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SURVEY OF TECHNIQUES FOR MONITORING SEWAGE SLUDGE CHARGED TO MUNICIPAL SLUDGE INCINERATORS

U.S. ENVIRONMENTAL PROTECTION AGENCY
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SURVEY OF TECHNIQUES FOR MONITORING SEWAGE SLUDGE CHARGED TO MUNICIPAL SLUDGE INCINERATORS

by

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Division of Stationary Source Enforcement

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DISCLAIMER

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1.0 INTRODUCTION

As the quality of wastewater treatment has improved, sludge handling and disposal have become a greater problem. Section 301 of the Federal Water Pollution Control Act of 1972 establishes effluent limitations for both publicly owned and nonpublicly owned wastewater treatment plant discharges. As more and more municipalities upgrade their wastewater facilities in order to comply with the Clean Water Act requirements, the quantity of municipal sludge generated continues to increase. Incineration is rapidly becoming an important means of disposal for these increasing amounts of sludge.

By 1985 it is estimated that nearly 6.7 million tons of dry sludge will be generated annually by municipal wastewater treatment facilities (Ref. 1). Of this amount, approximately 2.3 million tons will be incinerated (Ref. 1). Multiple-hearth and fluid-bed incinerators are typical types used to combust municipal sludges. An advantage of incineration is that it destroys the organic matter present in sludge, leaving only an odorless, sterile ash, while reducing the solid mass input by about 90 percent. The principal disadvantages are that sludge incineration can be a significant source of fine particulate emissions if the units are not equipped with suitable control devices, and residual ash must be disposed of in an environmentally safe manner.

The Environmental Protection Agency has promulgated New Source Performance Standards (NSPS) for new or modified sewage sludge incinerators. Section 60.153 of the NSPS requires the owner or operator of any sludge incinerator to install and operate flow measuring devices that will determine the amount of sludge charged to the incinerator and to provide access to the sludge stream for collecting representative grab samples (Ref. 2). These devices are intended to facilitate the determination of particulate emission rates during incinerator compliance test runs. A more detailed discussion of NSPS requirements is delineated in Section 3.0 of this report.

During the review of an operating permit application for a new municipal sewage sludge incinerator recently constructed in Washington County, Oregon, the Oregon Department of Environmental Quality (DEQ), which has been delegated responsibility for enforcing Federal NSPS, noticed that provisions for monitoring the sludge charged to the furnace had not been included in the plant design. An operating permit cannot be issued until the multihearth unit is retrofitted to comply with NSPS requirements. The incinerator is part of the Federally funded Durham, Oregon, Advanced Wastewater Treatment Facilities expansion designed by Stevens, Thompson, and Runyan, Inc., to serve residents in this Portland, Oregon, suburb.

PEDCo Environmental, Inc., was contracted by the Oregon DEQ through EPA Region X to determine and recommend retrofit requirements necessary for the Durham incinerator to comply with NSPS; specific recommendations and estimated equipment costs are summarized in a separate report.* In conjunction with the retrofit study, PEDCo Environmental was also contracted by the EPA Division of Stationary Source Enforcement to perform a survey of other municipal incinerators in several EPA regions to determine what is being done at these installations to conform with NSPS requirements. The intent of the survey is to develop technical and cost information on sludge monitoring systems meeting NSPS requirements for use as a data base to guide regional offices and state agencies in their consideration in reviewing the adequacy of facility designs and stipulating installation of such devices where provisions for acceptable monitoring devices are inadequate. This report summarizes the results of that survey.

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* Retrofit Recommendations for the Durham, Oregon Incinerator(s) Required for NSPS Compliance. Contract Report No. 68-02-1375, Task No. 31. Environmental Protection Agency. Research Triangle Park, North Carolina. June 1977.

2.0 SCOPE OF THE SURVEY

PEDCo Environmental completed the following tasks as part of its survey:

1. Visited several municipal sludge incinerators either recently completed or under construction after the effective date of NSPS. On-site inspections were made of techniques, controls, and equipment utilized to monitor incinerator sludge feed rates in compliance with NSPS. Engineering drawings, manufacturers' specifications, and plant layouts were reviewed to determine the guidelines used for incinerator design.

2. Contacted various manufacturers of incinerators, solids/liquid separators, conveyors, and weigh-scale devices for information regarding alternatives for monitoring sludge.

3. Compiled capital cost estimates for various sludge monitoring alternatives.

4. Prepared a summary report based on the completion of the above tasks.

The tasks which PEDCo Environmental completed specific to the Durham incinerator are listed below, but are summarized in a separate report (see footnote on p. 1-2):

1. Conducted a detailed, in-depth review of engineering drawings, overall site layouts, and equipment specifications for the unique Durham incinerator operation and its associated network of screw-conveyor-feed systems.

2. Visited the Durham site to review the layout and construction of the incinerators.

3. Compiled a list of alternative recommendations and capital cost estimates for flow-monitoring and grab-sampling the four individual feedstreams to the Durham incinerator.

4. Completed a summary report for the Oregon DEQ describing the results of the above three tasks to provide technical assistance in establishing retrofit requirements for NSPS compliance before a permit to operate is granted.

3.0 NEW SOURCE PERFORMANCE STANDARDS FOR SEWAGE TREATMENT PLANTS

Federal New Source Performance Standards for sewage treatment plants were promulgated by the EPA on March 8, 1974. These regulations (39 FR 47) were amended into the General Provisions for New Source Performance Standards (40 CFR 60) and apply to any sewage sludge incinerator whose construction or modification began after June 11, 1973. Appendix A delineates fully the NSPS requirements pertinent to sewage sludge incinerators.

Subpart O of the NSPS for sewage treatment plant sludge incineration outlines guideline provisions for:

- ° Standards for particulate matter (Section 60.152)
- ° Monitoring of operation (Section 60.153)
- ° Test methods and procedures (Section 60.154)

In particular, Section 60.153 deals with the requirements of monitoring and sampling sludge feed to an incinerator. This section states that:

(a) The owner or operator of any sludge incinerator subject to the provisions of this subpart shall:

1. Install, calibrate, maintain, and operate a flow measuring device which can be used to determine either the mass or volume of sludge charged to the incinerator. The flow measuring device shall have an accuracy of ±5 percent over its operating range.

2. Provide access to the sludge charged so that a well-mixed representative grab sample of the sludge can be obtained.

3.1 INTERPRETATION OF NSPS SECTION 60.153 FOR DURHAM FACILITY

The Durham facility includes two multihearth sludge incinerators manufactured by the Nichols Company. One is being set up as a lime sludge incinerator for the recovery or recalcination of spent lime used in a tertiary wastewater treatment process for phosphate removal. The other will be used to dispose of the following feedstreams that feed the unit at four different points:

- Organic sludge centrifuge cake
- Waste lime sludge (lime not fit for recalcining)
- Scum (and oil)
- Grit

Figure 1 is a flowsheet representation of the generation and subsequent incineration of various sludges at the Durham facility.

The two incinerator units are nearly identical, with a series of interconnecting screw conveyors between them to permit lime recalcination or sludge disposal in either or both furnaces if circumstances require. Because of the complexity of the Durham design, it is difficult to discern what constitutes an acceptable monitoring program for four different feedstreams. The EPA Project Officer reviewed the applicability of Section 60.153 (NSPS) to the Durham facility with EPA's Compliance Monitoring Branch (Division of Stationary Source Enforcement). The following summarizes the pertinent aspects covered (Ref. 3):

1. NSPS covers grit, scum, and waste lime sludge burned in the incinerator along with the sewage sludge cake; provisions must be made for monitoring and sampling individually each input to the furnace.

2. Incinerators used solely for lime recalcination are not covered under NSPS; however, nonrecoverable waste lime sludge disposed of in a sewage sludge incinerator is covered.

3. The purpose of the monitoring device is to measure sludge input to the incinerator during a compliance test run. Installation of a continuous monitoring device is not required, nor is continuous recordkeeping or continuous recording of the measurement data required.

With the above interpretations regarding the Durham facility, we directed our survey towards discerning the complexity of other municipal sludge incinerator designs, and learning how each was operating (or not operating) to conform with Section 60.153 of NSPS.

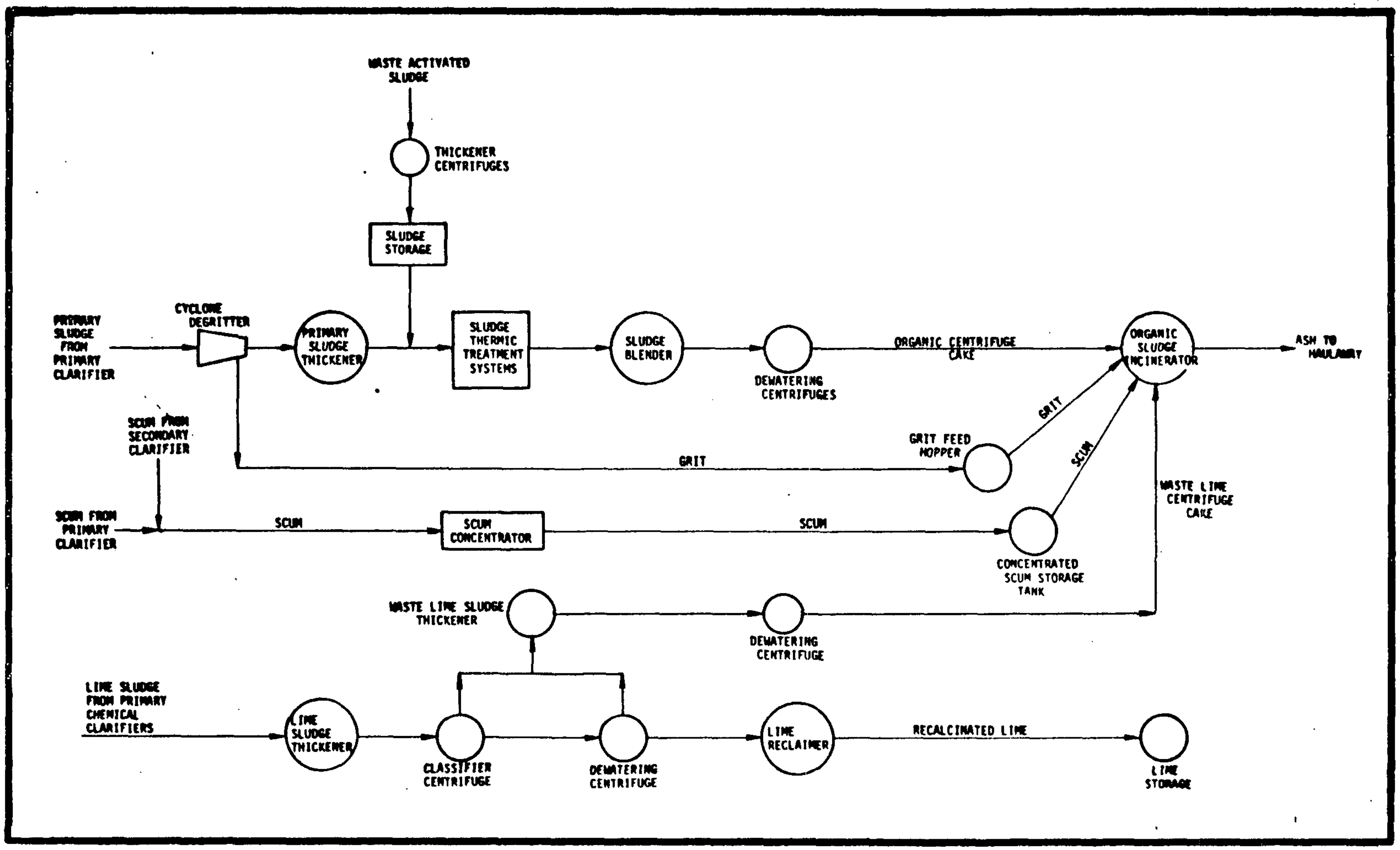


Figure 1. Flowsheet representation of sludge generation and incineration at the Durham Wastewater Treatment Plant.

4.0 SURVEY OF WASTEWATER TREATMENT PLANTS

An extensive survey of 21 wastewater treatment facilities encompassing six U.S. EPA regions and one province in Canada was conducted. A breakout of the plants surveyed is shown in Table 1, and Figure 2 shows distribution of the plants.

Table 1. BREAKOUT OF MUNICIPAL WASTEWATER TREATMENT PLANTS SURVEYED

EPA Region	Number of facilities surveyed
III	3
IV	6
V	5
VII	2
IX	1
X	3[a]
Canada	
Chilliwack, British Columbia	1[b]

[a] This breakout does not include the Durham WTP in Washington County, Oregon.

[b] Surveyed because of its unique capability of feed control and monitoring sludge cake to a multihearth incinerator using a Moyno pump.

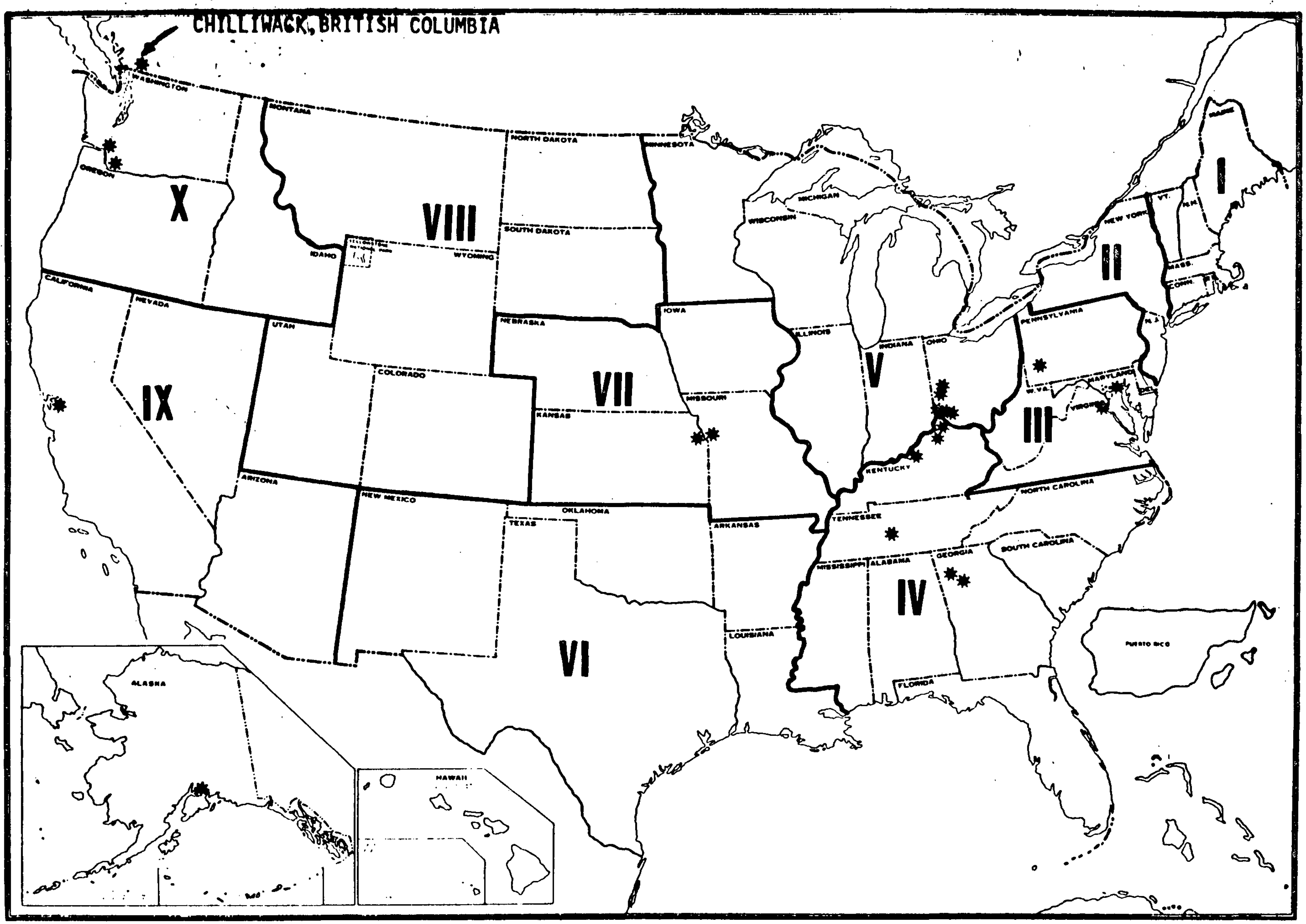


Figure 2. Distribution of wastewater treatment plants surveyed.

The plants surveyed represent candidates from several EPA regions and provide a sectional appraisal of conformance with NSPS requirements. At the onset of the project, some incinerators were included because of their proximity to PEDCo offices and because previous contacts had been established. Information from EPA Regional Office Enforcement Division personnel, recommendations from equipment manufacturers, and previous associations proved useful for generating a list of potential candidates.

Plant personnel from the respective sewerage agencies were contacted to arrange for mutually acceptable times for a visit. Enforcement division personnel from DSSE regional offices were notified of the pending visits and given the option to participate. Usually the visits produced a full sharing of information and access was readily given to engineering drawings and specifications of the plant incinerator design and operation. In only one instance did a sanitary engineering design firm and their local sewerage agency client show reluctance to allow us to extract technical data from the plant specifications or refer in any detail to their engineering design materials.

4.1 RESULTS AND RECOMMENDATIONS

A summary of the pertinent information obtained for each of the treatment facilities visited appears in Table 2; Appendix C contains more detailed information for the individual plants.

Of the 21 wastewater treatment plants surveyed, 14 had some type of sludge-monitoring device or technique. The weightometer belt scale was the most commonly used monitoring device when a belt conveyor was utilized to transport the sludge to the furnace (10 of 14 plants); a nuclear weigh scale unit (C-Frame type) was used in two plants, a vibrametric weigh-belt feeder in one plant, and a nuclear density meter in one plant. A more detailed discussion of these devices and material-balance techniques is summarized in Section 5.4. The wastewater plants that have no sludge monitoring devices or control techniques are summarized in Table 3.

Table 2. SUMMARY RESULTS OF WASTEWATER TREATMENT PLANT SURVEY

Wastewater treatment plant	EPA Region	Incinerator type	Conveyor type	Sludge feed monitoring device	Representative grab samples taken	Comments
1. Kiski Valley WPCA Appollo, Pennsylvania	III	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
2. Parkway STP Laurel, Maryland	III	Fluid-bed	Enclosed pipe	None	Yes; from discharge of incinerator feed pump	Feed rate to incinerator is determined by a material balance calculation around the centrifuge
3. Lower Potomac WWTP Lorton, Virginia	III	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
4. Snapfinger Creek WWTP Decatur, Georgia	IV	Multihearth	Belt conveyor	None	Yes; directly from belt conveyor	
5. R.M. Clayton WPCP Atlanta, Georgia	IV	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
6. Central WWTP Nashville, Tennessee	IV	Multihearth	Belt conveyor	Nuclear weigh scale (C-Frame type)	Yes; directly from belt conveyor	
7. Bromley WWTP Bromley, Kentucky	IV	Multihearth	Belt conveyor	None	Yes; directly from belt conveyor	Plant scheduled to be phased out in 1977
8. Dry Creek WWTP Constance, Kentucky	IV	Multihearth	Belt conveyor that feeds a screw conveyor	Vibrametric weigh-belt feeder	Yes; from feed hopper to vibrametric weigh-belt feeder	
9. Morris Forman WWTP Louisville, Kentucky	IV	Multihearth	Belt conveyor	Nuclear weigh scale (C-Frame type)	Yes; directly from belt conveyor	
10. Mill Creek WWTP Cincinnati, Ohio	V	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
11. Muddy Creek WWTP Cincinnati, Ohio	V	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	

Table 2 (continued). SUMMARY RESULTS OF WASTEWATER TREATMENT PLANT SURVEY

Wastewater treatment plant	EPA Region	Incinerator type	Conveyor type	Sludge feed monitoring device	Representative grab samples taken	Comments
12. Little Miami WWTP Cincinnati, Ohio	V	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	These units will be scrapped under new expansion plans for the existing facility. New design will utilize belt conveyors feeding a system of screw conveyors; a weightometer belt scale will also be used
13. Middletown WWTP Middletown, Ohio	V	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
14. Franklin Solid Waste Recycling Plant Franklin, Ohio	V	Fluid-bed	Screw conveyor	None	Yes; from sludge surge tank sample valve	Feed rate is controlled by throttling the pumping rate from the surge tank
15. Big Blue River WWTP Kansas City, Missouri	VII	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
16. Mission-Main WWTP Mission, Kansas	VII	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
17. Palo Alto WQCP Palo Alto, California	IX	Multihearth	Screw conveyor	Nuclear density meter	Yes; via a trap door in the screw conveyor housing	Actual feed rate to incinerator is determined by a material balance calculation around the centrifuge
18. City of Vancouver Westside Plant Vancouver, Washington	X	Multihearth	Belt conveyor	None	Yes; directly from belt conveyor	
19. Cowlitz County WWTP Longview, Washington	X	Multihearth	Belt conveyor	Weightometer belt scale	Yes; directly from belt conveyor	
20. Point Woronzof WWTP Anchorage, Alaska	X	Multihearth	Belt conveyor	None	Yes; direct from belt conveyor	
21. Chilliwack STP Chilliwack, British Columbia, Canada	Not Applicable	Multihearth	Enclosed pipe	None	Yes; trap door in down chute feeding centrifuge cake to Moyno pumps	Feed rate to incinerator is determined by a material balance calculation around the centrifuge.

Table 3. SUMMARY OF WASTEWATER TREATMENT PLANTS

NOT HAVING SLUDGE-MONITORING FEED DEVICES

Wastewater treatment plant	Comments
1. Parkway STP Laurel, Maryland	Utilized a material balance calculation around the centrifuge.
2. Snapfinger Creek WTP Decatur, Georgia	Should be no problem adding a weightometer scale to satisfy compliance requirements; grab samples could easily be taken.
3. Bromley WWTP Bromley, Kentucky	Plant to be phased out in 1977.
4. Franklin Solid Waste Recycling Plant Franklin, Ohio	
5. City of Vancouver Westside Plant Vancouver, Washington	Should be no problem adding a weightometer scale to satisfy compliance requirements; grab samples could easily be taken.
6. Point Woronzof WWTP Anchorage, Alaska	
7. Chilliwack STP[a] Chilliwack, British Columbia (Canada)	Utilized a material balance calculation around the centrifuge.

[a] Under Canadian legislation.

On the basis of this survey, several conclusions can be drawn regarding techniques for monitoring sewage sludge to municipal incinerators:

- In most designs NSPS compliance for municipal sludge incinerators is not a problem.

- The Durham WTP incinerator with its four distinct feedstreams and series of interconnecting screw conveyors is uniquely complex.

- Most incinerators have only one common feedpoint or inlet; most commonly, grit is landfilled and scum is combined with other sludges in an anaerobic digestion step prior to dewatering.

- None of the incinerators surveyed was combusting waste-lime sludge.

- When the solids/liquid separation was effected by a rotary (or straight-line) vacuum filter, a belt conveyor was used to feed the resultant sludge to the incinerator. For this type of operation, a weightometer belt scale was normally used to monitor sludge feed rates, and grab samples were easily taken.

- When the solids/liquid separation was effected by a centrifuge, a screw conveyor was used to feed the resultant sludge to the incinerator. The sludge feed to the incinerator was usually monitored by coupling a magnetic-flowmeter and a nuclear density meter on the inlet to the centrifuge and subsequently performing a material-balance calculation around the centrifuge. Grab samples were taken through trapdoors in the screw conveyor housing at points near the incinerator feed inlet.

- Feed to fluid-bed incinerators is most often through an enclosed pipe; feed rate monitoring and sludge sampling are conducted either at a sludge surge tank or from a material-balance calculation around a centrifuge if the plant has one.

- In some instances, specially designed Moyno sludge pumps can be controlled at fixed speeds to feed a sludge cake (25 to 45 percent solids) to a sludge incinerator.

- Nuclear weigh scales (C-Frame type) are adaptable to belt and screw conveyors to monitor sludge feed to incinerator units.

- Output from weightometer belt scales, magnetic-flowmeters, nuclear density meters, nuclear weigh scales (C-Frame type), vibrametric weigh-belt feeders, or Moyno pumps can be displayed in digital (totalizer) or graphical form on the incinerator control panels.

5.0 TYPICAL WASTEWATER TREATMENT PLANT EQUIPMENT

This section describes the types of wastewater treatment equipment commonly utilized to separate, convey, and ultimately combust municipal sewage sludge. The latter part deals with the various sludge monitoring devices and techniques available, based on the 21 plant survey.

5.1 SOLIDS/LIQUID SEPARATORS

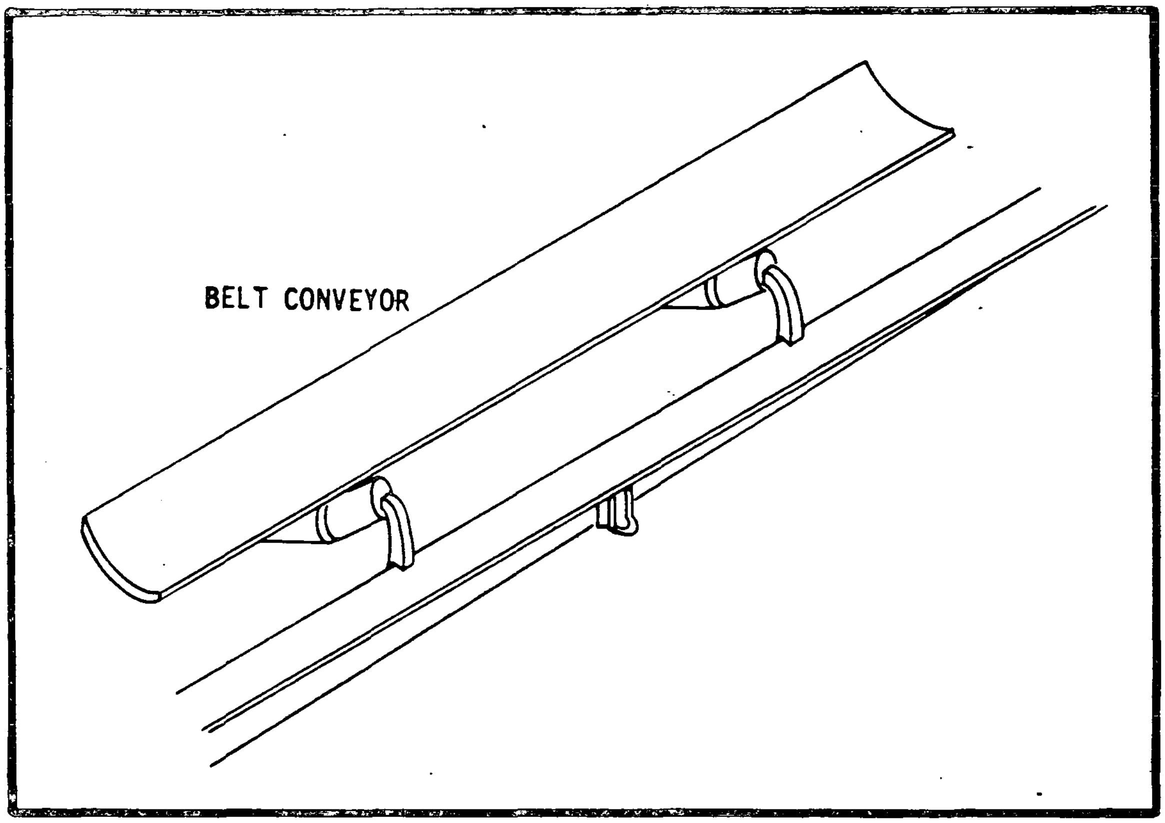
The most common types of solid/liquid separators used to dewater wastewater sludge streams are rotary vacuum filters or centrifuges. Of the 21 wastewater treatment plants surveyed, 17 used a rotary vacuum filter (or similar vacuum filter, e.g. straight-line), and 4 used centrifuges. Appendix B-1 summarizes some of the major manufacturers and locations of rotary vacuum and centrifuge equipment suppliers.

Vacuum filtration, particularly rotary-type, is probably the most widely used method of dewatering sludge (Ref. 4). Essentially, vacuum filtration reduces the water content of sludge, whether raw, digested, or elutriated, so that the proportion of solids increases from the 5 to 10 percent range to about 30 percent. The filtration process is continuous, with the solids being separated out on the surface of cylindrical (rotary) drum filters. These drums have surface areas of from 50 to more than 300 ft^2 and are equipped with various types of filtering media: cotton, wool, nylon, dacron, other synthetics, coil springs, or a wire-mesh fabric. As the drum rotates in a circular direction through a vat of sludge, a vacuum pulls the sludge to the filter media. The vacuum then pulls a liquid filtrate through the media and the sludge is adsorbed onto the media, then scraped off the drum with a stationary knife edge. As the sludge cake falls off the drum, it usually drops to a belt conveyor system feeding the incinerator. The filtrate is returned to the plant for further treatment.

In recent years, solid-bowl continuous centrifuges have been used with some success to dewater municipal wastewater treatment plant sludges. Sludge feeds the solid-bowl centrifuge and separates into a dense cake and a liquid, recyclable stream called the centrate. Typically, the solids content increases from 5 to 10 percent up to 15 to 40 percent, depending upon the sludge feed characteristics. The sludge cake from the centrifuge exits through a chute that usually intersects an enclosed screw conveyor feeding the incinerator; sometimes the sludge cake is fed to a Moyno pump, where it is pumped through an enclosed pipe to feed the incinerator. Centrifuges require less floorspace, have lower initial capital costs, and are simple, clean, and inexpensive to operate in contrast to rotary vacuum filters (Ref. 4). Disadvantages are noise, vibrational effects, higher power costs, and the need for disposal or recycle of the high suspended-solids centrate liquid.

5.2 CONVEYORS

Belt-type or screw-type conveyor systems are the most common ones used to feed sludge cake to incinerators. Figure 3 shows a schematic representation of these two types of conveyor systems. Of the 21 wastewater treatment plants surveyed, 17 used belt conveyors, 2 used enclosed screw conveyors, and 2 used an enclosed pipe through which the sludge was transported using a Moyno pump system. Belt conveyors provide easy access to take representative grab samples; the enclosed screw conveyors or pipes must incorporate trapdoors to provide access for sludge sampling. In most cases, belt conveyors are used in conjunction with rotary vacuum filters. Appendix B-2 summarizes the major manufacturers of belt-type and screw-type conveyors.



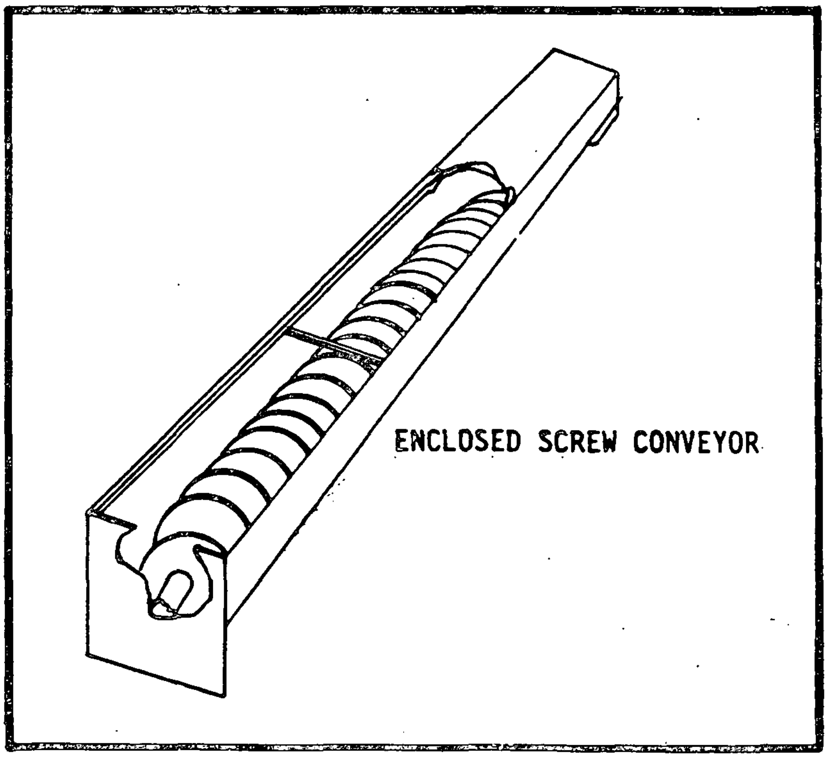


Figure 3. Schematic representation of belt-type and enclosed screw-type sludge conveyors.

5.3 INCINERATORS

Multihearth or fluid-bed incinerators are the most prevalent types used to combust dewatered municipal sewage sludges. Table 4 summarizes pertinent information on incinerator types, material incinerated, and incinerator manufacturers for the 21 wastewater treatment plants surveyed. Nineteen plants used multihearth incinerators; two used the fluid-bed type. Appendix B-3 summarizes some of the major manufacturers of multihearth and fluid-bed incinerators.

Traditionally, the multihearth sludge incinerator has been used most often to combust dewatered sludge. Figure 4 shows a schematic drawing of a multihearth sludge incinerator (Ref. 5). The unit operates in a countercurrent manner; heated air and products of combustion pass by sludge, which is continually raked to expose fresh surfaces, as it falls from the top hearth downward (See arrows on right side of Figure 4 for sludge pathway). Temperatures in the multihearth furnace (about 1400 to 1600°F) are highest in the middle hearths, where the sludge is actually combusted and auxiliary fuel is added to warm the furnace or to sustain combustion. At the top hearths, moisture is evaporated from the input sludge at about 1000 to 1200°F; the bottom or ash hearth cools the exit ash to about 600°F. In most units, there is a single feedpoint where sludge, grit, or scum are introduced together; in more complex designs, however, grit or scum are introduced to the middle hearths through separate entry points. This permits more efficient combustion since grit or scum have higher Btu values and lower moisture content than sludge cake.

In fluidized-bed incinerators, combustion occurs in a hot, suspended bed of sand, with much of the ash residue being swept out with the flue gas. Figure 5 shows a schematic representation of a fluidized-bed sludge incinerator (Ref. 5). A fluid-bed reactor provides a suitable environment for sludge combustion. An inert material such as silica sand is the fluid bed solids material, and air from a fluidizing

Table 4. PERTINENT INFORMATION SUMMARY ON MUNICIPAL SLUDGE INCINERATORS SURVEYED

Plant	Incinerator type	Material incinerated	Incinerator manufacturer
1. Kiski Valley WWTP	Multihearth	Sludge	Envirotech-BSP
2. Parkway STP	Fluid-bed	Sludge	Copeland Systems
3. Lower Potomac WWTP	Multihearth	Sludge	Nichols-Herreshoff
4. Snapfinger Creek WWTP	Multihearth	Sludge	Envirotech-BSP
5. R.M. Clayton WPCP	Multihearth	Sludge	Envirotech-BSP
6. Central WWTP	Multihearth	Sludge	Nichols-Herreshoff
7. Bromley WWTP	Multihearth	Sludge	Nichols-Herreshoff
8. Dry Creek WWTP	Multihearth	Sludge	Nichols-Herreshoff or Envirotech-BSP
9. Morris Forman WWTP	Multihearth	Sludge	Nichols-Herreshoff
10. Mill Creek WWTP	Multihearth	Sludge	Nichols-Herreshoff
11. Muddy Creek WWTP	Multihearth	Sludge	Envirotech-BSP
12. Little Miami WWTP	Multihearth	Sludge	Nichols-Herreshoff
13. Middletown WWTP	Multihearth	Sludge	Envirotech-BSP
14. Franklin Solid Waste Plant	Fluid-bed	Sludge/Refuse/ Liquid industrial waste	Dorr-Oliver
15. Big Blue River WWTP	Multihearth	Sludge	Nichols-Herreshoff
16. Mission-Main WWTP	Multihearth	Sludge	Eimco-BSP
17. Palo Alto WQCP	Multihearth	Sludge	Envirotech-BSP
18. Vancouver WWTP	Multihearth	Sludge	Denver Mine & Smelting
19. Cowlitz County WWTP	Multihearth	Sludge	Envirotech-BSP
20. Point Woronzof	Multihearth	Sludge	Envirotech-BSP
21. Chilliwack STP	Multihearth	Sludge	Denver Mine & Smelting

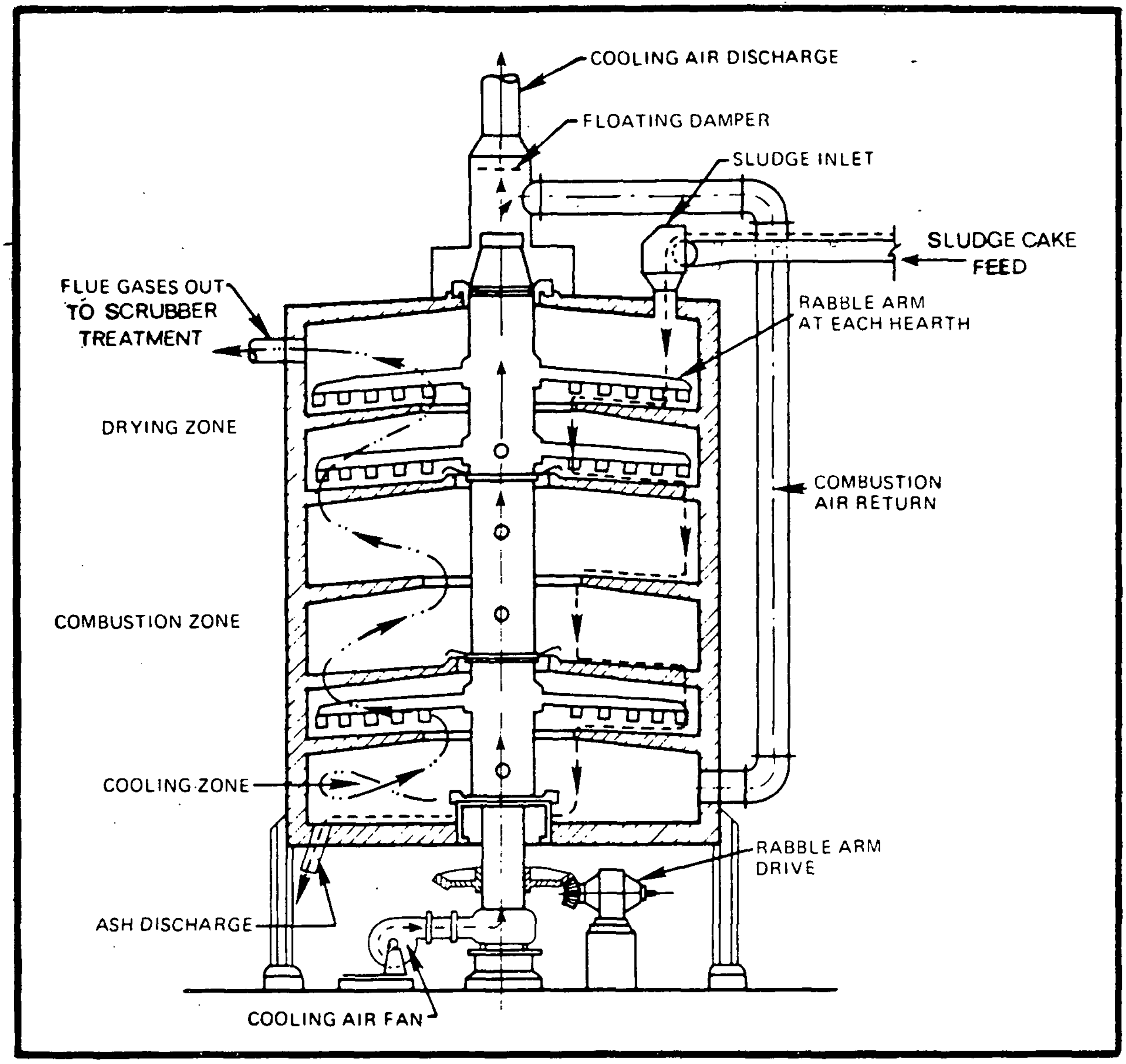


Figure 4. Schematic representation of a multihearth sludge incinerator unit.

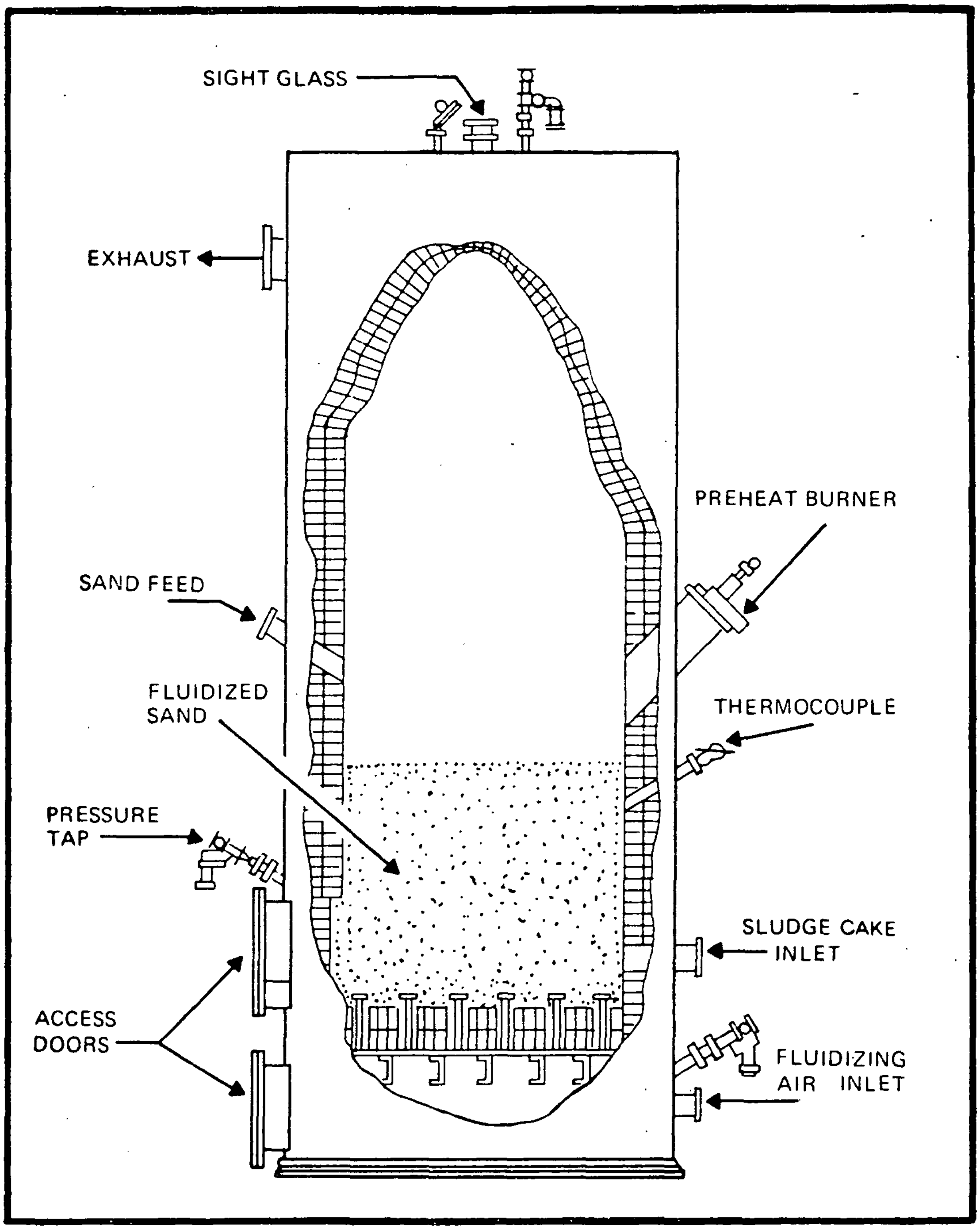


Figure 5. Schematic representation of a fluidized-bed sludge incinerator unit.

blower serves as the fluidizing gas medium. Dewatered sludge feeds the reactor either in or onto the sand bed, where it becomes rapidly and thoroughly mixed with the fluid bed by the boiling, mixing action of the bed itself. This action promotes rapid evaporation of sludge water, and combustion then occurs by reaction with the oxygen from the fluidizing air stream. All this occurs at temperatures of 1200 to 1500°F with but a minimum of excess oxygen required, because of the turbulent action of the bed. As more wastewater treatment expansion programs are undertaken and amounts of sludge needing to be incinerated increase accordingly, fluid-bed reactors are being used more frequently to combust biological sludges.

5.4 SLUDGE FEED MONITORING DEVICES AND TECHNIQUES

This section discusses types of equipment used to monitor sludge feed rates to incinerator units. Table 5 summarizes the various types and costs of sludge-monitoring equipment found in use from the 21-plant survey. Certain material-balance techniques are also used to determine sludge feed rates to an incinerator, particularly for a centrifuge dewatering step. These are summarized in Section 5.4.6. Various calibration techniques are available for each feed monitoring device. These procedures are typically supplied by the manufacturers of the equipment. Appendix B-4 summarizes major manufacturers and locations of the sludge-monitoring-device equipment suppliers.

5.4.1 Weightometer Belt Scales

The weightometer belt scale is designed to weigh moving loads continuously by mechanically multiplying the varying load on the conveyor belt (lb/ft) and the speed of the conveyor belt (ft/min) and displaying the successive product (lb/min or lb/hr) on a digital or recorder printout on the incinerator instrument panel (Ref. 6). The pounds-per-foot material load passing over the weigh platform is instantaneously and continuously counterbalanced by a pendulum beam. The deflection of the beam is proportional to the material load passing over the weigh platform at any one time. A totalizer that sums successive

Table 5. PERTINENT INFORMATION SUMMARY FOR VARIOUS TYPES OF SLUDGE-FEED-RATE MONITORING EQUIPMENT

Equipment type[a]	Suitability to type of conveyor or other	Accuracy of feedrate measurement, ± percent[b]	Estimated capital costs, $[c,d]
1. Weightometer belt scale	Belt-type	0.5 to 2	5,000 to 5,500 (includes linearizer, multiplier, totalizer, integrator, and recorder)
2. Vibrametric weigh-belt feeder	Screw-type	0.25 to 0.5	12,000 (includes totalizer and recorder)
3. Nuclear weigh scale (C-frame type)	Belt or screw-type	0.5	6,000 (includes linearizer, multiplier, totalizer, counter, cabinet, tachometer, and MA output)
4. Nuclear density gauge with magnetic flow meter	Enclosed pipe	1 to 2	8,000 to 10,000
5. Moyno pump	Screw conveyor or enclosed pipe	By material balance calculations	5,500

[a] Different models or suppliers are available for each type of sludge-monitoring equipment; presented here are data for representative applications and model types.

[b] Accuracy can vary with different applications and should be confirmed by experimental analysis with actual material feedstreams to be monitored.

[c] Costs are, f.o.b. point of origin, October 1976 basis, and do not include installation and associated labor costs. Installation costs can typically range from 5 to 10% of the capital costs based on discussions with the manufacturer. Costs can vary with respect to belt or screw conveyor sizing, pitch, pipe diameter, and with different weighing applications.

[d] Costs as supplied by the manufacturer are ±10%.

pounds (or tons) being fed to the incinerator is sometimes mounted near the weightometer. The difference of totalizer readings at the beginning and the end of a 24-hour period gives the total daily pounds (or tons) being fed to the incinerator.

The weightometer unit must be installed at a point on the conveyor where the belt's lifting effects off the weighing-device sensing mechanisms are minimal. Figure 6 shows a schematic representation of the key sensing elements - belt travel pulser and load cell - associated with a weightometer operation (Ref. 7). Accuracy of the weightometer belt scale, which is used only in conjunction with a belt conveyor, is ±0.5 to 2 percent. Of the 21 wastewater plants surveyed, 10 had weightometers, and 2 could easily add them if required.

5.4.2 Vibrametric or Other Weigh-Belt Feeder

The vibrametric weigh-belt feeder contains its own conveyor system as part of the equipment package. Figure 7 is a schematic representation of the operation of the vibrametric weigh-belt feeder (Ref. 8); Figure 8 shows an alternative type unit, which operates similarly and provides a digital readout (Ref. 9). In principle, a continuous ribbon of sludge is laid upon an internal conveyor belt driven by a variable-speed motor. A combination load cell senses the weight displaced on the belt at any given time, and a tachometer records a velocity figure for the conveyor belt speed. The integration of these numbers through a multiplier function establishes a feed rate in pounds per hour that can be displayed or recorded. A totalizer or summation quantity can also be displayed as the accumulated amount of material already delivered to the incinerator operation. The vibrametric type unit (Figure 7) features a feed-bin attachment with a vibrating nozzle for controlling the gravity feed of sludge to the internal conveyor.

The weigh-belt feeders have a scale accuracy of ±0.25 to 0.5 percent. Since each unit has its own conveyor system, it can be interconnected as part of an existing screw-conveyor system or a belt con-

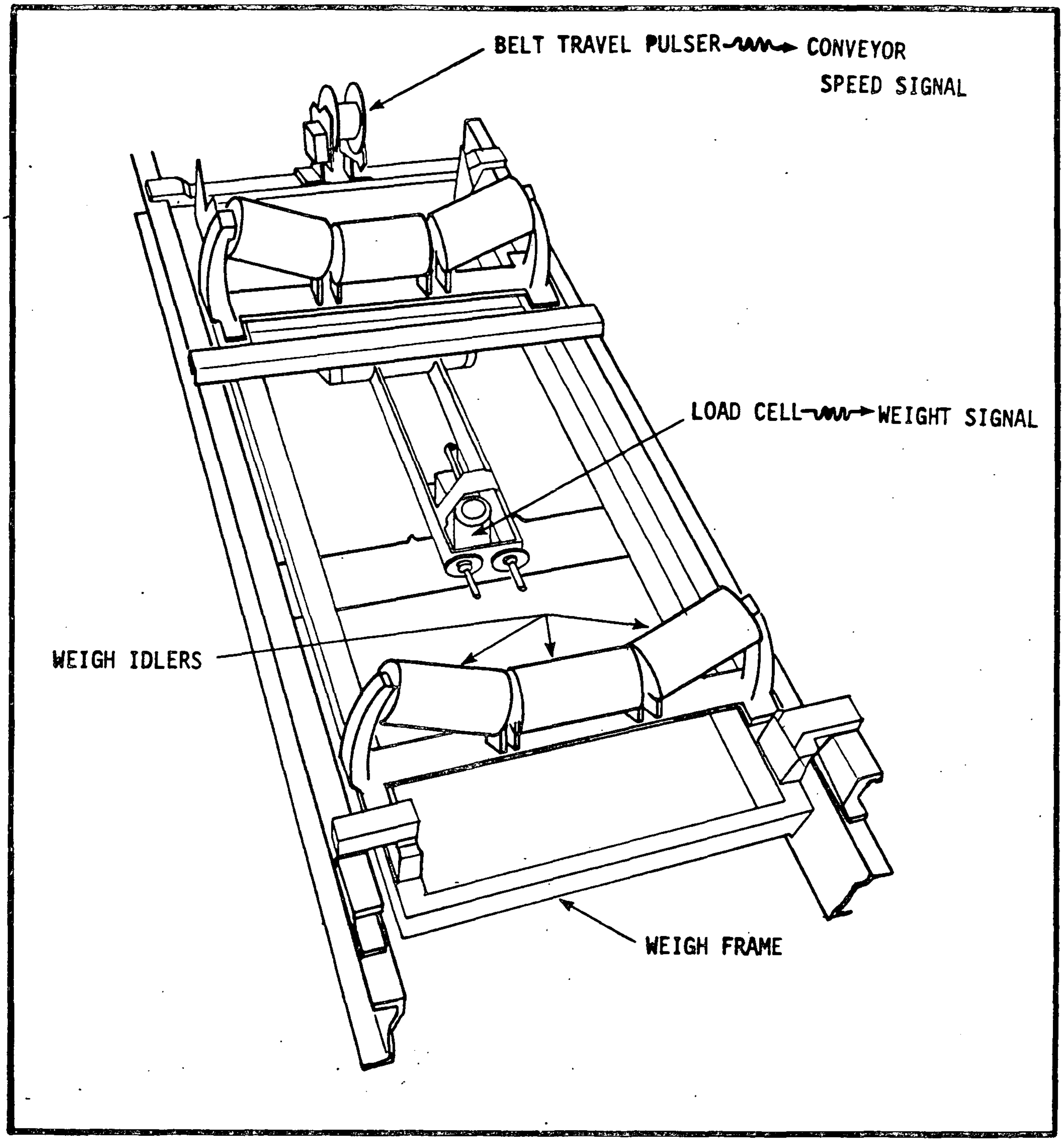


Figure 6. Sensing elements for weightometer belt scale operation.

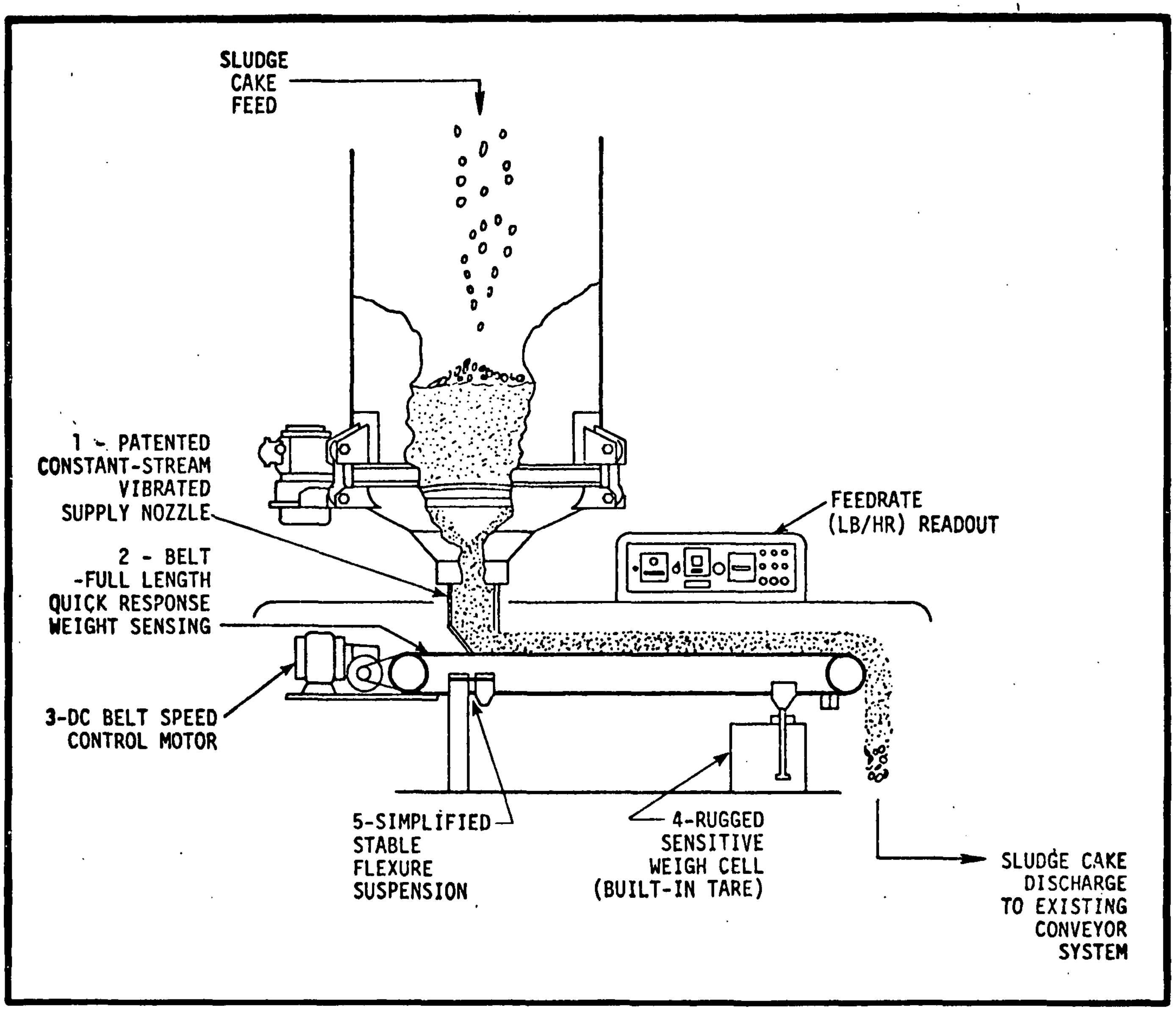


Figure 7. Schematic representation of a vibrametric weigh-belt feeder.

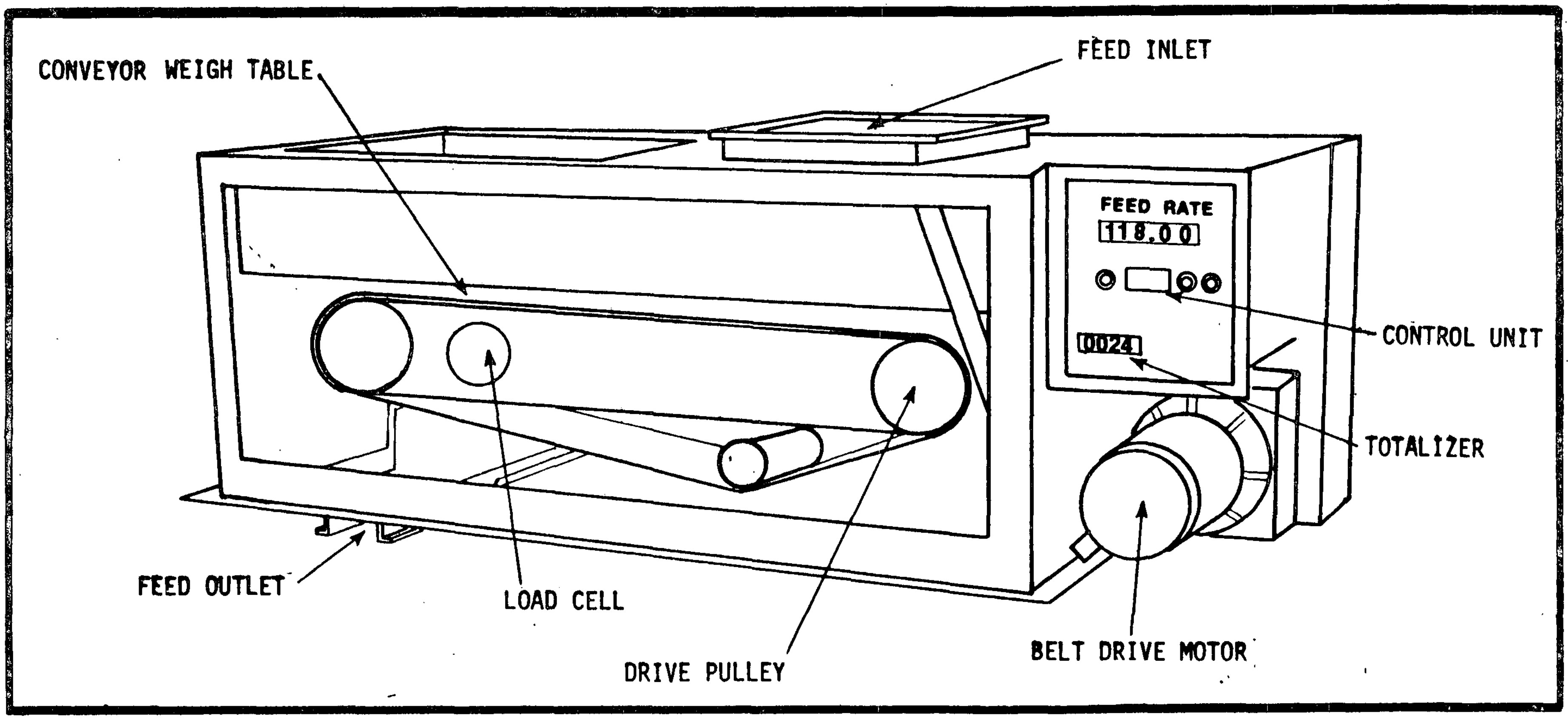


Figure 8. Schematic representation of digital readout weigh-belt feeder.

veyor system if desired. The Dry Creek WTP - part of the 21 plant survey - uses a vibrametric weigh-belt feeder to monitor the sludge feed coming off a belt conveyor before the sludge is dumped into a screw conveyor system that actually feeds the incinerator.

5.4.3 Nuclear Weigh-Scale (C-Frame Type)

The nuclear weigh-scale device utilizes nuclear radiation absorption to measure conveyor belt loading; this, in combination with a tachometer reading of conveyor speed, is translated into a delivered feed rate calculation (e.g. lb/hr). The principle of measurement involves placement of a gamma radiation source (Cesium 137) on one side of the material to be measured, and a measuring cell that converts radioactive energy into electrical current on the other side. As the thickness of the feed material varies, the amount of radiation transmitted will be altered and detected as a change in electrical current. This current variation indicates a change in material thickness proportional to the amount of material weight per unit conveyor length. When this value is combined with a tachometer reading of conveyor speed, the output is a mass feed rate (e.g. lb/hr). Figure 9 shows a schematic drawing of a C-Frame device monitoring sludge feed to an incinerator from a belt conveyor (Ref. 10,11).

The C-Frame weigh-scales are accurate to $\pm$0.5 percent, depending on the application. Two of the 21 plants surveyed were using these devices for belt-conveyor sludge-rate monitoring as shown in Figure 9. The C-Frame weigh-scales are adaptable not only to belt conveyors, but also to screw conveyors, vibrating conveyors, drag-chain conveyors, etc. The use of these C-Frame units to monitor sludge or grit in enclosed screw conveyors has not yet been demonstrated; however, feasibility is likely if a manufacturer's pilot plant test run of representative feed material samples proves satisfactory (Ref. 10,11). Overall, the C-Frame unit takes up little space and is easy to install and calibrate. There is no problem with contaminating radioactivity escaping, and most states will grant permit licenses when this type of unit is used.

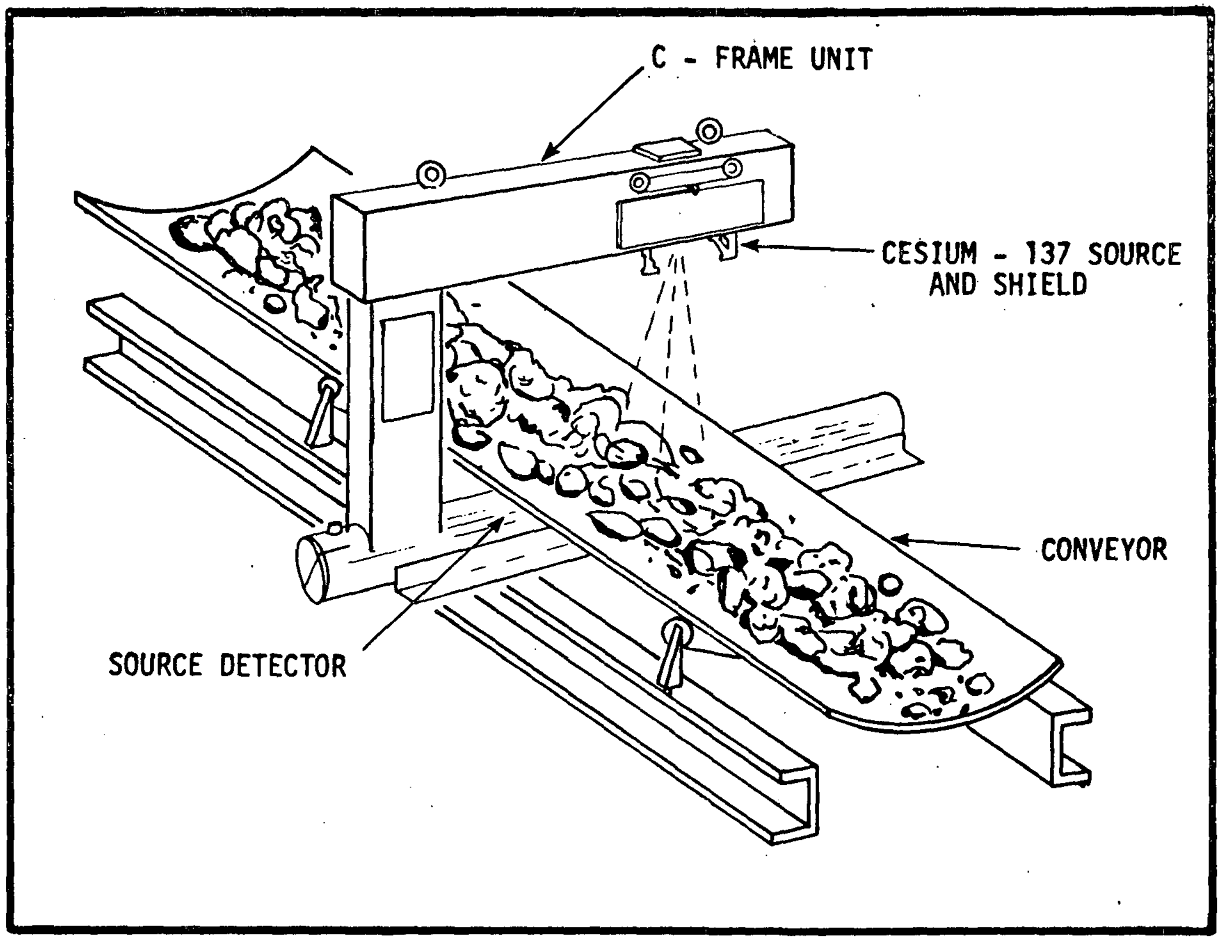


Figure 9. C-Frame nuclear weigh-scale application for monitoring sludge fed to an incinerator by a belt conveyor system.

5.4.4. Nuclear Density Gauge With Magnetic Flow-Meter

The nuclear density gauge is quite amenable for measuring sludge slurry concentrations in enclosed pipes such as those that feed as inlets to dewatering centrifuges. Such a density gauge has three components: a source head, a detector, and a transmitter that incorporates the power supply and signal-handling circuitry. Gamma rays emitted from the source pass through the attached pipe and are absorbed by the slurry in proportion to material density. On the underside of the pipe, unabsorbed radiation reaches a detector device, which produces an electronic signal inversely proportional to material density. An increase in product density results in a reduced detector signal. This signal can be fed into an SG mass-flow transmitter, wherein a corresponding flow rate signal from a magnetic flowmeter mounted on the same input line inputs a signal, the resultant output is a true representation of mass flow (i.e. lb/ft^3 density x ft^3/hr flow rate equals lb/hr mass rate). Figure 10 shows a flowsheet representation of a nuclear density gauge in conjunction with a magnetic flowmeter device (Ref. 11).

Such a combination as this provides a feed rate accuracy of ± 1 to 2 percent. Of the 21 wastewater treatment plants surveyed, one incorporated such a system. In order to get an actual dewatered-sludge-cake feed to the incinerator, a material-balance calculation around the centrifuge must be performed, as shown in Section 5.4.6. Such a combination of nuclear density and magnetic flowmeter devices has been used frequently in wastewater treatment plants to monitor solids concentration from clarifiers, thickeners, and activated sludge recycle lines.

5.4.5 Moyno Pump

Open-throat Moyno sludge pumps can be utilized to control a sludge-cake feed (25 to 40 percent solids) to an incinerator in an enclosed 4- to 6-inch diameter pipe. Figure 11 shows a schematic drawing of the sludge inlet and discharge through a Moyno pump (Ref. 12). Two of the 21 plants surveyed utilized this equipment to control feeds to an in-

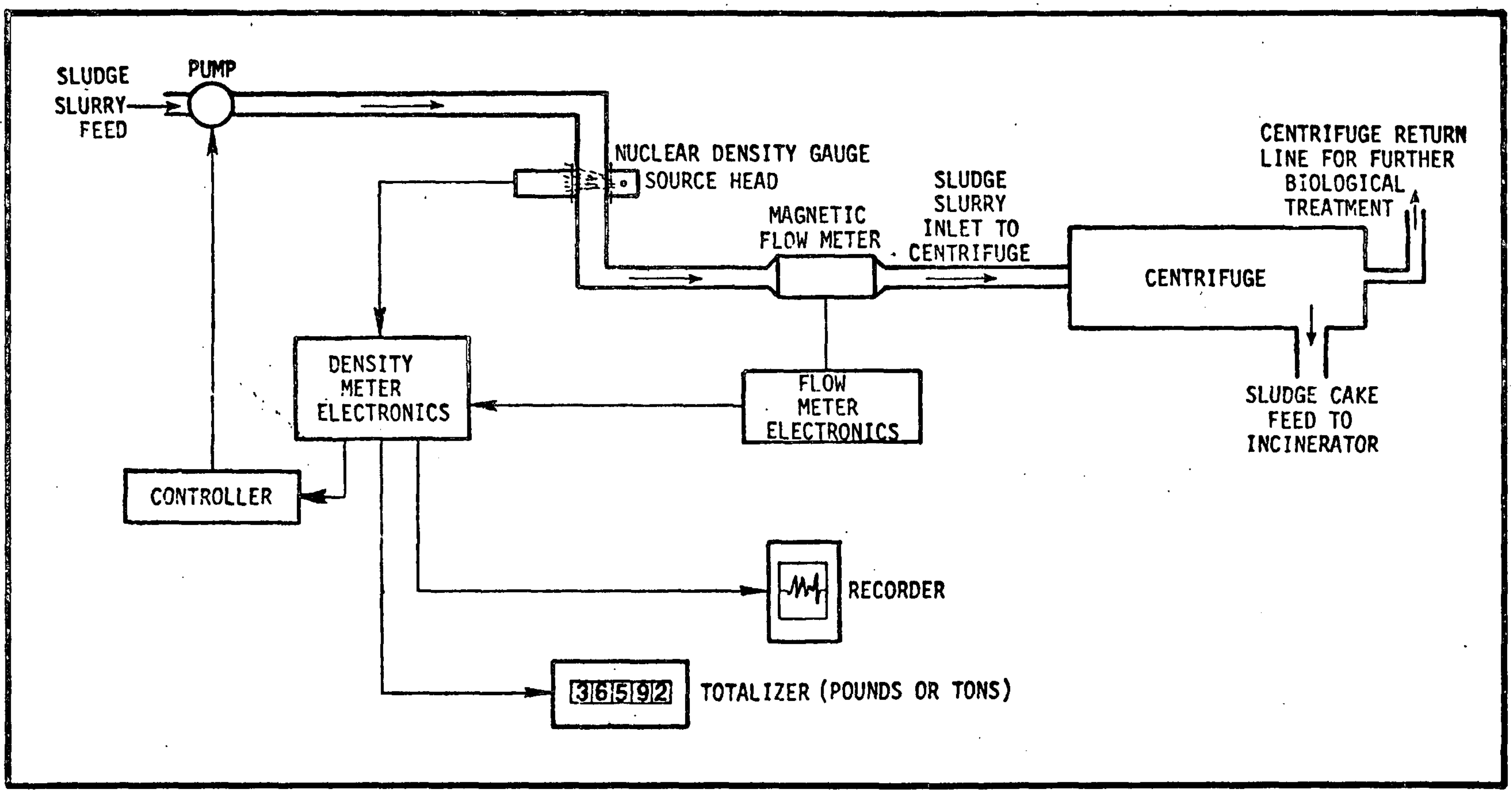


Figure 10. Flowsheet representation of nuclear density gauge and magnetic flowmeter device on sludge slurry inlet to a dewatering centrifuge.

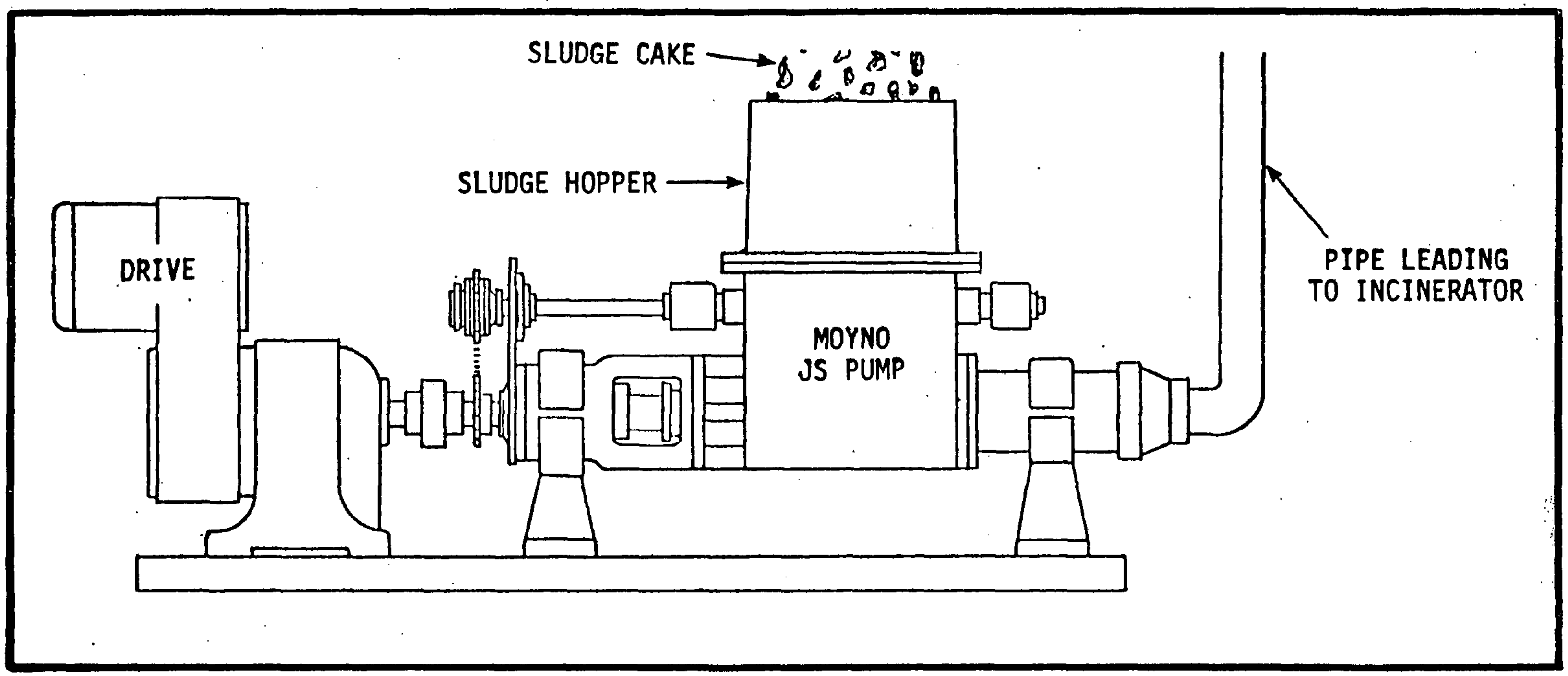


Figure 11. Open-throat Moyno pump for feeding sludge cake to an incinerator system.

cinerator. In both of these operations sludge cake was fed from the discharge side of a centrifuge dewatering step as it fell by gravity to the suction intake of the pump.

A hopper within the pump receives the sludge cake and permits gentle, full flow into the pump's suction housing; an auger feed conducts the sludge through the pump in a manner similar to that of a screw-conveyor. This controlled action within the pump provides a uniform discharge free of pulsation flow. The Moyno pump operation works satisfactorily, but actual feed rates to the incinerator can be determined only by a material-balance calculation around the centrifuge since it is not difficult to correlate the open throat rpm pump speed to actual discharge flow (say gpm) of a semi-solid sludge cake.

5.4.6 Material Balance Techniques

Section 5.4.4 discusses monitoring sludge slurry feed rates to the inlet of a centrifuge by using a nuclear gauge and a magnetic flowmeter combination; however, a material-balance calculation must be made around the centrifuge to determine the actual sludge cake feed rate to the incinerator to satisfy NSPS requirements. Figure 12 shows an analytical summary form for solids measurement of representative samples taken around the centrifuge streams, including the sludge slurry feed to inlet, centrate, and sludge cake. The analytical method for solids measurement is performed according to "208G. Volatile and Fixed Matter in Nonfiltrable Residue and in Solids and Semisolid Samples," Standard Methods for the Examination of Water and Wastewater, 14th Edition, American Public Health Association, Inc., New York, N.Y., 1975, pp. 96 to 98, with exceptions as listed in Appendix A, pp. A-9.

The following sample material-balance calculation is indicative of a representative centrifuge dewatering operation (Ref. 13):

	CENTRIFUGE NO. 1			CENTRIFUGE NO. 2		
DATE						
Sampling point	Sludge slurry to centrifuge	Liquid centrate	Sludge cake to incinerator	Sludge slurry to centrifuge	Liquid centrate	Sludge cake to incinerator
No. of dish						
pH						
Sample volume						
Wt. dish + sample						
Wt. dish						
Wt. sample						
Wt. dry						
Wt. solids						
% or mg/l solids						

Figure 12. Summary analysis sheet for analytical determination of stream(s) solids content for material balance around a centrifuge.

Input sludge slurry feed rate to centrifuge (based on nuclear density and mag-flowmeter readings)	:	25,000 lb/hr
Polymer (solid) feed rate to centrifuge	:	45 lb/hr
Polymer dilution water feed rate to centrifuge	:	7,500 lb/hr (15 gpm)
Solids in input sludge slurry:[a]	:	4.4 percent
Solids in centrate liquid[a]	:	0.6 percent
Solids in sludge cake feed to incinerator[a]	:	16.2 percent

[a] As determined by Standard Methods (See Figure 12).

Total feed input to centrifuge equals: 25,000 + 45 + 7,500 = 32,545 lbs/hr.

Total solids input to centrifuge equals: 25,000 (0.044) + 45 = 1,145 lb/hr.

A solids material balance around the centrifuge to determine X, the sludge cake feed to the incinerator, is as follows:

$$0.162\,(X) + 0.006\,(32{,}545-X) = 1{,}145$$

$$0.162\,X + 195 - 0.006X = 1{,}145$$

$$0.156X = 950$$

$X = \underline{6{,}090}$ lb/hr sludge cake feed to incinerator.

A similar material-balance calculation around the centrifuge that feeds sludge cake to the Moyno open throat pump (Section 5.4.5) must be made to determine the rate of sludge-cake feed to the incinerator. The flow rate (volume) is known for the centrifuge feed and the centrate, based on standardized pump settings, curves, and experience. This information coupled with solids measurement on all feedstreams in or out of the centrifuge allows the sludge cake rate to the Moyno pump to be determined, which can be translated to a feed rate of sludge cake to the incinerator.

5.5 OPERATIONAL BENEFITS OF INSTALLING FEED MONITORING DEVICES

With the promulgation of the New Source Performance Standards for Sewage Treatment Plants (Ref. 2), all new or modified sludge incinerators are required to install and operate a flow measuring device. Over the years, acceptance of feed monitoring devices for critical weighing applications has been rapidly increasing. The PEDCo survey indicated that these devices have been commonly used in sludge incineration applications (14 of 21 plants). Other industries where feed-monitoring devices are often used include (Ref. 11):

- Coal mining/mineral processing
- Iron and steel
- Cement plants
- Sand and gravel plants
- Shipping operations

Installation of feed monitoring devices on sludge incineration applications offers numerous benefits.

1. Section 60.152 of the NSPS regulates the emission of particulate matter not to exceed 1.30 lb/ton of dry sludge input, and these devices facilitate continuous monitoring during actual compliance testing.

2. Sludge input to the furnace can be easily recorded, totalized, and displayed on a control panel to recognize at a glance actual feedrates (Ref. 14).

3. Plant operators can be relieved for more important administrative or maintenance duties when feedrate devices are installed and operating (Ref. 15).

4. During startup and shutdown of the furnace operation, the feedrate device is a valuable process aid (Ref. 14).

5. A feedrate device can provide advance notice of malfunctioning in the operation of the incinerator; for instance, fluctuations in the feed rate can be sensed so that overloading of the furnace can be avoided (Ref. 15).

6. The amount of filter cake delivered by a vacuum filter is typically regulated through the feed monitoring control device. If this amount does not agree with the expected amount (from design data), the vacuum filter may not be functioning properly; this could be due to improper: (a) submergence of the drum into the trough; or (b) speed of the drum; or (c) sludge conditioning. The feedrate device in effect then helps gauge the performance of the vacuum filter (Ref. 15).

7. Most sludge incinerators require a substantial energy input in the form of supplementary fuel either at start-up or during operation (depending upon the heating value of the sludge). If the quantity of sludge input (lb/hr), and its heating value (Btu/lb) are known, then the amount of supplementary fuel, Btu/hr (lb/hr x Btu/lb) can be readily and accurately determined; in fact, the feedrate device aids in promoting energy conservation through readily available data on feedrate operation (Ref. 14).

8. Most feed monitoring devices are quite reliable and accurate within limits specified by manufacturers (usually ± 5 percent) (Ref. 14).

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APPENDIX A

NEW SOURCE PERFORMANCE STANDARDS

FOR SEWAGE TREATMENT PLANTS

APPENDIX A

NSPS STANDARDS OF PERFORMANCE FOR SEWAGE TREATMENT PLANTS

Chapter 1 - Environmental Protection Agency

SUBCHAPTER C - AIR PROGRAMS

PART 60 - STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Subpart A - General Provisions

§60.1 Applicability.

The provisions of this part apply to the owner or operator of any stationary source which contains an affected facility the construction of modification of which is commenced after the date of publication in this part of any standard (or, if earlier, the date of publication of any proposed standard) applicable to such facility.

§60.2 Definitions.

As used in this part, all terms not defined herein shall have the meaning given them in the Act:

(a) "Act" means the Clean Air Act (42 U.S.C. 1857 et seq., as amended by Public Law 91-604, 84 Stat. 1676).

(b) "Administrator" means the Administrator of the Environmental Protection Agency or his authorized representative.

(c) "Standard" means a standard of performance proposed or promulgated under this part.

(d) "Stationary source" means any building, structure, facility, or installation which emits or may emit any air pollutant.

(e) "Affected facility" means, with reference to a stationary source, any apparatus to which a standard is applicable.

(f) "Owner or operator" means any person who owns, leases, operates, controls, or supervises an effected facility of a stationary source of which an affected facility is a part.

(g) "Construction" means fabrication, erection, or installation of an affected facility.

(h) "Modification" means any physical change in, or change in the method of operation of, an affected facility which increases the amount of any air pollutant (to which a standard applies) emitted by such facility or which results in the emission of any air pollutant (to which a standard applies) not previously emitted, except that:

(1) Routine maintenance, repair, and replacement shall not be considered physical changes, and

(2) The following shall not be considered a change in the method of operation:

(i) An increase in the production rate, if such increase does not exceed the operating design capacity of the affected facility;

(ii) An increase in hours of operation;

(iii) Use of an alternative fuel or raw material if, prior to the date any standard under this part become applicable to such facility, as provided by §60.1, the affected facility is designed to accommodate such alternative use.

(i) "Commenced" means, with respect to the definition of "new source" in section 111(a) (2) of the Act, that an owner or operator has undertaken a continuous program of construction or modification or that an owner or operator has entered into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or modification.

(j) "Opacity" means the degree to which emissions reduce the transmission of light and obscure the view of an object in the background.

(k) "Nitrogen oxides" means all oxides of nitrogen except nitrous oxide, as measured by test methods set forth in this part.

(l) "Standard conditions" means a temperature of 20°C (68°F) and a pressure of 760 mm of Hg (29.92 in. of Hg).

(m) "Proportional sampling" means sampling at a rate that produces a constant ratio of sampling rate to stack gas flow rate.

(n) "Isokinetic sampling" means sampling in which the linear velocity of the gas entering the sampling nozzle is equal to that of the undisturbed gas stream at the sample point.

(o) "Start-up" means the setting in operation of an affected facility for any purpose.

(p) "Shutdown" means the cessation of operation of an affected facility for any purpose.

(q) "Malfunction" means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner. Failures that are caused entirely or in part by poor maintenance, careless operation, or any other preventable upset condition or preventable equipment breakdown shall not be considered malfunctions.

(r) "Hourly period" means any 60 minute period commencing on the hour.

(s) "Reference method" means any method of sampling and analyzing for an air pollutant as described in Appendix A to this part.

(t) "Equivalent method" means any method of sampling and analyzing for an air pollutant which have been demonstrated to the Administrator's satisfaction to have a consistent and quantitatively known relationship to the reference methods, under specified conditions.

(u) "Alternative method" means any method of sampling and analyzing for an air pollutant which is not a reference or equivalent method but which has been demonstrated to the Administrator's satisfaction to, in specific cases, produce results adequate for his determination of compliance.

(v) "Particulate matter" means any finely divided solid or liquid material, other than uncombined water, as measured by Method 5 of Appendix A to this part of an equivalent or alternative method.

(w) "Run" means the net period of time during which an emission sample is collected. Unless otherwise specified, a run may be either intermittent or continuous within the limits of good engineering practice.

§60.4 Address.

All requests, applications, submittals, and other communications to the Administrator pursuant to this part shall be submitted in duplicate and addressed to the appropriate Regional Office of the Environmental Protection Agency, to the attention of the Director, Enforcement Division.

§60.5 Determination of construction or modification.

When requested to do so by an owner or operator, the Administrator will make a determination of whether actions taken or intended to be taken by such owner or operator constitute construction or modification or the commencement thereof within the meaning of this part.

§60.6 Review of plans.

(a) When requested to do so by an owner or operator, the Administrator will review plans for construction or modification for the purpose of providing technical advice to the owner or operator.

(b) (1) A separate request shall be submitted for each construction or modification project.

(2) Each request shall identify the location of such project, and be accompanied by technical information describing the proposed nature, size, design, and method of operation of each affected facility involved in such project, including information on any equipment to be used for measurement or control of emissions.

(c) Neither a request for plans review nor advice furnished by the Administrator in response to such request shall (1) relieve an owner or operator of legal responsibility for compliance with any provision of this part or of any applicable State of local requirement, or (2) prevent the Administrator from implementing or enforcing any provision of this part of taking any other action authorized by the Act.

§60.7 Notification and record keeping.

(a) Any owner or operator subject to the provisions of this part shall furnish the Administrator written notification as follows:

(1) A notification of the anticipated date of initial start-up of an affected facility not more than 60 days or less than 30 days prior to such date.

(2) A notification of the actual date of initial start-up of an effected facility within 15 days after such date.

(b) Any owner or operator subject to the provisions of this part shall maintain for a period of 2 years a record of the occurrence and duration of any start-up, shutdown, or malfunction in operation of any affected facility.

(c) A written report of excess emissions as defined in applicable subparts shall be submitted to the Administrator by each owner or operator for each calendar quarter. The report shall include the magnitude of excess emissions as measured by the required monitoring equipment reduced to the units of the applicable standard, the date, and time of commencement and completion of each period of excess emissions. Periods of excess emissions due to start-up, shutdown, and malfunction shall be specifically identified. The nature and cause of any malfunction (if known), the corrective action taken, or preventive measures adopted shall be reported. Each quarterly report is due by the 30th day following the end of the calendar quarter. Reports are not required for any quarter unless there have been periods of excess emissions.

(d) Any owner or operator subject to the provisions of this part shall maintain a file of all measurements, including monitoring and performance testing measurements, and all other reports and records required by all applicable subparts. Any such instruments, reports and records shall be retained for at least 2 years following the date of such measurements, reports, and records.

§60.8 Performance tests.

(a) Within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after initial start-up of each facility and at such other times as may be required by the Administrator under section 114 of the Act, the owner or operator of such facility shall conduct performance test(s) and furnish the Administrator with a written report of the results of such performance test(s).

(b) Performance tests shall be conducted and data reduced in accordance with the test methods and procedures contained in each applicable subpart unless the Administrator (1) specifies or approves, in specific cases, the use of a reference method with minor changes in methodology, (2) approves the use of an equivalent method, (3) approves the use of an alternative method the results of which he has determined to be adequate for indicating whether a specific source is in compliance, or (4) waives the requirement for performance tests because the owner or operator of a source has demonstrated by other means to the Administrator's satisfaction that the affected facility is in compliance with the standard. Nothing in this paragraph shall be construed to abrogate the Administrator's authority to require testing under section 114 of the Act.

(c) Performance tests shall be conducted under such conditions as the Administrator shall specify to the plant operator based on representative performance of the affected facility. The owner or operator shall make available to the Administrator such records as may be necessary to determine the conditions of the performance tests. Operations during periods of start-up, shutdown, and malfunction shall not constitute representative conditions of performance tests unless otherwise specified in the applicable standard.

(d) The owner and operator of an affected facility shall provide the Administrator 30 days prior notice of the performance test to afford the Administrator the opportunity to have an observer present.

(e) The owner or operator of an affected facility shall provide or cause to be provided, performance testing facilities as follows:

(1) Sampling ports adequate for test methods applicable to such facility.

(2) Safe sampling platform(s).

(3) Safe access to sampling platform(s).

(4) Utilities for sampling and testing equipment.

(f) Each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard, the arithmetic means of results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs must be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances, beyond the owner or operator's control, compliance may, upon the Administrator's approval, be determined using the arithmetic mean of the results of the two other runs.

§60.9 Availability of information.

(a) Emission data provided to, or otherwise obtained by, the Administrator in accordance with the provisions of this part shall be available to the public.

(b) Except as provided in paragraph (a) of this section, any records, reports, or information provided to, or otherwise obtained by, the Administrator in accordance with the provision of this part shall be available to the public, except that (1) upon a showing satisfactorily to the Administrator by any person that such records, reports, or information, or particular part therof (other than emission data), if made public, would divulge methods or processes entitled to protection as trade secrets of such person, the Administrator shall consider such records, reports, or information, or particular part thereof, confidential in accordance with the purposes of section 1905 of title 18 of the United States Code, except that such records, reports, or information, or particular part thereof, may be disclosed to other officers, employees, or authorized representatives of the United States concerned with carrying out the provisions of the Act or when relevant in any proceeding under the Act; and (2) information received by the Administrator solely for the purpose of §60.5 and §60.8 shall not be disclosed if it is so identified by the owner or operator as being a trade secret or commercial or financial information which such owner or operator considers confidential.

§60.10 State authority.

The provision of this part shall not be construed in any manner to preclude any State or political subdivision thereof from:

(a) Adopting and enforcing any emission standard or limitation applicable to an affected facility, provided that such emission standard or limitation is not less stringent than the standard applicable to such facility.

(b) Requiring the owner or operator of an affected facility to obtain permits, licenses, or approvals prior to initiating construction, modification, or operation of such facility.

§60.11 Compliance with standards and maintenance requirements.

(a) Compliance with standards in this part, other than opacity standards, shall be determined only by performance tests established by §60.8.

(b) Compliance with opacity standards in this part shall be determined by conducting observations in accordance with Reference Method 9 in Appendix A of this part. Opacity readings of portions of plumes which contain condensed, uncombined water vapor shall not be used for purposes of determining compliance with opacity standards. The results of continuous monitoring by transmissometer which indicate that the opacity at the time visual observations were made was not in excess of the standard are probative but not conclusive evidence of the actual opacity of an emission, provided that the source shall meet the burden of proving that the instrument used meets (at the time of the alleged violation) Performance Specification I in Appendix B of this part, has been properly maintained and (at the time of the alleged violation) calibrated, and that the resulting data have not been tampered with in any way.

(c) The opacity standards set forth in this part shall apply at all times except during periods of start-up, shutdown, or malfunction, and as otherwise provided in the applicable standard.

(d) At all times, including periods of start-up, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

(e) (1) An owner or operator of an affected facility may request the Administrator to determine opacity of emissions from the affected facility during the initial performance tests required by §60.8.

(2) Upon receipt from such owner or operator of the written report of the results of the performance tests required by §60.8, the Administrator will make a finding concerning compliance with opacity and other applicable standards. If the Administrator finds that an affected facility is in compliance with all applicable standards for which performance tests are conducted in accordance with §60.8 of this part but during the time such performance tests are being conducted fails to meet any applicable opacity standard, he shall notify the owner or operator and advise him that he may petition the Administrator within 10 days of receipt of notification to make appropriate adjustment to the opacity standard for the affected facility.

(3) The Administrator will grant such a petition upon a demonstration by the owner or operator that the affected facility and associated air pollution control equipment was operated and maintained in a manner to minimize the opacity of emissions during the performance tests; that the performance tests were performed under the conditions established by the Administrator; and that the affected facility and associated air pollution control equipment were incapable of being adjusted or operated to meet the applicable opacity standard.

(4) The Administrator will establish an opacity standard for the affected facility meeting the above requirements at a level at which the source will be able, as indicated by the performance and opacity tests, to meet the opacity standard at all times during which the source is meeting the mass or concentration emission standard. The Administrator will promulgate the new opacity standard in the Federal Register.

§60.12 Circumvention.

No owner or operator subject to the provisions of this part shall build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable standard. Such concealment includes, but is not limied to, the use of gaseous diluents to achieve compliance with an opacity standard or with a standard which is based on the concentration of a pollutant in the gases discharged to the atmosphere.

Subpart O - Standards of Performance for Sewage Treatment Plants

§60.150 Applicability and designation of affected facility.

The affected facility to which the provisions of this subpart apply is each incinerator which burns the sludge produced by municipal sewage treatment facilities.

§60.151 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act and in subpart A of this part.

§60.152 Standard for particulate matter.

(a) On and after the date on which the performance test required to be conducted by §60.8 is completed, no owner or operator of any sewage sludge incinerator subject to the provisions of this subpart shall discharge or cause the discharge into the atmosphere of:

(1) Particulate matter at a rate in excess of 0.65 g/kg dry sludge input (1.30 lb/ton dry sludge input).

(2) Any gases which exhibit 20 percent opacity or greater. Where the presence of uncombined water is the only reason for failure to meet the requirements of this paragraph, such failure shall not be a violation of this section.

§60.153 Monitoring of operations.

(a) The owner or operator of any sludge incinerator subject to the provisions of this subpart shall:

(1) Install, calibrate, maintain, and operate a flow measuring device which can be used to determine either the mass or volume of sludge charged to the incinerator. The flow measuring device shall have an accuracy of ± 5 percent over its operating range.

(2) Provide access to the sludge charged so that a well-mixed representative grab sample of the sludge can be obtained.

§60.154 Test Methods and Procedures

(a) The reference methods appended to this part, except as provided for the §60.8(b), shall be used to determine compliance with the standards prescribed in §60.152 as follows:

(1) Method 5 for concentration of particulate matter and associated moisture content,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for volumetric flow rate, and

(4) Method 3 for gas analysis.

(b) For Method 5, the sampling time for each run shall be at least 60 minutes and the sampling rate shall be at least 0.015 dscm/min (0.53 dscf/min), except that shorter sampling times, when necessitated by process variables or sampling times, when necessitated by process variables or other factors, may be approved by the Administrator.

(c) Dry sludge charging rate shall be determined as follows:

(1) Determine the mass (S_M) or volume (S_V) of sludge charged to the incinerator during each run using a flow measuring device meeting the requirements of §60.153(a) (1). If total input during a run is measured by a flow measuring device, such readings shall be used. Otherwise, record the flow measuring device readings at 5-minute intervals during a run. Determine the quantity charged during each interval by averaging the flow rates at the beginning and end of the interval and then multiplying the average for each interval by the time for each interval. Then add the quantity for each interval to determine the total quantity charged during the entire run, (S_M) or (S_V).

(2) Collect samples of the sludge charged to the incinerator in non-porous collecting jars at the beginning of each run and at approximately 1-hour intervals thereafter until the test ends, and determine for each sample the dry sludge content (total solids residue) in accordance with "224 G. Method for Solid and Semisolid Samples", Standard Methods for the Examination of Water and Wastewater, Thirteenth Edition,[a] American Public Health Association, Inc., New York, N.Y., 1971, pp. 539-41, except that:

(i) Evaporating dishes shall be ignited to at least 103°C rather than the 550°C specified in step 3(a) (1).

(ii) Determination of volatile residue, step 3(b) may be deleted.

(iii) The quantity of dry sludge per unit sludge charged shall be determined in terms of either R_{DV} (metric units: mg dry sludge/liter sludge charged or English units: lb/ft^3) or R_{DM} (metric units: mg dry sludge/mg sludge charged or English units: lb/lb).

(3) Determine the quantity of dry sludge per unit sludge charged in terms of either R_{DV} or R_{DM}.

(i) If the volume of sludge charged is used:

$$S_D=(60\times10^{-3})\ \frac{R_{DV}S_V}{T} \quad \text{(Metric Units)}$$

or

$$S_D=(8.021)\ \frac{R_{DV}S_V}{T} \quad \text{(English Units)}$$

where:

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[a] Or 14th edition, 1975 pp. 96 to 98.

S_D=average dry sludge charging rate during the run, kg/hr (English units: lb/hr).
R_{DV}=average quantity of dry sludge per unit volume of sludge charged to the incinerator, mg/l (English units: lb/ft^3).
S_V=sludge charged to the incinerator during the run, m^3 (English units: gal).
T=duration of run, min (English units: min).

$60x10^{-3}$=metric units conversion factor, $l\text{-}kg\text{-}min/m^3\text{-}mg\text{-}hr$.
8.021=English units conversion factor, ft^2-min/gal-hr.

(ii) If the mass of sludge charged is used:

$$S_D=(50)\frac{R_{DM}S_M}{T} \quad \text{(Metric or English Units)}$$

where:

S_D=average dry sludge charging rate during the run, kg/hr (English units: lb/hr).
R_{DM}=average ratio of quantity of dry sludge to quantity of sludge charged to the incinerator, mg/mg (English units: lb/lb).
S_M=sludge charged during the run, kg (English units:lb).
T=duration of run; min (Metric or English units).
60=conversion factor, min/hr (Metric or English units).

(d) Particulate emission rate shall be determined by:

$$c^{aw}=c^sQ^s \quad \text{(Metric or English Units)}$$

where:

c^{aw}=particulate matter mass emissions, mg/hr (English units: lb/hr).
c^s=particulate matter concentration, mg/m^3 (English units: lb/dscf).
Q^s=volumetric stack gas flow rate, dscm/hr (English units: dscf/hr). Q^s and c^s shall be determined using Methods 2 and 5, respectively.

(e) Compliance with §60.152(a) shall be determined as follows:

$$C_{ds}=(10^{-3})\frac{c^{aw}}{S_D} \quad \text{(Metric Units)}$$

or

$$C_{ds}=(2000)\frac{c^{aw}}{S_D} \quad \text{(English Units)}$$

where:

C_{ds}=particulate emission discharge, g/kg dry sludge (English units: lb/ton dry sludge).

10^{-3}=Metric conversion factor, g/mg.

2000=English conversion factor, lb/ton.

APPENDIX B

MANUFACTURERS OF WASTEWATER TREATMENT PLANT EQUIPMENT

APPENDIX B-1. MANUFACTURERS OF SLUDGE DEWATERING EQUIPMENT

Company	Type of Dewatering Equipment	
	Vacuum filter	Centrifuge
1. Bird Machine Company, Inc. South Walpole, Massachusetts	X	X
2. Dorr-Oliver, Inc. 77 Havemeyer Lane Stamford, Connecticut	X	X
3. Envirotech Corporation Eimco-BSP 669 W. Second South Salt Lake City, Utah	X	
4. Komline-Sanderson Holland Avenue Peapack, New Jersey	X	
5. Sharples-Stokes Division Pennwalt Corporation 20525 Center Ridge Road Cleveland, Ohio		X
6. Wemco Division Envirotech Corporation P.O. Box 15619 Sacramento, California		X

APPENDIX B-2. MANUFACTURERS OF SLUDGE CONVEYOR SYSTEMS

Company	Type of Conveyor Manufactured		
	Belt	Screw	Other
1. Amercon Corporation P.O. Box 6425 Ft. Worth, Texas		X	
2. B.I.F., Inc. 1600 Division Rd. W. Warwick, RI	X		
3. Bonded Scale & Machine Company 2176 S. Third Street Columbus, Ohio	X		
4. The Bucket Elevator Company 24 Commerce Street Chatham, New Jersey	X		Bucket elevator
5. Colorado Conveyor Company 11575 W. 13th Avenue Denver, Colorado	X	X	Bucket elevator
6. Columbus Conveyor Company P.O. Box 510 Worthington, Ohio	X	X	
7. Envirotech-BSP One Davis Drive Belmont, California	X		
8. Fairfield Manufacturing Company Marion, Ohio	X		
9. Feeco International 3913 Algoma Road Green Bay, Wisconsin	X	X	
10. FMC Corporation Material Handling Equipment Division P.O. Box 1370 Tupelo, Mississippi	X	X	
11. Goodyear Tire & Rubber Company 1144 E. Market Street Akron, Ohio	X		

APPENDIX B-2 (continued). MANUFACTURERS OF SLUDGE CONVEYOR SYSTEMS

Company	Type of Conveyor Manufactured		
	Belt	Screw	Other
12. Jeffrey Manufacturing Company 274 E. First Ave. Columbus, Ohio	X		
13. Komline-Sanderson Holland Ave. Peapack, New Jersey	X		
14. The Rexnord Company Louisville, Kentucky	X		
15. Screw Conveyor Corporation Visalia, California		X	
16. Sprout Waldron & Company Muncy, Pennsylvania		X	Bucket elevator
17. Webster Manufacturing Company Tiffin, Ohio	X	X	

APPENDIX B-3. MANUFACTURERS OF SLUDGE INCINERATORS

Company	Type of incinerator manufactured	
	Multihearth	Fluid-bed
1. Copeland Systems 2000 Spring Road Oak Brook, Illinois		X
2. Denver Mine & Smelting (MSI Skinner) Denver, Colorado	X	
3. Dorr-Oliver International Headquarters Stamford, Connecticut		X
4. Envirotech Eimco-BSP One Davis Drive Belmont, California	X	
5. Nichols Engineering & Research Corporation Homestead & Willow Roads Belle Mead, New Jersey	X	
6. Zimpro, Inc. 14618 W. Sixth Avenue Golden, Colorado	X	

APPENDIX B-4. MAJOR MANUFACTURERS OF SLUDGE MONITORING DEVICE EQUIPMENT

Company	Weightometer belt scales	Vibrametric or digital weigh-belt feeders	Nuclear weigh scale (C-frame type)	Nuclear density gauge	Moyno pump
1. Auto-Weigh, Inc. 1439 N. Emerald Ave. Modesto, California	X	X			
2. BIF, Inc. 1600 Division Road W. Warwick, Rhode Island	X				
3. K-Tron Corp. P.O. Box 548 Glassboro, New Jersey		X			
4. Merrick Scale Mfg. Co. 180 Autumn Street Passaic, New Jersey	X	X			
5. Ohmart Corp. 4241 Allendorf Dr. Cincinnati, Ohio			X		
6. Ramsey Engineering Co. 1853 W. County Road C St. Paul, Minnesota	X	X			
7. Robbins & Myers 1895 W. Jefferson St. Springfield, Ohio					X
8. Texas Nuclear Corp. Subsidiary of G.D. Searle & Co. P.O. Box 9267 Austin, Texas			X	X	
9. Thayer Scale (Myer Industries, Inc.) Pembroke, Massachusetts	X	X			
10. Vibra Screw, Inc. 755 Union Blvd. Totowa, New Jersey		X			

[a] Magnetic flowmeters are available from several suppliers, including: Foxboro (Foxboro, Massachusetts), Fisher and Porter (Warminister, Pennsylvania), Badger (Milwaukee, Wisconsin), and Honeywell (Fort Washington, Pennsylvania).

APPENDIX C

SUMMARY QUESTIONNAIRES FOR WASTEWATER TREATMENT PLANT SURVEY

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Kiski Valley WPCA

      Address Pine Run Rd., Allegheny Township, Pennsylvania

      Phone Number (412) 568-3655

      Contact Don Brewer Title Superintendent

      Facility located in EPA Region III

   b. Date of Visit 9/28/76

   c. PEDCo Personnel V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum Filter

   b. Manufacturer Eimco Division of Envirotech

   c. Cake solids content 30%

3. SLUDGE CONVEYOR

   a. Type Belt Conveyor

   b. Manufacturer Eimco-Envirotech

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken from a platform near the conveyor

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Weightometer belt scale

   b. Manufacturer Thayer Scale Mfg. Co., Pembroke, Massachusetts

   c. Operational details Scales are mounted along the incline length of conveyor

   d. Accuracy ±5%

5. INCINERATOR

   a. Type Multi-hearth, 1 unit, 7 hearths

   b. Manufacturer BSP-Envirotech

   c. Date construction or modification began Sept., 1974

   d. Feed rate/material 1.5 tons/hr filter cake

   e. No. of ports of feed entry One

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   Some minor modifications were made on the incinerator in March 1976. Grease and scum are introduced into hearth No. 2 or 4 and its feed is monitored by a variable speed pump.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Parkway STP

      Address Maryland Rt. 197 at Balt.-Maryland Pkwy.

      Phone Number (301) 953-3580

      Contact Tom Schell Title Superintendent

      Facility located in EPA Region III

   b. Date of Visit 9/29/76

   c. PEDCo Personnel V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Solid-bowl centrifuge

   b. Manufacturer Pennwalt Sharples Corporation

   c. Cake solids content 23%

3. SLUDGE CONVEYOR

   a. Type 4 inch pipeline

   b. Manufacturer Not applicable

   c. Can a representative sample be taken? Yes, from the discharge end of the reactor feed pump. Centrifuge feeds to the incinerator via the feed pump.

   d. Additional information Feed pump is an open throat Moyno pump.

4. CONVEYOR WEIGH SCALE

   a. Type None

   b. Manufacturer Not applicable

   c. Operational details Feed to incinerator is monitored by a material balance around the centrifuge.

   d. Accuracy Not applicable

5. INCINERATOR

   a. Type Fluid-bed, 2 units

   b. Manufacturer Copeland Systems

   c. Date construction or modification began 1970

   d. Feed rate/material 1,182 lb/hr sludge cake

   e. No. of ports of feed entry One

   f. Is mercury monitored in flue gas? Yes

6. ADDITIONAL INFORMATION/COMMENTS

Results of mercury analysis are proprietary. Repair work to the venturi scrubber and the incinerator have been done after 1973.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Lower Potomac WPCP

      Address 9399 Richmond Highway, Lorton, Virginia

      Phone Number (703) 550-9590

      Contact Ralph Schlesinger Title Superintendent

      Facility located in EPA Region III

   b. Date of Visit 9/27/76

   c. PEDCo Personnel V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum Filter

   b. Manufacturer Kolmline-Sanderson, Peapack, New Jersey

   c. Cake solids content 23%

3. SLUDGE CONVEYOR

   a. Type Belt Conveyor

   b. Manufacturer Columbus Conveyor Co., Columbus, Ohio

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken from the floor level.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Weightometer belt scale

   b. Manufacturer Merrick Scale Mfg. Co., Passaick, New Jersey

   c. Operational details Scales are mounted along the horizontal length of the conveyor.

   d. Accuracy ±2%

5. INCINERATOR

   a. Type Multi-hearth, 4 units, 2 with 6 hearths, 2 w/7 hearths/unit

   b. Manufacturer Nichols Engineering & Research Corp.

   c. Date construction or modification began See No. 6

   d. Feed rate/material 8 tons/hr filter cake and grease

   e. No. of ports of feed entry one/unit

   f. Is mercury monitored in flue gas? Yes

6. ADDITIONAL INFORMATION/COMMENTS

   Two furnaces (7 hearths) were constructed in 1970; two furnaces (6 hearths) were constructed in June, 1974. Results of mercury analysis are not available, however, they are within the limits (1.30 lb/ton).

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

a. Name of Facility Snapfinger Creek WWTP

Address 4124 Flakes Mill Rd., Decatur, Georgia

Phone Number (404) 981-0220

Contact John Spotts Title Branch Chief

Facility located in EPA Region IV

b. Date of Visit 9/30/76

c. PEDCo Personnel V. Patel

2. SLUDGE TREATMENT

a. Dewatering device Vacuum Filter

b. Manufacturer Envirotech-BSP

c. Cake solids content 15%

3. SLUDGE CONVEYOR

a. Type Belt Conveyor

b. Manufacturer Envirotech-BSP

c. Can a representative sample be taken? Yes, manual grab samples can be taken from the floor level.

d. Additional information None

4. CONVEYOR WEIGH SCALE

a. Type None

b. Manufacturer Not applicable

c. Operational details Not applicable

A weightometer belt scale or an atomic absorption unit can be installed if needed.

d. Accuracy Not applicable

5. INCINERATOR

a. Type Multiple-hearth, 1 unit, 7 hearths

b. Manufacturer Envirotech-BSP

c. Date construction or modification began June, 1974

d. Feed rate/material 1,100 lb/hr filter cake and grease

e. No. of ports of feed entry One, to hearth #2

f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

Grease is blended in the mixing tanks with sludge.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility R. M. Clayton WPCP

      Address 2440 Bolton Rd., Atlanta, Georgia

      Phone Number (404) 351-6120

      Contact Ted LeJeune Title Engineer

      Facility located in EPA Region IV

   b. Date of Visit 9/30/76

   c. PEDCo Personnel V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Solid-bowl centrifuge

   b. Manufacturer Pennwalt Sharples Corporation

   c. Cake solids content 25%

3. SLUDGE CONVEYOR

   a. Type Belt Conveyor

   b. Manufacturer FMC-Link Belt Division

   c. Can a representative sample be taken? Yes, manual grab samples can be taken from floor level.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Weightometer Belt Scale

   b. Manufacturer A B C Div., Howe Richardson, Cleveland, Ohio

   c. Operational details Scale has an integrator and a totalizer

   d. Accuracy ±1%

5. INCINERATOR

   a. Type Multi-hearth, 2 units, 10 hearth/unit

   b. Manufacturer BSP-Envirotech

   c. Date construction or modification began 1972

   d. Feed rate/material 7 tons/hr filter cake

   e. No. of ports of feed entry one/unit

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

Some bricks in the furnace were restored in August, 1976.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Central WWTP

      Address 1600 Second Ave., Nashville, Tennessee

      Phone Number (615) 259-6441

      Contact Walter Blackman Title Superintendent

      Facility located in EPA Region IV

   b. Date of Visit 10/1/76

   c. PEDCo Personnel V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum Filter

   b. Manufacturer Kolmline-Sanderson, Peapack, New Jersey

   c. Cake solids content 20%

3. SLUDGE CONVEYOR

   a. Type Belt Conveyor

   b. Manufacturer Rexnord, Louisville, Kentucky

   c. Can a representative sample be taken? Yes, manual grab samples can be taken off the conveyor.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Atomic absorption

   b. Manufacturer Omhart Corp., Cincinnati, Ohio

   c. Operational details A radioactive source emits gamma rays which are absorbed in proportion to the mass of the material on the conveyor.

   d. Accuracy ±0.5%

5. INCINERATOR

   a. Type Multi-hearth, 4 units, 10 hearths/unit

   b. Manufacturer Nichols-Herreshoff

   c. Date construction or modification began See No. 6

   d. Feed rate/material 4,000 lb/hr filter cake

   e. No. of ports of feed entry two/unit

   f. Is mercury monitored in flue gas? Yes

6. ADDITIONAL INFORMATION/COMMENTS

One incinerator was built in 1958, one in 1965 and two in 1972. Each furnace has two feed entry points at the top of the furnace. Mercury results are not available, however, they are well below standards (1.30 lb/ton).

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Bromley WWTP

      Address Rout 8, Bromley, Kentucky

      Phone Number (606)431-8020

      Contact Vance Wright Title Operator

      Facility located in EPA Region IV

   b. Date of Visit 2/6/76

   c. PEDCo Personnel C. Sawyer; V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum filter

   b. Manufacturer Eimco-BSP

   c. Cake solids content 25 to 35%

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer Jeffrey Mfg. Co., Columbus, Ohio

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken from the floor level.

   d. Additional information Plant personnel take sludge samples off the vacuum filter.

4. CONVEYOR WEIGH SCALE

   a. Type None

   b. Manufacturer Not applicable

   c. Operational details Not applicable

   d. Accuracy Not applicable

5. INCINERATOR

   a. Type Multiple-hearth, 1 unit, 5 hearths

   b. Manufacturer Nichols-Herreshoff

   c. Date construction or modification began 1956

   d. Feed rate/material 1,200 lb/hr filter cake

   e. No. of ports of feed entry one

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   The plant is going to be phased out when the new Dry Creek facility is completed.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Dry Creek WWTP

      Address High Water Rd., Constance, N. Kentucky

      Phone Number Not applicable

      Contact Robert Goebel Title Superintendent

      Facility located in EPA Region IV

   b. Date of Visit 2/6/76

   c. PEDCo Personnel C. Sawyer; V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum filter

   b. Manufacturer Eimco-BSP

   c. Cake solids content 35% (Design)

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer Fairfield Mfg. Co., Marion, Ohio

   c. Can a representative sample be taken? Yes, a manual grab sample at point where weigh scales are located.

   d. Additional information Conveyor not installed yet.

4. CONVEYOR WEIGH SCALE

   a. Type Vibra-Metic Weigh belt

   b. Manufacturer Vibra Screw, Inc., Totowa, New Jersey

   c. Operational details The scales are set between the belt conveyor and the screw conveyor and serves as its own conveyor system. Not installed.

   d. Accuracy ± 5%

5. INCINERATOR

   a. Type Multiple-hearth, 2 units, 8 hearths/unit

   b. Manufacturer Nichols-Herreshoff or Envirotech-BSP

   c. Date construction or modification began 1977

   d. Feed rate/material 36 tons/day filter cake

   e. No. of ports of feed entry one/unit

   f. Is mercury monitored in flue gas? Not yet

6. ADDITIONAL INFORMATION/COMMENTS

   Plant is under construction.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Morris Forman WWTP

      Address 4522 Algonquin Blvd., Louisville, Kentucky

      Phone Number (502)775-6481

      Contact R. A. Kasting Title Manager

      Facility located in EPA Region IV

   b. Date of Visit 6/1/76

   c. PEDCo Personnel F. Meadows

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum filter

   b. Manufacturer Kolmline-Sanderson, Peapack, N. J.

   c. Cake solids content 40%

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer Dover Co.

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken off the conveyor.

   d. Additional information Location of Dover Co. is not known.

4. CONVEYOR WEIGH SCALE

   a. Type Nuclear Ray-Weigh scale

   b. Manufacturer Omhart Corp., Cincinnati, Ohio

   c. Operational details A nuclear radiation absorption is employed to measure belt loading, and its signal used in combination with a tachometer to indicate weight delivered.

   d. Accuracy ± 5%

5. INCINERATOR

   a. Type Multiple hearth, 4 units, 8 hearths/unit

   b. Manufacturer Nichols-Herreshoff

   c. Date construction or modification began 1974

   d. Feed rate/material 76 tons/day filter cake (Design)

   e. No. of ports of feed entry One/unit

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   The furnaces were installed recently; the nuclear scales were not on line at the time of visit.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Mill Creek WWTP

      Address 1600 Gest St., Cincinnati, Ohio

      Phone Number (513)352-4800

      Contact Robert Huddle Title Operator

      Facility located in EPA Region V

   b. Date of Visit 1/23/76

   c. PEDCo Personnel C. Sawyer, V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum filter

   b. Manufacturer Eimco-BSP

   c. Cake solids content 35%

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer B.I.F. Inc., Providence, Rhode Island

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken from the floor level.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Weightometer belt scale

   b. Manufacturer B.I.F., Inc., Providence, Rhode Island

   c. Operational details Scale is attached to belt conveyor.

   d. Accuracy $\pm$ 2%

5. INCINERATOR

   a. Type Multiple-hearth, 4 units, 9 hearths/unit

   b. Manufacturer Nichols-Herreshoff

   c. Date construction or modification began Aug. 1972

   d. Feed rate/material 12,500 lb/hr/unit filter cake

   e. No. of ports of feed entry one/unit

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   Incinerator is about 15 years old, but was refurbished in 1972. Changes include new refractories, I.D. fans, rabble arms and teeth, burners, instrumentation and ash collection system.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

a. Name of Facility Muddy Creek WWTP

Address River Rd., Cincinnati, Ohio

Phone Number (513)352-4923

Contact Charles Heider Title Superintendent

Facility located in EPA Region V

b. Date of Visit 1/23/76

c. PEDCo Personnel C. Sawyer; V. Patel

2. SLUDGE TREATMENT

a. Dewatering device Vacuum filter

b. Manufacturer Eimco-BSP

c. Cake solids content 20%

3. SLUDGE CONVEYOR

a. Type Belt conveyor

b. Manufacturer Falk Conveyor Co.

c. Can a representative sample be taken? Yes, a manual grab sample can be taken from a platform near the conveyor.

d. Additional information Location of Falk Conveyor Co. is not known.

4. CONVEYOR WEIGH SCALE

a. Type Weightometer belt scale

b. Manufacturer Merric Scale Mfg. Co., Passaic, New Jersey

c. Operational details Scale is attached on the inclined length of the conveyor and connected to a totalizer.

d. Accuracy ± 0.5%

5. INCINERATOR

a. Type Multiple-hearth, 1 unit, 6 hearths

b. Manufacturer Envirotech-BSP

c. Date construction or modification began 1971

d. Feed rate/material 3,100 lb/hr filter cake

e. No. of ports of feed entry one

f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

The furnaces have not been refurbished since they were constructed in 1971.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Little Miami WWTP

      Address Wilmer Ave., Cincinnati, Ohio

      Phone Number (513)352-4921

      Contact Robert Pritchard Title Superintendent

      Facility located in EPA Region V

   b. Date of Visit 2/17/76

   c. PEDCo Personnel C. Sawyer; V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum filter

   b. Manufacturer Not known (filters shut down)

   c. Cake solids content Not known

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer Goodyear Tire and Rubber Co.

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken from the floor level.

   d. Additional information Conveyors are no longer operating.

4. CONVEYOR WEIGH SCALE

   a. Type Weightometer belt scale

   b. Manufacturer Not known

   c. Operational details Weigh scales are no longer operating.

   d. Accuracy Not known

5. INCINERATOR

   a. Type Multiple-hearth, 2 units, 6 hearths/unit

   b. Manufacturer Nichols-Herreshoff

   c. Date construction or modification began Shut down

   d. Feed rate/material (Not known), filter cake

   e. No. of ports of feed entry one/unit

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   Vacuum filtration and incineration operations have been shut down since 1959. New design will have belt conveyors (Mercer or Goodyear Tire & Rubber Co.) feeding a system of screw conveyors (Jeffrey Mfg. Co. or FMC Link Belt Div.) leading to Multi-hearth furnace (Zimpro). Belt will have scales attached (Merric or Gilmore Industries).

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Middletown WWTP

      Address Oxford State Rd., Middletown, Ohio

      Phone Number (513)425-7766

      Contact Harry Keith Title Operator

      Facility located in EPA Region V

   b. Date of Visit 1/26/76

   c. PEDCo Personnel C. Sawyer; V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum filter

   b. Manufacturer Komline-Sanderson, Peapack, N. J.

   c. Cake solids content 25%

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer Jeffrey Mfg. Co., Columbus, Ohio

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken from the floor level.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Weightometer belt scale

   b. Manufacturer Merric Scale Mfg. Co., Passaic, N. J.

   c. Operational details Scale is attached on the inclined length of belt and has a totalizer. Scale has a good deal of down time.

   d. Accuracy ± 0.5%

5. INCINERATOR

   a. Type Multiple-hearth, 2 units, 6 hearths/unit

   b. Manufacturer Envirotech-BSP

   c. Date construction or modification began 1970

   d. Feed rate/material 5,000 lb/hr filter cake

   e. No. of ports of feed entry one/unit

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   The weightometer belt scale was not operating at the time of the visit.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Solid Waste Recycling/Resource Recovery Plant

      Address Route 73, Franklin, Ohio

      Phone Number (513)422-4561

      Contact Earl Blakley Title Project Manager

      Facility located in EPA Region V

   b. Date of Visit 1/26/76

   c. PEDCo Personnel C. Sawyer; V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Cone press

   b. Manufacturer Black Clawson, New York, New York

   c. Cake solids content 45% average

3. SLUDGE CONVEYOR

   a. Type Screw conveyor

   b. Manufacturer FMC - Link Belt Division

   c. Can a representative sample be taken? No, the screw conveyor is enclosed. Sample could be taken from the surge tank.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Not a weigh scale. Have a surge tank.

   b. Manufacturer Not known

   c. Operational details Feed is monitored at specified pumping rate from the surge tank.

   d. Accuracy Not applicable

5. INCINERATOR

   a. Type Fluid-bed, 1 unit

   b. Manufacturer Dorr-Oliver

   c. Date construction or modification began Aug. 1970

   d. Feed rate/material 12,000 gal/day sludge; 150 tons/day refuse, sludge and liquid chemical wastes

   e. No. of ports of feed entry one

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   This is not a typical wastewater treatment plant. The solid waste plant, wastewater plant and the Systech industrial liquid waste plant are integrated to form a comprehensive waste treatment facility.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

a. Name of Facility Big Blue River WWTP

Address 7300 Rochester, Kansas City, Missouri

Phone Number (816)231-8373

Contact Lynne Petree Title Operator

Facility located in EPA Region VII

b. Date of Visit 2/13/76

c. PEDCo Personnel N. S. Walsh

2. SLUDGE TREATMENT

a. Dewatering device Vacuum filter

b. Manufacturer Eimco, Salt Lake City, Utah

c. Cake solids content 25%

3. SLUDGE CONVEYOR

a. Type Belt conveyor

b. Manufacturer FMC - Link Belt Division

c. Can a representative sample be taken? Yes, a manual grab sample can be taken off the conveyor.

d. Additional information None

4. CONVEYOR WEIGH SCALE

a. Type Weightometer belt scale

b. Manufacturer B.I.F. Industries, Providence, Rhode Island

c. Operational details Scale is attached to the conveyor with a readout on the control panel.

d. Accuracy ± 1%

5. INCINERATOR

a. Type Multiple-hearth, 3 units, 8 hearths/unit

b. Manufacturer Nichols-Herreshoff

c. Date construction or modification began 1964

d. Feed rate/material 15,000 lb/hr filter cake

e. No. of ports of feed entry One/unit

f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

The multi-hearth furnaces have not been modified or refurbished since they were constructed.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

a. Name of Facility Mission-Main WWTP

Address 4800 Nall, Mission, Kansas

Phone Number (913)432-3820

Contact Ralph Ward Title Operator

Facility located in EPA Region VII

b. Date of Visit 2/12/76

c. PEDCo Personnel K. Axetell

2. SLUDGE TREATMENT

a. Dewatering device Vacuum filter

b. Manufacturer Komline-Sanderson, Peapack, New Jersey

c. Cake solids content 20%

3. SLUDGE CONVEYOR

a. Type Belt conveyor

b. Manufacturer Kolmline-Sanderson, Peapack, New Jersey

c. Can a representative sample be taken? Yes, a manual grab sample can be taken off the belt.

d. Additional information None

4. CONVEYOR WEIGH SCALE

a. Type Weightometer belt scale

b. Manufacturer Merric Scale Mfg. Co., Passaic, New Jersey

c. Operational details Scale is attached to the conveyor belt.

d. Accuracy ± 2%

5. INCINERATOR

a. Type Multiple-hearth, 1 unit, 5 hearths

b. Manufacturer Eimco-BSP

c. Date construction or modification began 1969

d. Feed rate/material 1,200 lb/hr filter cake

e. No. of ports of feed entry one

f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

Some of the refractories in the incinerator were replaced in 1973.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Palo Alto Regional WQCP

      Address 250 Hamilton, Palo Alto, California

      Phone Number (415)329-2598

      Contact Jack Williams Title Operator

      Facility located in EPA Region IX

   b. Date of Visit 8/9/76

   c. PEDCo Personnel C. J. Sawyer

2. SLUDGE TREATMENT

   a. Dewatering device Solid bowl centrifuge

   b. Manufacturer Bird Machine Company

   c. Cake solids content 15%

3. SLUDGE CONVEYOR

   a. Type Screw conveyor

   b. Manufacturer Screw Conveyor Corp., Visalia, California

   c. Can a representative sample be taken? Yes, through a trap door on screw conveyor a grab sample can be taken.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Density meter

   b. Manufacturer Nuclear Chicago, Chicago, Illinois

   c. Operational details A material balance is made about the centrifuge (feed, cake and centrate). Scale measures density. Mag-flow meter attached to scale measures input.

   d. Accuracy ± 5%

5. INCINERATOR

   a. Type Multiple-hearth, 2 units, 6 hearths/unit

   b. Manufacturer Envirotech-BSP

   c. Date construction or modification began Oct. 1972

   d. Feed rate/material 16,700 lb/hr centrifuge cake

   e. No. of ports of feed entry One to top of 2nd hearth

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   Scum is thickened, dewatered and then incinerated by adding to 3rd hearth at 10 gph on 3 days/month.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility City of Vancouver WWTP

      Address 1800 Delmont Way, Vancouver, Washington

      Phone Number (206)696-8157

      Contact Tom Kolby Title Supervisor

      Facility located in EPA Region X

   b. Date of Visit 8/11/76

   c. PEDCo Personnel C. J. Sawyer

2. SLUDGE TREATMENT

   a. Dewatering device Belt extractor

   b. Manufacturer Eimco-BSP, Salt Lake City, Utah

   c. Cake solids content 36%

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer Colorado Conveyor Co., Denver, Colorado

   c. Can a representative sample be taken? Yes, a manual grab sample can be taken off the conveyor.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type None

   b. Manufacturer Not applicable

   c. Operational details Not applicable

   d. Accuracy Not applicable

5. INCINERATOR

   a. Type Multiple-hearth, 1 unit, 7 hearths

   b. Manufacturer Denver Mine & Smelting, Denver, Colorado

   c. Date construction or modification began June 1973

   d. Feed rate/material 10,500 lb/hr filter cake

   e. No. of ports of feed entry one

   f. Is mercury monitored in flue gas? Yes

6. ADDITIONAL INFORMATION/COMMENTS

   Weighing device could be added if needed. All the burners in the incinerator were replaced in July 1976. Mercury in the flue gas was 87 g/d in February 1976.

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Cowlitz County WWTP

      Address Longview, Washington

      Phone Number (206)577-3127

      Contact Herb Filer Title Operator

      Facility located in EPA Region X

   b. Date of Visit Phone discussion on 8/11/76

   c. PEDCo Personnel C. J. Sawyer

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum filter

   b. Manufacturer Komline-Sanderson, Peapack, N. J.

   c. Cake solids content 35%

3. SLUDGE CONVEYOR

   a. Type Belt conveyor

   b. Manufacturer FMC, Link-Belt Division

   c. Can a representative sample be taken? A manual grab sample can be taken off the conveyor.

   d. Additional information None

4. CONVEYOR WEIGH SCALE

   a. Type Belt scale

   b. Manufacturer Auto Weigh, Inc., Modesto, California

   c. Operational details Scales are attached to the belt and are connected to an electronic readout.

   d. Accuracy ± 1%

5. INCINERATOR

   a. Type Multiple-hearth, 1 unit, 7 hearths

   b. Manufacturer Envirotech-BSP

   c. Date construction or modification began 1974

   d. Feed rate/material 5,000 lb/hr filter cake

   e. No. of ports of feed entry one

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   None

SLUDGE INCINERATION

CHECK LIST/QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

   a. Name of Facility Point Woronzof WWTP

      Address P. O. Box 6285, Anchorage, Alaska 99508

      Phone Number (907) 274-3663

      Contact Richard Hutson Title Superintendent

      Facility located in EPA Region X

   b. Date of Visit Telephone discussion on 10/7/76

   c. PEDCo Personnel V. Patel

2. SLUDGE TREATMENT

   a. Dewatering device Vacuum Filter

   b. Manufacturer Komline-Sanderson, Peapack, New Jersey

   c. Cake solids content 23%

3. SLUDGE CONVEYOR

   a. Type Belt Conveyor

   b. Manufacturer (Local Steel Fabricator)

   c. Can a representative sample be taken? Yes, manual grab samples can be taken from floor level.

   d. Additional information A 6 inch tube conveyor was replaced by the belt conveyor 1 year ago.

4. CONVEYOR WEIGH SCALE

   a. Type None

   b. Manufacturer Not Applicable

   c. Operational details Not Applicable

   d. Accuracy Not Applicable

5. INCINERATOR

   a. Type Multi-hearth, 1 unit, 6 hearths

   b. Manufacturer BSP-Envirotech

   c. Date construction or modification began 1971

   d. Feed rate/material 9 ton/d filter cake

   e. No. of ports of feed entry two (See No. 6)

   f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

   There are two ports of feed entry - one at the top hearth and one at the No. 3 hearth. Sceemings can be introduced either at the top hearth together with the sludge or to the No. 3 hearth, using Moyno pumps. Sceemings are stored in a decant tank. Grit is landfilled.

SLUDGE INCINERATION

CHECK LIST QUESTIONNAIRE

PEDCo Project Number 3155-EE-6

1. GENERAL

a. Name of Facility Chilliwack STP

Address 45 Spadina, Chilliwack, B. C.

Phone Number (604)792-7251

Contact Larry Lowe Title Operator

Facility located in EPA Region Not applicable

b. Date of Visit 8/3/76

c. PEDCo Personnel J. J. Sawyer

2. SLUDGE TREATMENT

a. Dewatering device Centrifuge

b. Manufacturer Bird Machine Co.

c. Cake solids content 22%

3. SLUDGE CONVEYOR

a. Type Enclosed pipe

b. Manufacturer Not applicable

c. Can a representative sample be taken? Yes, through a trap door on down chute feeding sludge cake from centrifuge.

d. Additional information None

4. CONVEYOR WEIGH SCALE

a. Type Controlled pumps

b. Manufacturer Moyno Pump, Springfield, Ohio

c. Operational details By material balance around centrifuge and controlled pumping rate, the feed rate is monitored.

d. Accuracy Not applicable

5. INCINERATOR

a. Type Multiple-hearth, 1 unit, 5 hearths

b. Manufacturer Denver Mine & Smelting, Denver, Colorado

c. Date construction or modification began 1/1/1975

d. Feed rate/material 12 to 15 gal/min sludge and scum

e. No. of ports of feed entry one

f. Is mercury monitored in flue gas? No

6. ADDITIONAL INFORMATION/COMMENTS

Moyno pumps are positive displacement, progressive cavity, with helical feed screws, flanged open-feed hoppers, fabricated steel housing, wear and corosion resistant steel motors and elastomeric stators.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-340/1-77-016a	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Survey of Techniques for Monitoring Sewage Sludge Charged to Municipal Sludge Incinerators		5. REPORT DATE Date of Issue: June 1977 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Charles J. Sawyer and Vijay Patel		8. PERFORMING ORGANIZATION REPORT NO. 3155-EE-6 (3270-1-R)
9. PERFORMING ORGANIZATION NAME AND ADDRESS PEDCo Environmental, Inc. 11499 Chester Road Cincinnati, Ohio 45246		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-02-1375, Task 31
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency Division of Stationary Source Enforcement Research Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED Final 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES DSSE Project Officer was Mr. Kirk Foster.		

16. ABSTRACT

Incineration is rapidly becoming an important means of municipal sludge disposal as municipalities upgrade their wastewater facilities to comply with the Clean Water Act requirements. New or modified sludge incinerators are regulated by the New Source Performance Standards; NSPS requires the installation of sludge feed monitoring devices, to determine the amount of sludge charged to the incinerator.

A survey of municipal incinerators in several EPA regions was conducted, to determine what is being done to conform with NSPS requirements. From these survey results, technical and cost information on sludge monitoring systems meeting NSPS requirements was compiled as a data base to guide regional offices and state agencies in their review and evaluation of feed monitoring devices.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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