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NATIONAL LEAD COMPANY OF OHIO (NLCO), AN OUTLINE DESCRIPTION OF THE CONSTRUCTION OF CHEMICAL WASTE PIT NO. 5 - (USED AS A REFERENCE IN OU1 FS)

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CENTRAL FILES

DEC 4 1970

Mr. C. L. Karl, Area Manager
U. S. Atomic Energy Commission
P. O. Box 39188
Cincinnati, Ohio 45239

SUBJECT: DESCRIPTION OF DESIGN AND CONSTRUCTION ACTIVITIES ON WET CHEMICAL SCRAP PIT NO. 5

Reference: CP-68-13

Dear Mr. Karl:

In accordance with your verbal request, we have assembled information that describes the design and construction activities on Pit No. 5. A narrative was prepared that describes the project only briefly, but this has been supplemented by attaching copies of other data (drawings, specifications, and construction progress photographs) that were available in our files. These attachments give a more detailed description of all aspects of the work.

We have prepared only one set of the attachments for the narrative description; however, we have made a record that identifies the attachments and could produce additional sets if it becomes necessary. One extra copy of the narrative is enclosed for your files.

Sincerely yours,
Original Signed By
M. S. NELSON
Manager
M. S. Nelson
Manager

JBS/wfk

Atts.

cc: C. L. Karl
P. G. Defazio - w/narrative, w/o narrative atts.
Central Files - " " " "

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AN OUTLINE DESCRIPTION
OF THE
CONSTRUCTION OF CHEMICAL WASTE PIT NO. 5

December 4, 1970

FEED MATERIALS PRODUCTION CENTER
NATIONAL LEAD COMPANY OF OHIO

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I. INTRODUCTION

Wastes from the FMPC Refinery and Recovery Plant operations are pumped in the form of a thin slurry to a lagoon which serves as a settling basin. This gravity-type, separation facility collects the solids fraction of the waste and overflows clear water which is pumped to the Great Miami River. When a basin becomes sufficiently full of solids that its settling capability is lost, the basin is abandoned and a new one takes its place. Three of these basins have been built at this site. Two have been abandoned and the third (known as Pit No. 5) is now in service.

These waste disposal facilities have been constructed by excavating pits on an essentially level plateau west of the plant production area. Prior to the construction of Pit No. 5, these facilities were built by excavating into a naturally occurring layer of impervious blue clay that exists in the area. The excavated material was used to build embankments around the pits, and a portion of the blue clay bottom was placed on the inner face of the embankments as a seal. The elevation of the impervious clay layer fixed the depth of the finished pits at 25 to 30 feet.

Several years ago, a group of sampling wells was drilled around the waste disposal area to monitor the effectiveness of the natural clay pit liners. Ground water samples were periodically withdrawn from these wells and analyzed for constituents that might originate from the disposal pits. The radioactive compounds in the plant waste streams are almost always in an insoluble form. It was, therefore, very unlikely that any of these materials would be carried into the ground water system. However, some constituents of the wastes are soluble, and a liner failure could permit them to percolate into the aquifer.

Approximately three years after the second in the series of settling basins was placed in service, data from the sampling wells began to indicate that materials were leaching through the clay barriers. Higher than background quantities of nitrates and chlorides were consistently noted in the samples. This situation was closely monitored and the array of sampling wells was expanded to assure that an adequate surveillance was maintained. Expert assistance in this work was provided by the U.S.G.S. and a ground water consultant. The surveillance program has shown that the quantity of materials that has invaded the ground water system is relatively small and does not migrate from the disposal area in troublesome quantities. This program has also shown that there has been no invasion of leachant into the lower aquifer which is actually the production aquifer in this region. The FMPC production wells and all other major water users in the area are utilizing this lower aquifer as their supply source.

I. INTRODUCTION (cont'd)

Planning for the abandonment of basin number two and its replacement by a new basin made it necessary to consider the wisdom of continuing to rely on the native clays for basin sealants. It was decided that this was not wise, and that even though no significant difficulties had been experienced, future basin liners should provide a more positive seal.

II. DESIGN

After a decision was reached to substitute an artificial pit liner in the new design for the previously used native clays, it was necessary to select the proper lining system. The aim, of course, was to select a material that would provide long-term protection at the lowest possible cost. A brief description of this investigative effort follows:

A. Bentonite - This material was the first considered due to predicted economic advantages. Also, preliminary discussions with the American Colloids Company lead to a belief that a successful lining could be built with bentonite. A laboratory test program was performed by American Colloids utilizing actual samples of the slurry that was to be routed to the new pit. This program showed that a bentonite lining would not be suitable for the waste materials even with rather extreme dosages of bentonite. Eventual leakage rates of 4,000 gallons per acre per hour were predicted.

The estimated installed cost of the bentonite liner that had originally been predicted to be suitable was $.25 per square foot. This estimate was based on the use of 6" of sand with a 4# per square foot dosage of bentonite. Also, included was the cost of wave action protection for the portion of the pit slope that would be exposed to this attack. A layer of 4" size, crushed stone or slag was planned for this requirement.

B. Asphalt Panels - The suitability of an asphalt panel lining for the pit was investigated with W. R. Meadows, Inc., and the Philip Carey Corporation. Neither firm actually tested their materials with the waste liquids, but based their recommendations on a typical waste analysis. W. R. Meadows recommended a double lining, utilizing a bottom layer of 1/2" thick Hydromat and a top layer of 1/8" thick Meadowmat which has a PVC plastic core. The materials would be furnished in 4' x 12' sheets. The sheets would be placed in a rectangular pattern, butted, and would have gusset strip joints. The sheets in the top layer would be staggered and offset from the bottom layer sheets. The Meadows Company estimated the installed cost of such a system to be $.62 per square foot.

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B. Asphalt Panels (cont'd)

The Philip Carey Company recommended a very similar two-ply installation, except, of course, utilizing materials of their manufacture. Their estimate of the installed cost was $.40 per square foot.

It was believed that the actual installed cost of an asphalt panel lining would be somewhere between these two estimates.

C. Rubber - The suitability of rubber membranes was investigated with the assistance of UniRoyal, Inc. Materials were tested with the actual plant wastes in UniRoyal's laboratory in Mishawaka, Indiana. This work resulted in UniRoyal's recommendation that their Royal-Seal EPDM Elastomeric Membrane, 1/16" thick, was entirely suitable for the proposed use. This material is supplied in 20' x 100' rolls and splices are formed with an adhesive that does not require the use of heat. They further offered a 15 year guarantee on the recommended membrane.

UniRoyal estimated the installed cost of the recommended lining membrane to be $.55 per square foot.

D. Plastics - Plastics were not studied in the same detail as other materials considered in the investigation. Experience with the weathering characteristics of plastic films in other applications caused these materials to be placed at the lowest priority in the investigation sequence. Consequently, the project completion schedule made it necessary to make a material selection before the suitability of plastic membranes was ever seriously studied.

The rubber membrane was selected as the proper lining material for the new pit. This decision was reached because the bentonitic clay system had been proven to be unsuitable by laboratory test, and the asphalt panel systems were more susceptible to joint failure than rubber systems due to the type of joint and the comparative total joint length. Furthermore, there was no clear-cut economic advantage to asphalt over rubber. One additional consideration was the offer of a system guarantee by UniRoyal. In this particular case, this may have been purely academic since it is doubtful if there would be a feasible method for repairing such a leak if it were discovered. Nevertheless, it was thought that this was a plus in favor of rubber, particularly since the asphalt people refused to make a comparable offer.

After the decision had been made to use rubber as the lining membrane, the design of the pit and auxiliary features was completed. The lining specification was written on the basis of the material being 1/16" thick, Royal-Seal Membrane Compound No. 5617, or an approved equal. The adhesives and

II. DESIGN (cont'd)

splicing materials were those recommended by UniRoyal for use with this membrane. Goodyear, Carlisle, and perhaps other rubber companies, manufacture a material that was specified.

III. CONSTRUCTION

Contractors with experience in the installation of membrane linings are specialists in this field and are not organized to undertake an entire project as a general contractor. Recognition of this fact prompted a decision to subdivide the total pit construction project into two separate contracts—one to cover the earthwork and auxiliary features, and the other the installation of the membrane liner.

The construction drawings and specifications were prepared in a manner that would permit bidding on a subdivided basis. Five bids were received on the general contract phase of the work and four were received on the lining phase. Three of the four lining bidders proposed to use UniRoyal material, the other proposed Carlisle Rubber Company material. Awards were made to the low bidder on each phase. Cost and scheduling information on each contract is given in Section V of this outline.

The construction features for this facility are described in considerable detail by the attachments to this document; however, two potential pitfalls, that may not be obvious, should be carefully considered in the planning for such a facility. They are:

A. The preparation of the subgrade to receive this type membrane requires greater care than most earthwork contractors normally expect to provide. The fine grading effort is particularly tedious to assure removal of all sharp stones, sudden irregularities, etc., that might puncture the membrane. This aspect should be emphasized in the earthwork specification to avoid conflicts during the construction stage between the earthwork contractor and the lining contractor.

B. The site should be carefully selected to assure that there are no significant ground water flows into the area to be lined. Also, considerable forethought should be given to provisions for rapid removal of rainwater that may collect in the work area. Field splices of this material can be made in virtually any temperature but little or no moisture can be tolerated. Failing to provide a means of assuring reasonably dry working conditions will cause serious delays.

IV. OPERATING EXPERIENCE

The pit was placed in service on October 21, 1968. The experience with this facility has been excellent to this time. Quite recently, two minor joint failures were noted and repairs have been scheduled for December, 1970. One failure was at a molded fitting forming a corner junction between the effluent tower and the pit lining. This failure is below the normal liquid operating level and it is certain that some liquid loss was experienced. There is no evidence that the loss was significant since no erosion or extensive subgrade saturation is evident. The other failure is at a membrane field splice near the feed end of the pit. This failure is above the normal liquid operating level.

V. STATISTICAL DATA

A.	Total Pit Volume	21.9×10^6 Gal.
B.	Volume to Lower Operating Level	13.3×10^6 Gal.
C.	Volume to Upper Operating Level	20.7×10^6 Gal.
D.	Area Covered by Lining Membrane	173,000 Sq. Ft.
E.	Construction Costs	
	1. General Contract	$115,580
	2. Lining Installation	92,342
	3. Total Cost (Incl. Engr'g.)	220,014
F.	Construction Schedule	
	1. General Contract	
	a. Start	July 11, 1968
	b. Finish	December 13, 1968
	2. Lining Installation	
	a. Start	August 27, 1968
	b. Finish	October 11, 1968
G.	Date Pit Was Placed in Service	October 21, 1968
H.	Unit Costs	
	1. $/Gal. of Usable Space	0.0106 1/
	2. $/Cu. Yd. of Usable Space	2.15 1/
	3. $/Sq. Yd. of Lining Installed	0.533 2/

1/ Includes Engineering Costs
2/ Exclusive of Engineering Costs

Attachments
1. Set of Drawings.
2. Technical Specifications.
3. Construction Progress Photographs.

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