APPENDIX E

BACKWASH SLUDGE DEWATERING

Pages

RAPID SLUDGE DEWATERING SYSTEM (RSDS) TEST DATA E1-7

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LETTER OF TRANSMITTAL

DISTRIBUTORS/REPRESENTATIVES

Project: DER Quakake, PA

Engr.:

Bids Due:

Date: August 17, 1981

Re: Rapid sludge dewatering

GEO-Technical Services
851 South 19th Street
Harrisburg, PA 17104

Attention: Stephen J. McBride, P.E.

Reply to:

PK ASSOCIATES INC.
P. O. Box 710
Valley Forge, PA 19481
215/935-9201

We are sending you: xx enclosed herewith
____ delivered by hand
____ under separate cover via ____

Item	Copies	Description
1	1	DER Quakake, PA Test Report

These are transmitted: xx for your use
____ for approval
____ as requested
____ for review

Submitted by ____, PK ASSOCIATES INC.
Peter Kaye

cc: Norm Batcheler
Bob Roberts
H. H. Weldes

8/17/81
RD Systems

DER QUAKAKE WTP TESTS

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1. OBJECTIVE

The objective was to determine the following:

A. Can this sludge be dewatered with the rapid sludge dewatering system?

B. What if any chemical conditioners, polymers, etc., are required and their approximate cost?

C. What size system would be required to adequately handle the daily sludge generated from the waste treatment plant?

D. What quality filtrate can be expected?

E. Should an alternate type of dewatering system be considered?

2. TEST DATES

The testing of sludge from the Quakake plant was conducted on July 22, 1981, on site.

3. TESTING

Initial jar testing was done using polymers of the anionic type. These polymers were added to test samples in dosages equal to $2.00/dry ton of cake. Since this jar testing produced a satisfactorily looking floc, good settling and clear supernatant, a full scale test was conducted.

All dewatering tests were accomplished utilizing a 6" diameter rapid sludge dewatering plexiglass test unit with vacuum pump 1/45th hp capable of 10" of mercury.

4. RESULTS

Two (2) tests were actually made utilizing the sludge produced from the water plant pilot system. The first test used an anionic polymer, the second test was accomplished without a polymer. An average of 26% dry solids was achieved.

5. TEST RESULTS

Test No.	Feed Solids %	Cycle Time	% D.S.	Filtrates* ppm
1	1.6%	100 Min.	27.5%	424 (clear)
2	1.6%	63 Min.	24.5%	332 (clear)
Average	1.6%	82 Min.	26%	378

*Includes dissolved solids

6. CONCLUSION

The sludge generated at the Quakake pilot site can be satisfactorily dewatered on the rapid sludge dewatering system. These sludges will floc well with an anionic polymer @ $2.00/DT. However, they can be dewatered without the use of polymers. A decant system should be considered. Sludge will dewater from approx. 1.6% to 25% within two (2) Hrs. or less. Several cycles could be achieved in an eight (8) Hr. working day.

RD Systems

Date 7/22/81

Test No. 1

Performed By PK/HHW

Test Site DER - Quakake Water Plt. Contact Norman S. Batcheler

Type of Sludge Lime/Water Plant (abandoned mine drainage)

Daily Plant Flow 10 MGD, Daily Sludge Volume ________

Filter Plate Used, RSDS No. 3, ~~Coarse~~/Fine

PERCOLATION/TEST DATA

Time		Heights In Inches			Vacuum Inches	Comments
Actual	Elapsed Min.	Total	Sediment	Supernatant		
12:47	0	10	2	8		Start
12:50	3	9	1	[illegible]		Clear Filtrate
1:00	13	6				
1:07	20	4 3/4				Start Vacuum Pump
1:09	22	3 3/4			10"	
1:10	23	3			10"	
1:11	24	2 1/2			0	lost ~~more~~ Vacuum
1:14	27	1 1/2	1/2		10"	
1:15	28	1			10"	Filtrate Thru
1:15 1/2	28 1/2				0	Cake Cracking
2:10	83					Off

Solids:

Starting 1.6 % d.s.

End 27.5 % d.s.

Cycle Time 1 1/4 hrs.

Polyelectrolyte: Type Anionic 311FL

55 ml of 1.5 % solution 8 per ~~gallon~~/liters

____ % on dry solids. Cost per lb. $ 2.00

Cost: $ 2.00 /ton of dry solids

RD Systems

Date 7/22/81
Test No. 2
Performed By PK/HHW

Test Site DER - Quakake Water Plt. Contact Norman S. Batcheler

Type of Sludge Lime/Water Plant (abandoned mine drainag

Daily Plant Flow 10 MGD, Daily Sludge Volume ______

Filter Plate Used, RSDS' No. 3, ~~Coarse~~/Fine

PERCOLATION/TEST DATA

Time		Heights In Inches			Vacuum Inches	Comments
Actual	Elapsed Min.	Total	Sediment	Supernatant		
3:24	0	9 1/4				Start
3:25 1/2	1 1/2	9				Clear Filtrate
3:29	5	8 1/2				
3:31	7	8 1/4				
3:34	10	8				
3:44	20	7 1/4				Start Vacuum Pump
3:45 1/2	21 1/2	6 1/2			10"	~~Start~~ vacuum ~~pump~~
3:47	23	5			10"	
3:48	24	4			10"	
3:50	26	2 1/2			10"	
3:51	27	1 3/4			10"	
3:52	28	1			0	Stopped Vac. for 2 min.
3:54	—	—			10"	Vacuum on again
3:55	29	1/2			10"	Filtrate Thru
4:06	42	1/4			10"	Cake begins to crack
4:27	63	1/4				Off

Solids:

Starting 1.6 % d.s.

End 24.5 % d.s.

Cycle Time 1 hrs.

Polyelectrolyte: Type None Used

______ ml of ______ % solution ______ per gallon/lite

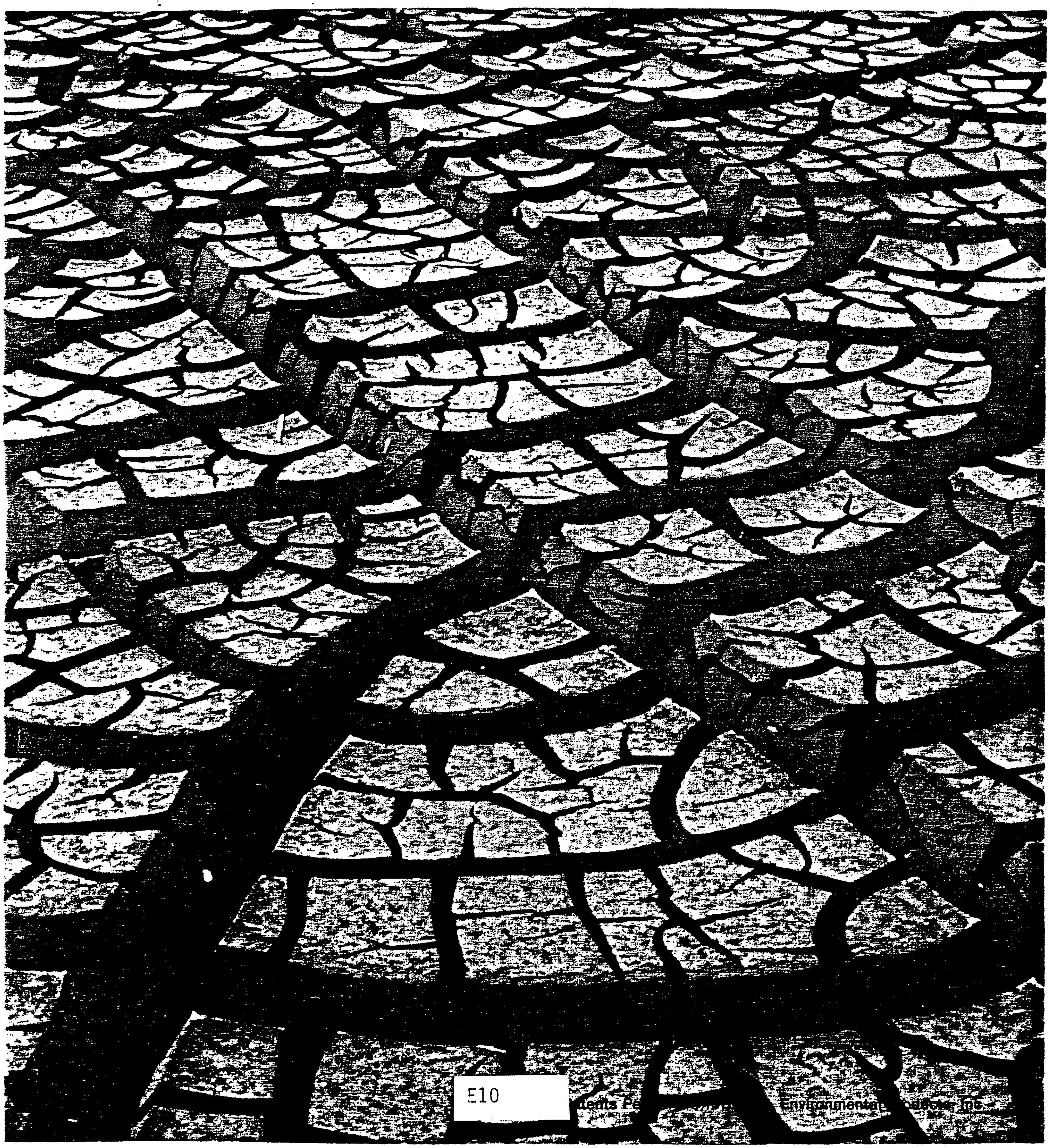
______ % on dry solids. Cost per lb. $______

Cost: $______ /ton of dry solids

RSDS-I™ rapid sludge dewatering system*

U.S.E.P.

A technological breakthrough in rapid sludge dewatering from U. S. Environmental Products, Inc.



E10

The simple, efficient, rapid dewatering system

RSDS-I, the rapid sludge dewatering system marketed by U. S. Environmental Products, Inc., represents a technological breakthrough in the rapid dewatering of most types of domestic sludge.

RAPID DEWATERING
RSDS-I can dewater from less than 0.5% to over 4% dry solids aerobic domestic sewage sludge much faster than conventional sandbeds. For example, RSDS-I loaded to a depth of 12- inches, can dewater 2% aerobic activated sludge with no polymer or other chemical dosage to a liftable condition within twenty-four hours. When a polymer is used, the same condition can be achieved within eight hours.

OPTIMUM LAND USE
With the same example, if the system were cycled once every 24 hours, it would result in a *loading rate of up to 454 pounds of dry solids per square foot per year.* Because of this rapid dewatering capability, RSDS-I uses 7% or less of the land required for conventional sandbeds.

CONSERVES ENERGY
Operating and maintenance costs are greatly reduced since only three functions are performed by moving parts. The filtrate pump, vacuum pump and small polymer pump can all be easily monitored from a single control panel. Since the RSDS-I filter does not clog, the beds need only a quick hosing off to be ready for subsequent loads.

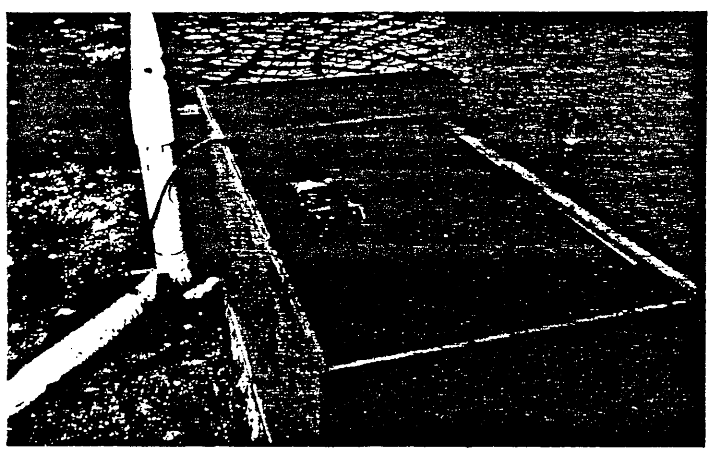
VERSATILE
RSDS-I can be modified to meet particular requirements of space and climate. A typical 20′ × 40′ × 3′ bed can be tiered to conserve land and can be covered for year-round use in colder climates.

Once the filtrate has been drawn out of the sludge, the remaining cake residue can be removed by automated vacuum, conveyor/scraper systems, appropriate front end loader or manually.

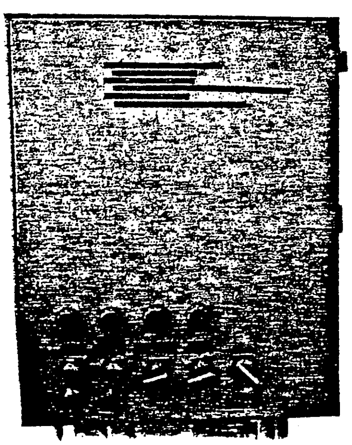
The RSDS-I may be used for thicker anaerobic digested domestic sewer sludge as well.

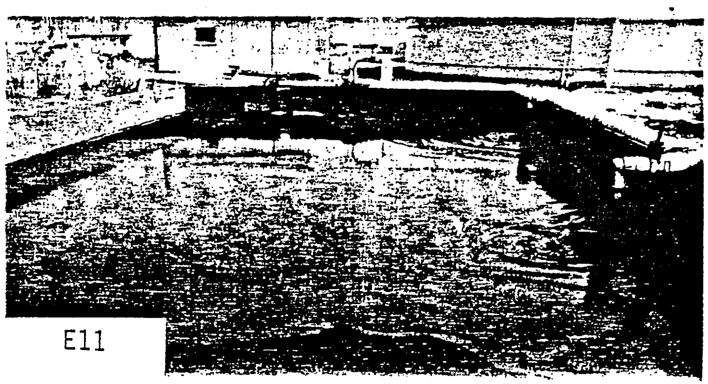
DEMONSTRATION SYSTEM
All U. S. Environmental Products representatives can demonstrate this system at any plant site with a portable test unit.

Small polymer pump adds coagulant just prior to sludge being poured on bed.



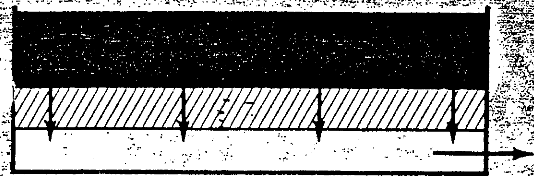
A central control panel operates all equipment for the system.



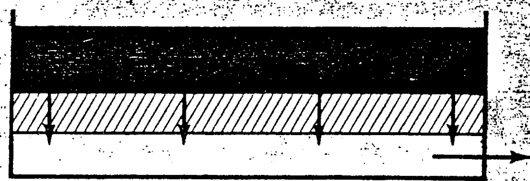


Sludge is then piped on to the bed until filled to a depth of 12 inches.

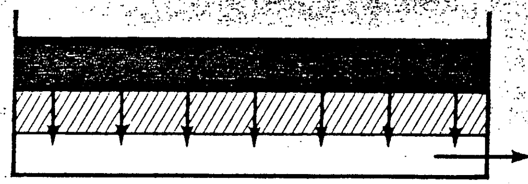
Gravity and vacuum provide **unique double filter**



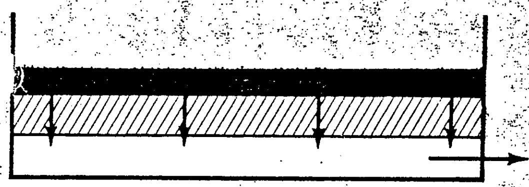
A. Sludge is poured onto the drying bed and the free water begins to drain.



B. Large floc "blinds" media by settling first under gravity as free water continues to drain.

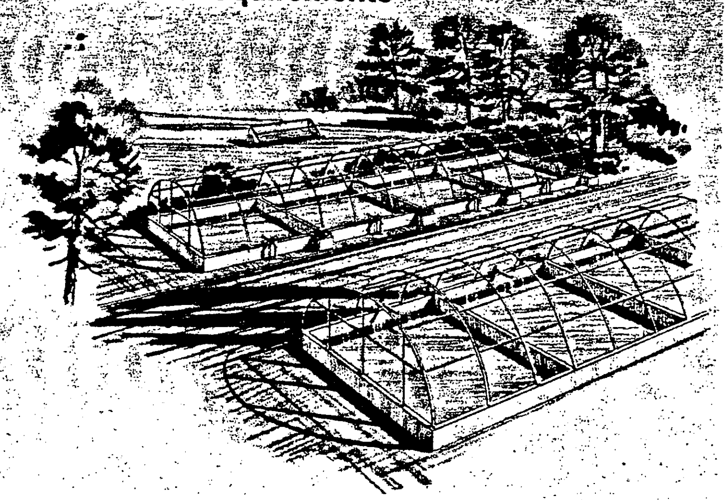


C. "Blind" media traps fine particles, forming a chemical filter on top of filter media as free water now drains under vacuum assist.



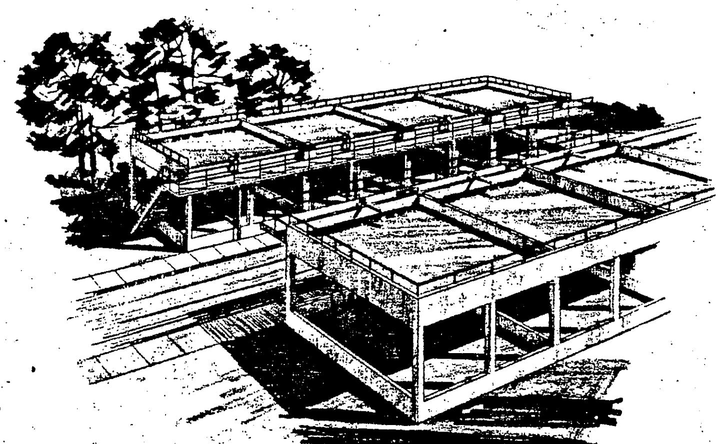
D. The sludge cake dries while water trapped in floc is pulled by vacuum.

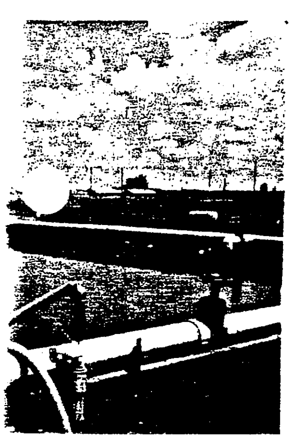
RSDS-I meets climate and **land use requirements**

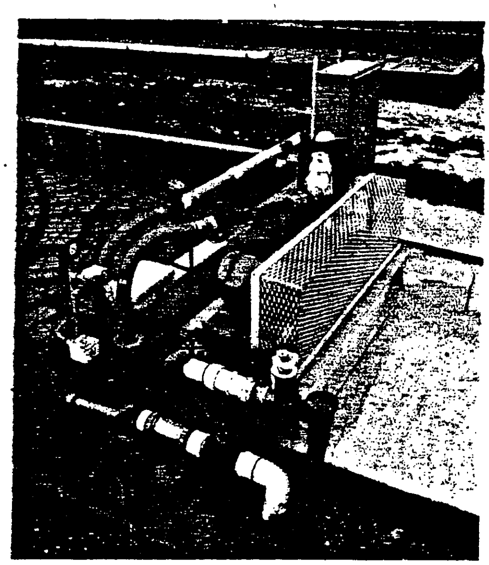


The Rapid Sludge Dewatering System-I can be adapted for use in most all climates. A greenhouse-type cover is utilized in instances where the system would be exposed to adverse weather conditions.

RSDS-I also offers optimum land use through multi-level construction.







The filtrate is returned to the treatment plant for reprocessing.

Once dry, the caked residue can be removed by mechanical loaders, a vacuum system or any number of other methods.

Test units available for on-site demonstration.

What others are saying about the future of Drying Beds.

An objective review of past results and consideration of the developments of the past 5-7 years in modifying the dewatering capacity and improving the mechanical removal capabilities of drying beds must lead to the conclusion that they should be much more widely used than at present.

It seems clear that a judicious combination of the following aspects would in many locations make drying beds the dewatering system of choice:

1. Provision in the bed design for mechanical removal via front end loaders.
2. Provision for conditioning of the sludge on its way into the bed with polyelectrolytes or equivalent as needed.
3. Inclusion in the design of a translucent roof, or a total greenhouse type enclosure with adequate ventilation and odor control systems.
4. Where required for capacity purposes some form of vacuum assistance for increasing the drainage rate and enhancing evaporation where indicated.

If these aspects were included in conceptual designs, the design criteria in terms of square footage of bed area required would be many times less than the figures listed in the Ten State Standards.

As a result of this an overall system evaluation of cost-effectiveness would surely result in more wide-spread use of drying beds than is currently the case.

From "Review of Developments in Dewatering Wastewater Sludges," prepared for U.S. Environmental Protection Agency's Sludge Treatment and Disposal Seminar, March, 1978, Cincinnati, Ohio.

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