards landfill gas control, the use of a point venting system rather than an extensive gas control system is proposed. Current levels of generated gas including the age of the landfill are used to conclude that the maximum potential for gas generation at this landfill had passed. It is inappropriate to use current levels of combustible gas (in an open landfill) to estimate the likelihood of generating extensive gas when the landfill is capped except if the nature and volume of the fill is known. There is always the potential for migration through the unsaturated zone (not assessed in the gas monitoring) as noted on p. 2 of the correspondence provided in Appendix B.

## II. Design Report on Alternative Groundwater Controls for Tybots Corner Landfill

The use of a modified version of the MODFLOW model appears to improve predictions of the effects of pumpage on groundwater. I agree the absence of the aquitard at the southern end of the landfill (as stated in the report) questions the need for the southern drain together with interceptor wells.

My concern however, is with the northern drain which is now proposed to be replaced by a trench. The discontinuous nature of the aquitard, even with the presence of the ground water divide, questions the effectiveness of the trench. Some downward flow has been modeled/reported.

AR002590

Also with the trench, it is reported that there would still be some saturated thickness of the refuse. Any design should eliminate any water coming in contact with refuse.

There is also the question about the effect of the extraction wells in reversing flow into the landfill.

Consequently, I am not convinced that it is in the Agency's best interest in replacing the drain by the trench. However, I must admit that I am not an expert in trench construction. My comments should therefore be viewed in the light of comments from experts in the field.

Should you have any questions, please let me know.

AR002591



Center do not support the consultant's contention that a lateral drainage zone is unnecessary.

Should you have any questions or wish to discuss this further, please contact Mary F. Beck of the General States Permits Section at 7-7239.

cc: Paul Gothold (3HW51)  
Renee Gelblat (3HW51)  
Bill Schrep (3HW52)  
C. K. Lee (3HW51)

AR002593



GANNETT FLEMING, INC.  
Suite 200  
East Quadrangle  
The Village of Cross Keys  
Baltimore, MD 21210  
Fax: (301) 433-8820  
Office: (301) 433-8832

July 26, 1991

Mrs. Paula Retzler  
Enforcement Project Manager  
U.S. Environmental Protection Agency  
Region III  
841 Chestnut Street  
Philadelphia, Pennsylvania 19107

Reference: Subcontract No. 87-0037-001  
ARCS III Program

Subject: Tybouts Corner Landfill Site RD/RA Oversight  
EPA Work Assignment Number 37-03-3N09  
Review of PRP's submittals in June, 1991

Dear Mrs. Retzler:

The following pre-design reports have been reviewed:

- *Main Landfill Grading and Cap Design Alternative Conceptual Evaluation Report*
- *Permits and Access Requirements Report*
- *Predesign Groundwater Quality Report*

The review comments are attached. With your approval, the fourth report which was titled, *Subsurface Drain Design Testing Report*, was not reviewed at this time. Instead, it will be reviewed along with PRP's submittal of a report presenting the evaluation of the alternatives (slurry wall and interceptor wells) to the subsurface drain.

Per your request, we have checked into the wetland issue in relation to the *Permits and Access Requirement Report*. We concur with the report that no wetland-related permit is needed for the proposed remediation activities. However, we do believe that the presidential policy of no net loss of wetland still applies to the Tybouts Landfill Site although no permit is required. The first sentence on Page 2 of this report needs to be carefully reviewed by EPA's legal experts. Under normal circumstances, legal claims such as this should not be in a technical report.

Our **75th** Year

AR002594

Mrs. Paula Retzler  
U.S. Environmental Protection Agency  
July 26, 1991  
Page 2

Please call me if you have any questions about this review.

Sincerely,

GANNETT FLEMING, INC.

  
Chen-yu Yen, Ph.D.  
Project Manager

CYY:ijk

**Attachments**

cc: James McKenzie (EPA Region III)  
John Machita (EPA Region III)  
Sue Janowiak (EPA Region III)  
Leonard Johnson (Halliburton NUS)  
Margaret Price (Halliburton NUS)  
David Sheridan (GF)

GF: 27163.001/0430

AR002595

July 26, 1991

MEMORANDUM

TO: Paula Retzler, EPM

FROM: Chen-yu Yen *cy*

RE: Tybouts Landfill Superfund Site RD/RA Oversight  
Review Comments on *Task Item III.B.3, Main Landfill Grading and Cap Design  
Alternatives Conceptual Evaluation Report*

In general, this report contained adequate information about the predesign concepts for our review. The review comments are arranged by major topics addressed in the report.

A. Grading Concepts

Pending resolution of other questions that may impact grading considerations, Gannett Fleming concurs that the Alternative 1 grading concept appears to have merit over Alternative 2. Final design should explore, however, the technical merit of using some of the Alternative 2 features such as fill reduction and internal drainage pathways in some areas to produce more uniform bulk fill thicknesses and possibly reduce settlement problems.

B. HELP Analysis and Cap Performance

1. The submission included only a summary of the HELP model results. A summary of all HELP model input parameters should also be furnished for review.
2. There is no indication which, if any, of the preliminary HELP model runs represent the components of the proposed cap.
3. No information was presented regarding the membrane characteristics used in the model. Both the assigned parameters and the basis for those values should be furnished.
4. No information was provided regarding the assumed permeability values for the vegetative layer soils. Both the assigned parameters and the basis for those values should be furnished.
5. The permeability values assigned to the barrier layer ( $\leq 1 \times 10^{-6}$  cm/s) are consistent with known properties of the Ward clay.

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MEMORANDUM

TO: Paula Retzler

July 26, 1991

Page 2

6. The input parameters used for layers 1, 2, and 3 seemed to be default values typically used for uncompacted agricultural soils. Soils used for landfill caps are normally compacted. The example output files provided to Gannett Fleming do not look like this was done.
7. The runoff curve number used for the topsoil (72) appears to be much too high. The TR55 Manual recommends 30 for continuous grass and soil with a permeability greater than  $2 \times 10^{-4}$  cm/sec.
8. It is presumed that the HELP model was run using grades established by initial grading, yet the submission indicates that final grades after settlement may be reduced substantially. Accordingly, regardless of other considerations, Gannett Fleming recommends that additional HELP runs be made for the various cases to evaluate possible performance under a maximum settlement scenario.
9. Gannett Fleming's interpretation of the HELP model results differs somewhat from DPL's evaluation. The results, in our opinion, show that the membrane contribution is significant and important rather than simply redundant. Gannett Fleming sees no basis for considering a cap design that does not include a membrane above the barrier layer.

C. Synthetic Membrane

Gannett Fleming checked with the manufacturer of Typar membranes, and was not able to obtain any existing material that was suitable for capping. Seaming of the coated geotextile material is extremely difficult. The strength at the seams and their potential failure due to differential settlement are of concern. Also of concern is the ability of the fabric seams to meet the  $1 \times 10^{-7}$  cm/sec or less hydraulic conductivity requirement.

D. Settlement Considerations

1. Documentation consisting of both references and calculations should be provided to permit review of estimated settlements.
2. After review of the estimated settlements, a plan should be generated showing estimated post-settlement contours, which may be of assistance in optimizing grading and in determining required actions after primary settlement has occurred.
3. Based on information contained in the submission regarding magnitude of estimated settlements, construction staging to incorporate a waiting period after bulk fill placement may be mandatory.

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MEMORANDUM

TO: Paula Retzler

July 26, 1991

Page 3

E. Drainage Layer

1. Based on the HELP summary of results in Table 1, Gannett Fleming concurs that a drainage layer, if included, should have a high permeability such as that assumed for the stone drain.
2. Gannett Fleming concurs that the HELP model results suggest that including a drain is in the region of diminishing returns in terms of overall cap performance for cap designs incorporating a membrane and a barrier layer having an as-built permeability of  $1 \times 10^{-7}$  cm/sec.
3. Gannett Fleming shares DPL's concerns of a sagging drain layer resulting from settlement, but this can be significantly mitigated by a waiting period to allow primary settlement due to bulk fill placement to occur. However, even with a waiting period, some sagging and underground ponding is possible. Repairs of such sagged areas are likely to be both difficult and costly and could result in damage of adjacent or underlying cap components.
4. It is Gannett Fleming's opinion that eliminating the drainage layer in its entirety could result in serious operation and maintenance problems in terms of erosion, inspection access, and maintenance functions. We feel this potential is increased by the Alternative 1 grading plan, which is based on long continuous slopes across the landfill.

F. Gas Vent System

DPL is recommending a passive gas vent system based on an individual vertical point concept. The report submitted by Wehran Engineering recommended such a system based on preliminary studies but recommended supplemental testing and a more extensive evaluation of data to confirm applicability of such a design. Gannett Fleming concurs with the recommendations contained in the Wehran Engineering Report.

G. Stormwater Management

1. No documentation is given to support the selection of runoff curve numbers and Mannings roughness coefficient used in determining the existing conditions for evaluation of stormwater management needs. Drainage areas and routing for existing and proposed conditions need adjustments. We were not able to duplicate the TR-55 results in Appendix C.

AR002598

**MEMORANDUM**

**TO: Paula Retzler**

**July 26, 1991**

**Page 4**

2. There are discrepancies between the Limits of Refuse, Plate 3, and the Limits of Landfill Cap, Plates 1 and 2.

**CYY:ijk**

**cc: David Wilson (GF)  
Jeff Stamm (GF)  
Win Westervelt (GF)**

**GF: 27163.001/0430**

AR002599

July 11, 1991

MEMORANDUM

TO: Chen Yen  
FROM: Win Westervelt *WJ*  
RE: Review of Task Item III. A. 1. C--Identification of Permits  
and Site Access Requirements

The submittal appeared to be complete with no major deficiencies. I checked the contents against the following documents which we have in our office:

- CERCLA as amended by SARA
- RCRA
- Delaware Erosion and Sediment Control Handbook
- New Castle County, DE, Drainage Code

On page 1, the report states that no permits are required for any onsite activities, in accordance with CERCLA Section 121(e). I believe this is correct. The report therefore addresses only permits and agreements required for offsite activities such as obtaining easements and right-of-ways, improving stream crossings, and excavating fill material.

As stated on page 2, capping activities are generally exempt from RCRA Land Ban requirements where wastes are consolidated onsite and no offsite placement occurs. Therefore, no permits will be required to comply with federal regulations.

The report notes that communication has been established with several state agencies regarding site activities and, generally, recommends that design reports be supplied to the agencies for their approval. The submission of a Lines and Grades and Sediment and Erosion Control Plan, and the noted requests for temporary construction easements, right-of-ways, and improvements to stream crossings appear to be consistent with the state regulatory requirements.

WWW:jms

GF: 27163.001/0430

AR002600

July 26, 1991

MEMORANDUM

TO: Paula Retzler, EPM

FROM: Chen-yu Yen *CY*

RE: Tybouts Landfill Superfund Site RD/RA Oversight  
Review Comments on *Predesign Groundwater Quality Report*

The submittal is an improvement over the draft report that we reviewed in December, 1990. All of our earlier comments were addressed and corrections were made. The data summary appeared to be complete with no major deficiencies.

GF: 27163.001/0430

AR002601



GANNETT FLEMING, INC.  
Suite 200  
East Quadrangle  
The Village of Cross Keys  
Baltimore, MD 21210  
Fax: (301) 433-4520  
Office: (301) 433-6632

August 8, 1991

Mrs. Paula Retzler  
Enforcement Project Manager  
U.S. Environmental Protection Agency  
Region III  
841 Chestnut Street  
Philadelphia, Pennsylvania 19107

Reference: Subcontract No. 87-0037-001  
ARCS III Program

Subject: Tybouts Corner Landfill Site RD/RA Oversight  
EPA Work Assignment Number 37-03-3N09  
Review of PRP's submittals in June and July 1991

Dear Mrs. Retzler:

The attached memoranda constitute Gannett Fleming's additional and final review comments on the PRP's submittal *Main Landfill Grading and Cap Design Alternative Conceptual Evaluation Report* and our preliminary review comments on the PRP's submittals: *Subsurface Drain Design Testing Report* and *Design Report on Alternative Groundwater Controls for Tybouts Corner Landfill*.

As we discussed over the phone, the MODFLOW code revised by LMS may not be appropriate. Consequently, we will have to spend more time to assess the impact of this finding on the overall concept of slurry wall and interceptor well system.

Please call me if you have any questions about this review.

Sincerely,

GANNETT FLEMING, INC.

Chen-yu Yen, Ph.D.  
Project Manager

CYY:ijk  
Attachments

cc: James McKenzie (EPA Region III)  
John Machita (EPA Region III)  
Sue Janowiak (EPA Region III)  
Leonard Johnson (HALLIBURTON NUS)  
Margaret Price (HALLIBURTON NUS)  
David Sheridan (GF)


GF: 27163.001/0430

AR002602

August 8, 1991

**MEMORANDUM**

**TO:** Paula Retzler, EPM

**FROM:** Chen-yu Yen 

**RE:** Tybouts Landfill Superfund Site RD/RA Oversight  
Supplemental Review Comments on *Main Landfill Grading and Cap Design Alternative Conceptual Evaluation Report* and *Design Report on Alternative Groundwater Controls for Tybouts Corner Landfill*

**A. HELP Model Evaluation of the Landfill Cap**

1. I have made telephone inquiries to Duffield Associates after the July 29, 1991 meeting about their choices of the HELP model input parameters. For the HELP model runs presented in the *Main Landfill Grading and Cap Design Alternative Conceptual Evaluation Report*, runoff curve numbers that do not match the grass and soil conditions were used as stated in our previous comments. However, since that time, Duffield Associates did confer with Paul Schroeder (Author of the HELP model) and obtained the correct method of using the model. The HELP model output presented in the meeting seemed to have been run with the proper runoff curve numbers.

2. Duffield Associates had performed additional HELP model simulations to evaluate the use of a sand drainage layer. As presented in the submitted report, sand layer with drain pipes 500 feet apart did not drain properly. Their additional model simulations indicated that a sand layer with drain pipes spaced 50 to 100 feet apart would properly drain. Having more closely spaced pipes, however, would cost more.

3. HELP model may be used to evaluate different drainage systems (e.g., stones, gravel, sand) as to how well they may perform and how frequently the top soil will be fully saturated.

**B. Alternative Groundwater Controls (Slurry Trench and Interceptor Wells)**

1. I have contacted and sent a copy of the *Design Report on Alternative Groundwater Controls for Tybouts Corner Landfill* to George Gardener, the previous NUS RI/FS Project Manager. He stated that NUS had also had concerns about the drawbacks of the subsurface drain concept, namely the potential of clogging of the drain and the level of personnel protection needed during the construction of the drain system. He concurred with Gannett Fleming that the MODFLOW model could only be used to compare alternatives, and could not be relied on to predict actual groundwater levels for any of the alternatives.

2. The pump test performed by DPL on the interceptor wells did not show any effect on the water levels in the monitoring wells within the landfill. This result is not encouraging for the

AR002603

proposed alternative to dewater the saturated refuse. However, since the dewatering rate is expected to be very slow, the result is not incompatible with DPL's suggestion that the proposed system may work in five years.

3 Regardless of what the MODFLOW modeling is predicting, there is not enough evidence to conclude that the proposed system will either succeed or fail. Rather than agreeing with or rejecting the proposed concept outright, EPA's best position may be to demand a performance-based requirement for the groundwater control system. For example, EPA could require that the saturated refuse to be drained to less than one foot over the aquitard within a two-year evaluation period. If after this period the required performance is not achieved, additional wells can be installed in the problematic area inside the landfill and pumped to improve drainage.

GF: 27163.001 /0430

19  
11.

AR002604

Date: August 8, 1991

File: 27163.001

MEMORANDUM

To: Chen-yu Yen

Subject: Tybouts Landfill Superfund Site RD/RA Oversight  
Supplemental Review Comments  
Main Landfill Grading and Cap Design Alternatives  
Design Report on Alternative Groundwater Controls

A. Drainage Layer in Cap

1. A major issue appears to be whether the Preliminary Agreement requires a drainage layer and, if so, under what circumstances. DPL's opinion is that it is nonessential to cap performance in terms of significantly reducing infiltration, and therefore proposes to not include a drainage layer. DPL has reported the estimated cost of the drainage layer as \$2,000,000, which Gannett Fleming concurs is a reasonable estimate at this time.

2. EPA technical documents do not suggest that the drainage layer is optional on hazardous waste landfills. Specifically, EPA/530-SW-89-047 (July 1989) entitled Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments, clearly indicates that a drainage layer is standard in any basic cover system. Similarly, EPA/625/4-89/022 (August 1989) entitled Seminar Publication - Requirements for Hazardous Waste Landfill Design, Construction, and Closure, indicates that the drainage layer is a basic component of a cover system meeting EPA's proposed minimum technology guidance (MTG) requirements.

3. Aside from issues related to the Preliminary Agreement language, the calculated effect of a drainage layer on infiltration, and EPA's normal basic technical requirements, there remain the potential adverse effects related to surface erosion, establishing and maintaining vegetation, access, and maintenance of the landfill surface and vegetation that might arise if a drainage layer is not provided. It is Gannett Fleming's opinion that DPL has offered no reasonable evidence that a stable and maintainable surface will result if the drainage layer is eliminated. On the contrary, it was agreed that an unknown portion of the surface would be permanently saturated. Such areas will never be suitable for access or maintenance and may be highly susceptible to erosion damage. While we understand that the cost of the drainage layer is high, it is our opinion that elimination of the layer might result in unsatisfactory performance that could require remediation at even higher cost in the future. We recommend, therefore, that a drainage layer be included in the cover system unless completely convincing evidence can be provided to demonstrate that its elimination will not be detrimental.

4. At the July 29, 1991 meeting, DPL expressed their preference for using sand or gravel as a drainage material in lieu of synthetic geocomposite systems. DPL's June 1991 report further suggested that a gravel drainage layer would be

AR002605

required. Subsequently, however, Chen-yu Yen has had further discussions with DPL and has determined that either sand or gravel would be suitable, with the primary difference being the spacing and number of collection pipes required. It is Gannett Fleming's opinion that either material would be acceptable provided that a compatible system of related elements is provided. Specifically, the drainage collection system, the FMC, and the protective geotextiles must all be appropriate for the materials selected. There are advantages and disadvantages for each material. Using sand will generally result in fewer required precautions to protect the FMC, but it can be very difficult to reliably produce and deliver material meeting the permeability requirements. Conversely, using gravel ensures a reliable high permeability, but may require additional precautions to protect the FMC.

5. If necessary, there might be alternatives available for design of a drainage system that would satisfy the concerns while minimizing costs. These alternatives could be explored after the fundamental issues concerning the need for drainage is resolved.

B. Flexible Membrane Cover (FMC)

1. DPL has proposed using a 20-mil PVC for the FMC.

2. EPA guidance documents referenced previously indicate that a 20-mil thickness was the minimum recommended thickness but that EPA currently (August 1989) is proposing a 40 mil minimum.

3. Telephone contacts with 4 pvc liner manufacturers who were provided with a general description of the site size, slopes, and overlying and underlying materials resulted in manufacturer's recommendations that the FMC thickness be 30 mils. The average costs were reported to be less than 35 cents per square foot for a 30 mil FMC versus 25 cents per square foot for a 20 mil FMC. Therefore, the total project cost less than difference between a 30 mil PVC liner and a 20 mil PVC liner would be approximately \$200,000. Using a 40 mil PVC liner would add approximately \$400,000 to project costs compared to a 20 mil FMC.

4. Based on review of EPA documents, manufacturer recommendations, and our own experience, Gannett Fleming recommends that the thickness of a PVC membrane be at least 30 mils. Further, if stone is used as a drainage layer, it will probably be necessary to use a thicker membrane.

C. Slurry Trench

1. Assuming that hydrogeologic modeling demonstrates suitability from a performance standpoint, it appears that a soil-bentonite slurry trench is technically feasible. The required depth is within normal ranges for successful construction; the aquitard into which the slurry trench must penetrate is continuous along the proposed alignment; head differentials across the wall will be acceptable; and there are no particularly problematic soil layers that need to be penetrated.

2. It is reasonable to estimate the in-place permeability of a soil-bentonite slurry wall at  $1 \times 10^{-7}$  cm/sec.

AR002606

Gannett Fleming

Memo

-3-

August 8, 1991

3. Construction of a slurry trench cutoff at this site will be simpler than construction of a drain of equal depth.

4. Environmental hazards during construction are likely to be less for a slurry trench cutoff than for a drain.

5. Gannett Fleming concurs with DPL that long-term operation and maintenance costs are minimal for a soil-bentonite slurry trench.

6. There are many specific technical issues that must be fully addressed during the design of a slurry trench cutoff at a hazardous waste site, but it is Gannett Fleming's opinion that a slurry trench cutoff is likely to be fundamentally viable from a technical standpoint.

D. Other Comments

1. DPL should present the costs for at least two modified plans containing additional wells or other features necessary to completely dewater the two primary remaining areas of saturated refuse.

David S. Wilson

D. B. WILSON

mal

AR002607

August 9, 1991

MEMORANDUM

TO: Chen-yu Yen

FROM: Mark Mummert *Mark Mummert*

RE: Tybouts Landfill Superfund Site RD/RA Oversight  
Review Comments  
*Design Report on Alternative Groundwater Controls for Tybouts Corner Landfill*

This memo summarizes our preliminary comments for the above referenced review. The review is based on the following items received from DPL:

- o *Design Report on Alternative Groundwater Controls for Tybouts Corner Landfill*, dated July 1991.
- o MODFLOW input and output files
  - TYBMOD.DAT, dated 7/30/91 10:38a
  - TYBMOD.BCF, dated 5/23/91 3:36p
  - TYBMOD.SIP, dated 6/26/91 7:17a
  - TYBMOD.OPC, dated 6/25/91 4:31p
  - TYBMOD.GHB, dated 5/13/91 9:52a
  - TYBMOD.RIV, dated 5/13/91 9:52a
  - TYBMOD.RCH, dated 5/13/91 6:14p
  - TYBMOD.WEL, dated 6/25/91 4:29p
  - TYBMOD.OUT, dated 6/26/91 8:27a
  
  - TYBROD.DAT, dated 7/30/91 10:39a
  - TYBROD.BCF, dated 5/16/91 10:15a
  - TYBROD.SIP, dated 5/31/91 11:06a
  - TYBROD.OPC, dated 5/16/91 10:14a
  - TYBROD.GHB, dated 5/13/91 6:13p
  - TYBROD.DRN, dated 5/13/91 9:08a
  - TYBROD.RIV, dated 5/13/91 6:13p
  - TYBROD.RCH, dated 5/13/91 6:14p
  - TYBROD.WEL, dated 5/14/91 8:59a
  - TYBROD.OUT, dated 5/31/91 12:06p
  
  - TYBCAL.DAT, dated 5/31/91 8:21a
  - TYBCAL.BCF, dated 5/15/91 7:20a
  - TYBCAL.SIP, dated 5/31/91 11:08a
  - TYBCAL.OPC, dated 5/30/91 2:46p
  - TYBCAL.GHB, dated 5/13/91 5:03p

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- TYBCAL.RIV, dated 5/13/91 5:03p
- TYBCAL.RCH, dated 5/13/91 5:41p
- TYBCAL.WEL, dated 5/09/91 11:20a
- TYBCAL.OUT, dated 5/31/91 11:21a

Summary comments are as follows:

1. We are in agreement with the overall approach that was used to evaluate suitability of the alternative groundwater controls, which involved use of the MODFLOW computer program to evaluate thickness of saturated refuse.

DPL used average thickness of saturated refuse as a summary parameter to compare effectiveness of alternative controls. This parameter has the potential to mask areas that may have relatively thick saturated refuse. We recommend that DPL report the minimum and maximum thickness of saturated refuse as well as the approximate volume of refuse with saturated thickness greater than one foot.

2. We found the number and extent of layers in the DPL Model to be acceptable.
3. We have not completed our review of boundary condition assumptions contained in the DPL Model.
4. Apparently there is an input error for  $V_{com}$  between layer 1 and 2 at row 14, column 19. The  $V_{com}$  at this location was set at  $0602529E-02 \text{ days}^{-1}$  (6,025.29) compared to the next largest value of  $0.60000E-02 \text{ days}^{-1}$ . Since the cell at row 14, column 19 is located within the landfill, the high value could bias the estimates of saturated refuse thickness. We suggest that the MODFLOW calculations be redone with a corrected  $V_{com}$ , and that DPL provide the EPA with the backup calculations used to derive  $V_{com}$ .
5. Given that assessment of the alternative groundwater controls' effectiveness is based upon results of groundwater modeling and that models are only as reliable as the input data used, we found the documentation on set-up, calibration and use of the MODFLOW model to be incomplete. The following information should be added to the design report:
  - paper copies of the MODFLOW output
  - input data tables and graphics showing hydraulic conductivity, starting heads,  $V_{com}$ , storage coefficients, depths for layer 2 and 3, bottom elevation for layer 1, recharge rates, and all other parameters specific to River, General Head, Well and Drain packages.
  - justification of the input data values.

Providing this information would speed the next EPA review.

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6. A section describing the methods and results of model calibration should be added to the design report.
  
7. Attached is a copy of contoured differences in elevations between the bottom of refuse surface assumed by DPL (TESTB1.GRD) and the bottom of refuse surface calculated using SURFER from 19 borings in or near the landfill. We expected to find that differences would equal zero near borings because, irregardless of the contouring method used, the DPL bottom refuse surface should match known points. We suggest that DPL provide EPA with the background calculations used to create the DPL bottom of refuse surface. Sensitivity analysis should be done to evaluate how bottom of refuse elevations affect the reported 0.4 and 0.3 feet saturated thickness numbers.